



DEPARTMENT OF THE AIR FORCE
377TH AIR BASE WING (AFGSC)

ENTERED



DEC 20 2017

Colonel Dawn A. Nickell
377th Air Base Wing
2000 Wyoming Blvd SE
Kirtland AFB NM 87117

Mr. John Kieling, Bureau Chief
Hazardous Waste Bureau (HWB)
New Mexico Environment Department (NMED)
2905 Rodeo Park Drive East, Building 1
Santa Fe NM 87505-6303



Dear Mr. Kieling

Attached please find the *Work Plan for Data Gap Monitoring Well Installation, Bulk Fuels Facility, Solid Waste Management Unit (SWMU) ST-106/SS-111, Kirtland Air Force Base, New Mexico, dated December 2017*. The enclosed work plan is submitted in accordance with the Notice of Deficiency letter dated 16 November 2017, and extension request letter dated 15 December 2017.

If you have any questions or concerns, please contact Mr. Christopher Segura at (505) 853-5443 or at christopher.segura.2@us.af.mil or Mr. Scott Clark at (505) 846-9017 or at scott.clark@us.af.mil.

Sincerely

DAWN A. NICKELL, Colonel, USAF
Vice Commander

Attachment:

Work Plan for Data Gap Monitoring Well Installation, Bulk Fuels Facility, Solid Waste Management Unit ST-106/SS-111, Kirtland Air Force Base, New Mexico, dated December 2017; 2 Hard Copies/2 CDs

cc:

NMED (Borrogo) letter
NMED GWQB (Agnew, Hunter), letter and CD
EPA Region 6 (King, Ellinger), letter and CD
SAF-IEE (Lynnes), electronic only
AFCEC/CZ (Renaghan, Segura, Clark, O'Grady), electronic only
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KIRTLAND AIR FORCE BASE ALBUQUERQUE, NEW MEXICO

WORK PLAN FOR DATA GAP MONITORING WELL INSTALLATION BULK FUELS FACILITY SOLID WASTE MANAGEMENT UNIT ST-106/SS-111

December 2017



**377 MSG/CEI
2050 Wyoming Boulevard Southeast
Kirtland Air Force Base, New Mexico 87117-5270**

**KIRTLAND AIR FORCE BASE
ALBUQUERQUE, NEW MEXICO**

**WORK PLAN FOR DATA GAP MONITORING WELL
INSTALLATION
BULK FUELS FACILITY
SOLID WASTE MANAGEMENT UNIT ST-106/SS-111**

December 2017

Prepared for

U.S. Army Corps of Engineers
Albuquerque District
4101 Jefferson Plaza NE
Albuquerque, New Mexico 87109-3435

Prepared by

EA Engineering, Science, and Technology, Inc., PBC
320 Gold Avenue SW, Suite 1300
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Contract No. W912DR-12-D-0006/Delivery Order DM01

NOTICE

This Work Plan was prepared for the U.S. Army Corps of Engineers by EA Engineering, Science, and Technology, Inc., PBC for the purpose performing activities related to data gap monitoring well installation and inclusion of existing wells into the groundwater monitoring and gauging network. This work is associated with the Kirtland Air Force Base (AFB) Bulk Fuels Facility, Solid Waste Management Unit ST-106/SS-111, and is performed under the U.S. Air Force Environmental Restoration Program, under requirements set forth in the Resource Conservation and Recovery Act permit issued to Kirtland AFB, with the New Mexico Environment Department serving as the lead regulatory agency.

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14. ABSTRACT This Work Plan describes groundwater monitoring well installation procedures and groundwater quality monitoring and analysis to be conducted under the Resource Conservation and Recovery Act for the Bulk Fuels Facility leak at Solid Waste Management Unit ST-106/SS-111 at Kirtland Air Force Base, New Mexico. The Work Plan includes the technical approach for the drilling and installation of monitoring wells to address data gaps in the existing groundwater monitoring network, and inclusion of existing wells into the groundwater monitoring and gauging network.					
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DAWN A. NICKELL, Colonel, U.S. Air Force
Vice Commander, 377th Air Base Wing

21 Dec 17

Date

This document has been approved for public release.



KIRTLAND AIR FORCE BASE
377th Air Base Wing Public Affairs

20 DEC 17

Date

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PREFACE

This Work Plan is prepared by EA Engineering, Science, and Technology, Inc., PBC (EA) for the U.S. Army Corps of Engineers (USACE), under Contract Number W912DR-12-D-0006, Delivery Order DM01. This Work Plan pertains to the expansion of the groundwater monitoring (GWM) network to address existing data gaps, including the installation of new GWM wells, and the inclusion of existing wells into the current GWM network. This work will be performed as a continuance to address the fuel leak at the Kirtland Air Force Base (AFB) Bulk Fuels Facility (site), Solid Waste Management Unit ST-106/SS-111. The site is located in Albuquerque, New Mexico. This Work Plan was prepared in accordance with the permit issued to Kirtland AFB under the Resource Conservation and Recovery Act and applicable federal, state, and local laws and regulations.

The objective of the Work Plan is to describe specific GWM well installation activities and incorporate existing wells into the current GWM network to address existing data gaps. Details on the installation of six new GWM wells and the incorporation of those wells and multiple existing monitoring wells into the GWM program are provided in this Work Plan.

This Work Plan describes work to be performed beginning in 2018, including four quarters of baseline monitoring for newly added wells. Mr. Trent Simpler, PE, is the USACE–Albuquerque District Project Manager. The Environmental Restoration Section Chief for this program is Mr. Scott Clark of Kirtland AFB. The Work Plan was prepared by Devon Jercinovic, PG, CPG, PMP; Dustin Graves, PG; and Pamela Moss, all of EA. Devon Jercinovic is the EA Project Manager.



Devon Jercinovic, PG, CPG, PMP
Project Manager
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ACRONYMS AND ABBREVIATIONS

%	percent
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
amsl	above mean sea level
APP	Accident Prevention Plan
ARCH	air-rotary casing hammer
BFF	Bulk Fuels Facility
C&D	construction and demolition
CFR	Code of Federal Regulations
DoD	Department of Defense
EA	EA Engineering, Science, and Technology, Inc., PBC
EDB	ethylene dibromide (also known as 1,2-dibromoethane)
EDD	electronic data deliverable
ELLE	Eurofins Lancaster Laboratories Environmental, LLC
EPA	U.S. Environmental Protection Agency
ERPIMS	Environmental Resources Program Information Management System
ft	foot (feet)
GWM	groundwater monitoring
GWTS	groundwater treatment system
IDW	investigation-derived waste
in.	inch
LNAPL	light non-aqueous phase liquid
mg/kg	milligram(s) per kilogram
NMED	New Mexico Environment Department
No.	number
O&M	operation(s) and maintenance
NMOSE	New Mexico Office of the State Engineer
PID	photoionization detector
PLSOP	primary land survey objective point

ACRONYMS AND ABBREVIATIONS (CONCLUDED)

Q1	first quarter
Q4	fourth quarter
QA	quality assurance
QAPjP	Quality Assurance Project Plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
SOP	Standard Operating Procedure
SSHP	Site Safety and Health Plan
SWMU	Solid Waste Management Unit
USACE	U.S. Army Corps of Engineers
USAF	U.S. Air Force
VA	Veterans Affairs

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EXECUTIVE SUMMARY

This Work Plan has been prepared by EA Engineering, Science, and Technology, Inc., PBC to describe activities to be performed at Solid Waste Management Unit ST-106/SS-111, the Bulk Fuels Facility (BFF) at Kirtland Air Force Base (AFB), New Mexico. The Work Plan demonstrates the U.S. Air Force's commitment to continue addressing fuel contamination resulting from the BFF fuel leaks. This Work Plan outlines activities to be performed to address existing data gaps in the groundwater monitoring (GWM) and gauging network, as listed below that are primarily the result of rising groundwater elevations. In conjunction with the Quality Assurance Project Plan provided in Appendix A, this Work Plan will become the procedural guidance document for conducting these activities. These documents meet the most recent requirements of the Department of Defense (DoD) regarding planning documents for DoD facilities. This Work Plan was written in accordance with Part 6 of the Kirtland AFB's Resource Conservation and Recovery Act Permit Number NM9570024423.

The objective of this Work Plan is to detail the activities to be implemented for the addition or incorporation of monitoring and gauging data points for the existing GWM network. The work to be completed is presented under each of the tasks listed below:

- Install six GWM wells at five locations off-Base and one location on-Base; two GWM wells will serve as sentinel wells for drinking water supply wells, and four wells will address data gaps in the existing GWM network for plume delineation
- Incorporate six existing wells into the GWM network for quarterly sampling (i.e., GWM wells and soil vapor monitoring wells that were previously dry and that now have water in the screens due to rising water table)
- Incorporate 12 existing wells into the GWM network for quarterly gauging depths to groundwater and light non-aqueous phase liquid (LNAPL), including the six wells previously mentioned for incorporation into the GWM network for quarterly sampling
- Perform gauging, sampling, and maintenance of the newly added wells
- Perform reporting of the data collected for the newly added wells, including groundwater elevations, LNAPL thickness, groundwater geochemical data, and well installation details.

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1. INTRODUCTION

Under Contract Number (No.) W912DR-12-D-0006, Delivery Order DM01, EA Engineering, Science, and Technology, Inc., PBC (EA) was contracted to perform tasks associated with monitoring well installation and inclusion of existing wells into the groundwater monitoring (GWM) and gauging network at Solid Waste Management Unit (SWMU) ST-106/SS-111, at Kirtland Air Force Base (AFB), New Mexico. This SWMU is known as the Bulk Fuels Facility (BFF) site. Environmental restoration efforts at the BFF site are being conducted under requirements set forth in Part 6 of the Resource Conservation and Recovery Act (RCRA) Permit Number No. NM9570024423 (RCRA Permit), with the New Mexico Environment Department (NMED) serving as the lead regulatory agency (NMED, 2010).

The Albuquerque Bernalillo County Water Utility Authority expects local groundwater elevations to rise by approximately 50 feet (ft) from current elevations. Due to the rising water table resulting from reduced withdrawal of groundwater from the regional aquifer, the existing BFF GWM network now has data gaps at the water table due to the submergence of existing well screens. The objective of the work described within this plan is to address those data gaps with newly added GWM well locations that are screened across the current water table elevations. This Work Plan addresses tasks supporting monitoring well installation and baseline water quality sampling and is the procedural guidance document for activities to be executed as part of the RCRA corrective action process. This Work Plan meets the most recent requirements of the Department of Defense (DoD) regarding planning documents for DoD facilities.

The requirements for the protection of health and attaining safety on the job sites are addressed in the companion *Accident Prevention Plan (APP) for the BFF Expansion of the Dissolved-Phase Plume Groundwater Treatment System (GWTS) Design and the Vadose Zone Treatability Studies (Revision 5)* (EA, 2017). The APP also incorporates the Site Safety and Health Plan (SSHP). The APP is a dynamic document that will be revised to cover all activity-specific concerns and will be updated as necessary.

1.1 Scope of Activities

The BFF site is located in Albuquerque, New Mexico (Figure 1-1). This Work Plan covers activities required to meet the performance objectives associated with the work outlined herein. This work includes drilling, well installation, and associated water quality sampling at six locations identified as data gaps in the existing GWM network. Additionally, this Work Plan covers the inclusion of existing wells into the GWM network and associated water quality sampling and groundwater level gauging. This Work Plan was prepared in accordance with the RCRA Permit for Kirtland AFB (NMED, 2010) and applicable federal, state, and local laws and regulations. For completeness, this Work Plan includes the required elements of a Sampling and Analysis Plan/Field Sampling Plan, including data and waste management.

1.2 Work Plan Organization

The Work Plan is divided into the following sections:

- **Section 1**—Presents an introduction to the plan and the scope of activities and organization of the Work Plan.
- **Section 2**—Presents the site description and operational history.

- **Section 3**—Summarizes the project tasks with sufficient detail on how the objectives will be accomplished. To avoid repetitiveness, activities that are common to more than one project task are presented only once, in Section 3.2.
- **Section 4**—Presents the project schedule.
- **Section 5**—Provides information on the organizational plan for the execution of work.
- **Section 6**—Describes the data management requirements.
- **Section 7**—Refers to the quality assurance (QA) and quality control (QC) requirements, which are further detailed in an appendix.
- **Section 8**—Presents information on the management and disposal of the waste generated during this project.
- **Section 9**—Refers to the safe work practices to be employed while executing this project, which are further detailed in the APP
- **Section 10**—Provides references cited in this Work Plan.

Figures and tables follow the main body of this Work Plan. Appendices provided at the end of this Work Plan include:

- **Appendix A**—Quality Assurance Project Plan (QAPjP)
- **Appendix B**—Construction Schematics for New Wells and Existing Monitoring Well Construction Diagrams
- **Appendix C**—Definition of Land Survey Objective/Measuring Points and Land Survey Campaign among the Kirtland AFB Monitoring Well Network
- **Appendix D**—Relevant Standard Operating Procedures (SOPs) from Kirtland AFB Base-Wide Plan (Appendix B) (U.S. Air Force [USAF], 2004)
- **Appendix E**—Field Forms.

2. BACKGROUND INFORMATION

2.1 Site Description

Kirtland AFB is located in Bernalillo County, in central New Mexico, southeast of and adjacent to the City of Albuquerque and the Albuquerque International Sunport (Figure 1-1). The approximate area of Kirtland AFB is 52,287 acres. The BFF site is located in the northwestern portion of Kirtland AFB.

2.2 Site History

The BFF and associated infrastructure operated from 1953 until 1999. During this time, the fueling area was separated into a tank holding area where bulk shipments of fuel were received and a fuel loading area where individual fuel trucks were filled. Kirtland AFB removed the underground piping at the facility from service in 1999 due to discovery of underground leakage. The exact history of the leaks or releases is unknown. Kirtland AFB learned through characterization activities the leaked fuel had reached the groundwater and the dissolved-phase fuel contamination migrated northeast and north of Kirtland AFB.

Interim Measures were implemented in accordance with Part 6.2.2.2.12 of the RCRA Permit for both groundwater and soil. The goals of the groundwater Interim Measures are to protect drinking water supply wells and collapse the distal ethylene dibromide (EDB) plume. Due to the rising water table resulting from reduced withdrawal of groundwater from the regional aquifer, the existing GWM network now has data gaps due to the submergence of existing well screens.

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3. TASKS AND ACTIVITIES

Section 3.1 describes the tasks that will be performed under this project. Section 3.2 provides detail of activities that are common to more than one task.

3.1 Project Tasks

Tasks outlined in this Work Plan include drilling and installing new GWM wells, sampling the newly installed and existing wells that have been added to the GWM network, managing investigation-derived waste (IDW), and maintaining the additional wells in the GWM network. These tasks are described in more detail in the sections below.

3.1.1 Drilling and Installation of Groundwater Monitoring Wells

Six new monitoring well locations were strategically selected in coordination with NMED and project stakeholders in the Technical Working Group meeting in September 2017, and in follow-up discussions on September 14, 2017. These wells (KAFB-106240 through KAFB-106245) will be installed as nested wells in 2018 to fill data gaps in the existing GWM network (Figure 3-1). Four of these monitoring wells will fill data gaps within the existing GWM network, and will primarily serve as additional data points for the performance assessment of the Interim Measures (i.e., KAFB-106240 through KAFB-106243). The two remaining monitoring wells (i.e., KAFB-106244 and KAFB-106245) will serve as sentinel wells for drinking water supply wells. KAFB-106244 will serve as a sentinel well for ST106-VA-2 at the Veterans Affairs (VA) Medical Center and KAFB-106245 will serve as a sentinel well for KAFB-016 at Kirtland AFB. Construction schematics are provided in Appendix B, and a summary of design details is provided in Table 3-1.

Each well nest will be comprised of two wells within a single borehole, each screened at a different depth interval, beginning with a 40-ft screen across the current water table elevation in the deeper well. A second screen, extending upward to shallower depths, will be completed as a “dry” contingency well to function in the future with rising groundwater elevations. The contingency wells will have a 25-ft screen length that extends above the 40-ft screen interval in the deeper well. The GWM nested wells will each be constructed using 3-inch (in.) diameter Schedule 80 polyvinyl chloride casing with a 0.010-in. slot screen size and 10/20 filter pack. Details of the annular material are shown on the well construction diagram provided in Appendix B. Table 3-2 provides a summary of the new monitoring wells to be included in the existing GWM network. The well nests are designed with 5-ft bentonite seals between each screen to ensure adequate hydraulic isolation. A minimum of at least 2 ft of sand will extend above and below the screened intervals; the resulting minimum separation distance between well screens will be 9 ft.

Based on the current static water elevation of approximately 4,871 ft, the final well screen depths were selected with the bottom of the deeper screen at approximately 15 ft below the water table (i.e., elevation 4,856 ft above mean sea level [amsl]). Due to the 9-ft separation distance between the well screens, there may be a period of time, dependent on the rate of water table rise, during which the monitoring location will not have a screen that intercepts the water table interface. Prior to the complete submergence of the deeper well screen, a replacement well will be installed, if required to meet data objectives.

Each borehole will be fully described on boring logs as discussed in Section 3.2.8. Soil cuttings will be screened in the field with a photoionization detector (PID) as discussed in Sections 3.2.9 and 3.2.10. Well construction diagrams will be prepared as discussed in Section 3.2.11. The wells will be developed as discussed in Section 3.2.12.

3.1.1.1 Drilling Approach and Methodology

The new monitoring wells (i.e., KAFB-106240 through KAFB-106245) will be installed via air-rotary casing hammer (ARCH) technology with casing advancement. Table 3-1 summarizes the drilling methodology and design summary for each location. Wells will be completed to the total target depths, as follows:

- 0–200 ft – ARCH using 11-3/4-in. casing diameter
- 200–total depth – ARCH using 9-3/8-in. casing bit diameter
- Surface casing – temporary 11-3/4-in. ARCH casing.

3.1.2 Addition of Existing Wells into the Groundwater Monitoring Network

In addition to the six new wells to be installed, as discussed in Section 3.1.2, six existing wells will be added to the GWM network for quarterly sampling, including KAFB-106041, KAFB-106149-484, KAFB-106151-484, KAFB-106152-484, KAFB-106153-484, and KAFB-106211 (Figure 3-1). These wells were selected for inclusion by the Kirtland BFF Technical Working Group in September 2017. Table 3-2 provides a summary of the existing monitoring wells to be included in the GWM network.

KAFB-106041 is an existing GWM well that was previously dry upon completion, but is now screened across the water table. Four of these wells (KAFB-106149-484, KAFB-106151-484, KAFB-106152-484, and KAFB-106153-484) were originally deep soil vapor monitoring wells within a well nest that are now screened across the water table due to the rising water elevation. KAFB-106211 is a former air sparge/vapor extraction well (with downhole equipment removed), with the bottom of the screen completed at an elevation of approximately 4,873 ft amsl. This well screen is approximately 2 ft above the water table elevation as of the fourth quarter (Q4) 2017. This well will continue to be gauged quarterly (Section 3.2.13), and will be added to the GWM network once sufficient water column is available for passive sampling (i.e., approximately 5 ft of water column). Construction diagrams for these wells are provided in Appendix B.

3.1.3 Groundwater Monitoring

The activities presented below will begin in the first quarter (Q1) 2018 and newly added wells will be added to the monitoring schedule as available. The newly added wells include existing wells that are “newly added” into the GWM network and wells that will be installed in 2018. The monitoring well designations are summarized on Table 3-2, and well locations are shown on Figure 3-1. These wells will be monitored in accordance with the procedures specified in this Work Plan and any subsequently approved revision of this plan. GWM will include collecting representative groundwater samples for offsite laboratory analysis. Groundwater samples will be collected as presented in Table 3-3.

The newly added wells will be surveyed with a licensed surveyor to the relevant wellhead measuring points in accordance with the U.S. Geological Survey SOP provided in Appendix C and surveying methods described in Section 3.2.16. EA may provide additional wellhead identification markings for the GWM network, as required.

All newly installed or newly added wells will be sampled for four consecutive quarters to establish baseline concentrations for the parameters listed in Table 3-3. All newly added wells will continue to be sampled quarterly for the parameters listed in Table 3-3 until an optimization plan is approved to reduce the sample parameters or frequency. The five existing data gap wells will begin the baseline monitoring

in Q1 2018 (KAFB-106041, KAFB-106149-484, KAFB-106151-484, KAFB-106152-484, and KAFB-106153-484). Well KAFB-106211, the former soil vapor extraction well, which was completed above the water table as of Q4 2017, will be included in quarterly monitoring once the water table rises sufficiently to sample (i.e., elevation 4,878 ft). The six new wells planned for installation in 2018 will begin baseline monitoring in the subsequent quarter following well installation and development. An estimated timeline for well installation and baseline monitoring is included in Table 3-2.

Gauging and sampling will be conducted according to the procedures outlined in Section 3.2.13. The QAPjP (Appendix A) provides additional information on assigning field sample identification numbers and requirements for QA/QC field and laboratory samples. IDW will be managed and disposed of as described in Section 8.

Information and data collected during any quarter from the newly added monitoring wells will be submitted in the BFF Quarterly Monitoring Reports. These reports present a summary of quarterly field activities performed, analytical data for groundwater samples and data evaluation reports, information associated with the operations and maintenance (O&M) of the GWM network, and a discussion of the hydrogeologic conditions at the site, including a presentation of the potentiometric surface maps for the different water-bearing zones, also known as reference elevation intervals.

3.1.4 Management of Purged or Excess Groundwater from Well Installation or Quarterly Sampling

EA will manage all purge water or excess groundwater generated during the groundwater sampling events. This volume of water is not anticipated to exceed 10 gallons per sampling event with passive sampling technology (Section 3.2.13). Excess water from passive samplers is consolidated from wells with documented, similar waste profiles.

EA will temporarily accumulate and manage the water pending analytical results and approval to discharge to the GWTS as described in Section 8.1 and in accordance with Section 1.0 of DP-1839 (NMED, 2017). Management includes container inspections, labeling, recordkeeping, waste characterization, and disposition tracking. Some of the newly added wells may potentially generate water that is characteristically hazardous waste under RCRA for benzene (D018). Purge water from these wells will be accumulated in the less than 90-day storage hazardous waste accumulation area and, if proven hazardous, will be disposed of offsite within the 90-day hold time. Recordkeeping will comply with 40 Code of Federal Regulations (CFR) 262.34 including weekly inspections, signage, preparing and implementing contingency plans, and maintaining a cumulative 3 years of records.

3.1.5 Maintenance of the Newly Added Groundwater Monitoring Wells

The existing and newly installed data gap GWM wells will be incorporated into the existing GWM network and will undergo inspections and maintenance quarterly. Wellheads will be inspected for integrity and necessary repairs will be performed as soon as possible. The findings of the inspections and repairs will be documented through photographs and on the appropriate field forms and included in the Quarterly Maintenance Report.

3.2 Activities Common to More than One Task

This section details the activities that are pertinent to more than one project task outlined in Section 3.1. The activities involve field implementation, and are described herein to avoid repetitiveness. Overall, the activities presented herein conform to the requirements of the Base-Wide Plans for the Environmental

Restoration Program at Kirtland AFB (USAF, 2004) ensuring that the data will be appropriate for the decision-making process. The following Kirtland AFB SOPs (USAF, 2004) are applicable to the work performed under this project, unless otherwise indicated in this Work Plan:

- B1.3, Monitoring Well Installation
- B2.3, Subsurface Soil Sampling
- B5.1, pH
- B5.2, Specific Conductance
- B5.3, Water Temperature
- B5.4, Dissolved Oxygen
- B5.5, Oxidation Reduction Potential
- B6.2, Tank Sampling.

The SOPs listed above are included in Appendix D. Of note, some of the activities outlined below may deviate to some extent from the Kirtland AFB SOPs as required to address specific regulatory comments received on documents prepared during former activities at this SWMU.

3.2.1 Site Clearance and Utilities Location/Relocation

A utilities clearance will be conducted to locate all underground and suspended utilities both on Kirtland AFB property and off-Base. On-Base utilities clearance activities will be conducted as prescribed by and in accordance with the Kirtland AFB procedures. Clearances will be renewed if they expire. No intrusive work will be initiated unless all locations are staked, the clearances from all on-Base and off-Base utilities have been obtained, and digging permits have been obtained. Utilities clearance activities at adjacent off-Base locations and City of Albuquerque right-of-ways will be prescribed by, and in accordance with, state of New Mexico utilities regulations. All underground utilities will be clearly marked before the start of any intrusive activities. All intrusive activities will take into account any existing utilities. The state of New Mexico's "New Mexico One Call" utility excavation clearance system will be used for all off-Base drilling and excavation locations. Pot-holing will be performed via hydro-vacuuming techniques to physically observe all utilities.

3.2.2 Permitting, Right-of-Way Agreements, and Right-of-Entry Agreements

Prior to any mobilization, copies of the right-of-entry agreements will be obtained for the location where work will be performed and documentation will be onsite with the field crew so that it is available for inspections. In addition to access and site clearance, the appropriate permits will be obtained for the various field activities. The list of permits for each well location is provided in Table 3-4. An effort will be made to time the permitting process such that permit approvals will be received in time to achieve the project schedule, but not too early in the process that they expire before work is initiated. All permit expiration dates will be tracked to ensure that no permits expire prior to completion of work. Permit renewals will be initiated such that the work will proceed without interruption. Depending on the timing, permits may be combined. The project schedule may be impacted if there are delays in permit approvals.

For existing wells that will be converted for groundwater monitoring (i.e., KAFB-106149-484, KAFB-106151-484, KAFB-106152-484, KAFB-106153-484, and KAFB-106211), the New Mexico Office of the State Engineer (NMOSE) confirmed that sampling these wells for groundwater is allowed under the conditions of existing permits (NMOSE, 2017).

The list of permits/plans required for this project are:

- NMOSE Well Drilling Permits for each of the new monitoring well locations with no consumptive use of water
- City of Albuquerque License for Property Access for GWM wells: this license is already in place and will be kept onsite at all times
- City of Albuquerque specific plans:
 - Noise Control Plan/Permit for drilling off-Base
 - Groundwater Well Permit for each GWM well located on City of Albuquerque property
 - Excavation/Barricade Permits for each drilling location off-Base on roadways
- Kirtland AFB specific-permits:
 - Air Force 322 Base Civil Engineer Work Request
 - Civil Engineer Digging Permit Request.
- Right-of-Entry Agreements and Licenses for accessing off-Base locations for drilling, gauging, and sampling:
 - City of Albuquerque
 - Department of VA Health Care System.

3.2.3 Readiness Review Meetings

Readiness review meetings will be conducted with U.S. Army Corps of Engineers (USACE) and Air Force Civil Engineer Center (AFCEC) a minimum of 1 week in advance of any new intrusive field activities (e.g., drilling). The meeting will be conducted to ensure that all pre-mobilization elements (e.g., approved plans, permits, access agreements, Kirtland AFB badging, and community notification) and mobilization elements (e.g., required staffing, equipment, and materials) have been completed.

3.2.4 Mobilization/Demobilization

EA (and subcontractors) will maintain three laydown areas to support field activities (Figure 3-2). These laydown areas have been approved with existing agreements, and have been coordinated with Kirtland AFB. A BFF field office is located at Kirtland AFB, near the GWTS and existing IDW storage yard. A secure fenced equipment yard has been established near the Truman gate for both heavy machinery and materials; this yard will also hold materials and supplies meant for use on the project at locations outside of Kirtland AFB, as required. Roll-off containers filled with solid waste (soil cuttings and mud) may be stored at the IDW storage area near the GWTS. Due to the large number of roll-off containers required for delivery and transfer during daily drilling activities, waste management support is a key element of mobilization. Laydown site locations are presented on Figure 3-2.

3.2.5 Site Security

A safe and secure well construction site will be maintained during the execution of all activities taking place on-Base and off-Base. EA site and safety personnel will coordinate with USACE and the AFCEC point-of-contact to gain insight into site security precautions (i.e., after hours security guards) that are in progress. A plan to control public access, minimize risks to pedestrians, and reduce interference with the surrounding area (traffic control, noise control, and site security) will be implemented and a safe work environment for the field teams and the surrounding community will be established. During times with an active work zone off-Base, including equipment onsite, it is anticipated that security guards will be onsite throughout the night shift (after normal work hours), weekends, and holidays that are not staffed by EA and subcontractors. A work site will not be left unattended by EA and subcontractors until the security guard has arrived for duty and, similarly, all security personnel will remain onsite until EA or subcontractors arrive and report to duty. On-Base, all critical laydown yards will be secured by fencing and locked gates and the office trailer will be locked.

3.2.6 Barricading/Traffic Control

Work areas for GWM well drilling and installation will be protected from pedestrian and vehicular access. Barricades, temporary traffic control measures, and detour routes will be established where necessary in accordance with City of Albuquerque Construction Services Division requirements for off-Base locations.

GWM well KAFB-106242 on San Pedro Drive Southeast will be barricaded during gauging and sampling activities (Figure 3-1). Barricades will be erected on City of Albuquerque property by a professional barricading company in compliance with the approved City of Albuquerque barricade permit if traffic is encumbered for a significant period of time. Temporary barricades will also be installed for gauging and sampling activities for GWM well KAFB-106244 in the VA parking lot (Figure 3-1).

3.2.7 Decontamination

Final decontamination of all equipment will take place in designated decontamination areas specific to the work activity and approved by Kirtland AFB. Water from decontamination will be managed as per Section 8.

The objective of field decontamination is to remove potential contaminants from sampling, drilling, and other field equipment so as not to jeopardize analytical data quality. Specifications for decontamination materials are as follows:

- Use a standard brand of phosphate-free laboratory detergent, preferably either liquid Liquinox® or powder Alconox®.
- Use tap water from a municipal water treatment system or use bottled drinking water for the wash. Soap and tap water will remove the gross contamination from the sampling equipment.
- Use deionized water for the final rinse of sampling equipment that has direct contact to the sampling medium.

3.2.8 Borehole Logging

During drilling, each boring will be fully described on the boring log form (Appendix E) in accordance with ASTM International D5434 and will include the following, when applicable:

- Identification number and location of each boring
- A general description of the drilling equipment used, such as rod size, bit type, pump type, rig manufacturer, and model
- Date and time of start and completion of boring
- Name of contractor, driller, and field geologist
- Size and length of casing used in each borehole
- Soil classification in accordance with the Unified Soil Classification System, color, relative density and consistency, soil components, soil moisture, stratification, hardness, grain size and size distribution, and odor
- Mineralogical content of the core (for correlation)
- Depth to water as first encountered during drilling, along with method of determination
- Observations during drilling will be noted, such as bit chatter, rod binding, rod drops, and flowing or heaving sands (if drilling fluid is used, the fluid losses, interval over which they occur, and the quantity lost will be recorded)
- Depth limits, type, and number of each sample taken
- Observations of visible contamination for each sample or from cuttings that appear to be contaminated.

3.2.9 Photoionization Detector

PIDs will be used for breathing zone monitoring during sampling activities. The PID will be calibrated and tested as required in the QAPjP (Appendix A). Monitoring wells will be installed via ARCH drilling methods, and no soil cores will be generated or collected; however, a PID will be used to monitor vapors from the soil cuttings as discussed in Section 3.2.10.

3.2.10 Headspace Screening

Headspace field screening will be performed in accordance with the following procedures.

1. Record PID measurements at a minimum of every 25 ft of drill cuttings down to 450 ft depth, and then every 10 ft of drill cuttings to total depth following the process below. PID headspace measurements will be taken from soil cuttings collected from the cyclone separator and bagged.

2. Immediately upon the retrieval, collect a representative portion of the sample and place in a clean, dedicated (e.g., single sample) 1-gallon press-and-seal plastic food storage bag.
3. Vigorously agitate the sample for at least 15 seconds and then allow a minimum of 10 minutes for the sample to adequately volatilize.
4. During cold weather, warm the samples to room temperature prior to taking the headspace measurement.
5. Re-shake the sample bag and quickly insert the vapor sampling probe and record the maximum meter response (this should be within the first 2-5 seconds).
6. Record headspace screening data on the boring log.

3.2.11 Well Construction Diagrams

Construction diagrams will be completed for the new monitoring wells, and well construction will be documented on forms such as the one provided in Appendix E. Each form will include:

- Project and site names, well number, and total depth of the well
- Depth of any grouting or sealing, the amount of cement and/or bentonite used, and the total depth of the boring
- Depth and type of well casing
- Static water level upon installation of the well and after well development
- Installation date or dates, and name of the driller and the geologist installing the well; each installation diagram will be signed by the preparer
- All pertinent construction details of the wells, such as depth to and description of backfill materials installed (i.e., gravel pack, bentonite, and grout); gradation of gravel pack, length, location, diameter, slot size, material and manufacturer of well screen(s); position of centralizers; and location of any blank pipe installed in the well
- Description of surface completion, including protective steel casing, protective pipes, and concrete surface seal
- A description of any difficulties encountered during well installation
- Survey coordinates and the elevation of the top of ground and top of well riser.

3.2.12 Well Development

Well development will be performed by surging and bailing. Development will occur within 2–7 days following well and grout installation (i.e., no sooner than 48 hours following grout installation). Well development details are as follows:

- Initial development will consist of swabbing and bailing until little or no sediment enters the well (approximately 2-4 hours). Development and purge water will be contained in a temporary tank, tote, or drum. If the addition of water is necessary to facilitate surging and bailing, only clean potable water will be used.
- A bailer fitted with a toggle valve will be lowered into the well and used to gently surge the screen interval to remove any sand, silt, and debris accumulated in the well bore. When the bailer is brought to the surface, an Imhoff cone will be used to collect water from the first bailer run to evaluate the amount of silt and sediment in the water. This process will be repeated after each cycle of surging development.
- A minimum of five casing volumes of water will be purged from the well to develop the filter pack. Additional volume will be purged during development to equal the volume of water added during the drilling process (if applicable).
- At the completion of well development, a sample will be collected and immediately photographed to document the results of the procedure.

The new wells (KAFB-106240 through KAFB-106245) were designed for passive sampling, and the 0.010-in. slot size should minimize formation fines in these wells. The site geologist will monitor field parameters including pH, temperature, turbidity, and specific conductance, and record the results and other pertinent information on the Well Development Record Form (Appendix E).

Existing GWM wells KAFB-106041, KAFB-106149-484, KAFB-106151-484, KAFB-106152-484, KAFB-106153-484, and KAFB-106211 will not be developed. Well KAFB-106211, a former air sparge/vapor extraction well (with downhole equipment removed), was completed to an approximate depth of 4,873 ft amsl, which is approximately 2 ft above the static water elevation in Q4 2017. This well will be included into the GWM network once sufficient water has entered the screen interval (i.e., static elevation of 4,878 ft amsl).

3.2.13 Groundwater Gauging and Sampling

Existing wells provided in Table 3-5 will be included in the site-wide quarterly gauging, beginning in Q1 2018. For the new monitoring wells to be installed, depth to groundwater and light non-aqueous phase liquid (LNAPL) will be measured following well development. The wells will be allowed to recover a minimum of 24 hours following development prior to gauging, or any applicable water sampling. All new monitoring wells will be included in the site-wide GWM network for gauging and sampling beginning in the subsequent quarter following well installation.

Groundwater sampling will be performed via passive sampling techniques for all existing and new GWM wells covered in this Work Plan and listed in Table 3-2, barring any environmental factors that would preclude the ability to sample with this technology (e.g., significant and continuous LNAPL thickness in the well). The sections below describe the procedures that will be employed for groundwater and LNAPL gauging and groundwater sample collection. Liquid IDW will be generated from groundwater sampling and decontamination activities and will be managed, characterized, and disposed of per the procedures outlined in Section 8.

3.2.13.1 Light Non-Aqueous Phase Liquid and Groundwater Gauging

Twelve existing wells will be included in the site-wide gauging event beginning in Q1 2018 (Figure 3-1 and Table 3-5). These include the six wells discussed in Section 3.1 to be included for GWM, and an additional six wells that will be included only for gauging purposes (i.e., KAFB-106148-484, KAFB-106150-484, KAFB-106154-484, KAFB-106155-484, KAFB-106156-484, and KAFB-106229). Additionally, once the six new wells (KAFB-106240 through KAFB-106245) are completed, these wells will be added to the gauging event in the subsequent quarter following well installation. The additional GWM wells that are included in the site-wide gauging events that are not discussed in this Work Plan are provided in the *Work Plan for BFF Expansion of the Dissolved-Phase Plume GWTS Design, SWMU ST-106/SS-111* (USACE, 2017a). Quarterly, all monitoring wells will be gauged in approximately 1 field week so that potentiometric surface maps can be prepared that represent a synoptic period.

An electronic oil-water interface probe, or similar device, will be used to determine if LNAPL is present in each well. Depth to groundwater and depth to LNAPL, if present, will be measured in each well. LNAPL thickness will be calculated, if present. Although some wells are located within the LNAPL area and would be more likely to contain LNAPL, measurements for LNAPL will be performed at all new wells for which past data are not available. These measurements will be used to help delineate the extent of the LNAPL.

The sequence of procedures used when measuring depth to LNAPL, depth to water, and LNAPL thickness is as follows:

- Segregate the wells between potentially contaminated and not contaminated categories. Wells will be gauged with water level meters designated for “clean” or “contaminated” wells; although water level meters are decontaminated between wells, this approach will further minimize the potential of cross-contamination.
- Identify which wells require barricading for access (if applicable) and ensure the barricade permit is available at the well location.
- Check operation of the PID aboveground. Before opening the well, don personal protective equipment as required by the SSHP.
- Visually examine the exterior of the monitoring well for signs of damage or tampering and record observations on the Monitoring Well Gauging Form (Appendix E).
- Recite the well identification, as labeled on the protective casing, vault cover, or identification tag, and compare to field forms and dedicated equipment tags to ensure appropriate forms and equipment are being utilized. Document this check on the gauging data sheet (Appendix E).
- Unlock the well cap or outer steel casing lid. Visually examine the interior of the monitoring well for signs of damage or tampering and record observations on the Monitoring Well Gauging Form (Appendix E).
- Take organic vapor readings with the PID at the well head immediately upon opening the cap and record information on the Monitoring Well Gauging Form (Appendix E). If high concentrations are detected, the appropriate measures, as outlined in the SSHP, will be taken.

- Lower interface probe into the well and note depth to LNAPL and depth to groundwater; in order to be consistent with former gauging data, all measurements will be taken from a reference mark located on either the top of the protective casing for wells with aboveground completion or from the top of the vault for wells with flush completion. Measurements are to be made to the nearest 0.01 ft.
- If the interface probe indicates the presence of LNAPL (whether measurable or not with the probe), a clear bailer will be deployed into the well to collect a sample from the top of the water column and confirm the presence of LNAPL. If LNAPL is recovered with the bailer, the thickness will be photo-documented and indicated on the field form, and the LNAPL and water within the bailer will be containerized for proper disposal.
- Once per year, the total well depth will be measured in wells using a tape with weights attached to the end.
- Record all gauging information on the field form (Appendix E).
- Record the time and day of the measurement.
- Decontaminate all groundwater level measurement devices and the weighted tape used for measuring the total well depth before and after each use to prevent cross-contamination of wells.

3.2.13.2 Preparation for Groundwater Well Sampling

All wells covered in this Work Plan will be sampled via passive sampling technology and, therefore, well purging will not be required in association with sampling (well development is discussed in Section 3.2.12). All wells will be sampled in order of increasing contamination based on historical analytical data, or proximity to the contaminant plume based on historical data from nearby monitoring points. Each well will have a dedicated tether for which to attach passive samplers (i.e., dual membrane samplers). The tethers will be designed and built based on the well construction data and latest static groundwater conditions, but will be designed with the ability to modify sample depths, as needed, due to fluctuating water table elevations. Groundwater samples will not be collected within 2 weeks of well development. For new GWM wells that have yet to be installed, the first groundwater sample will be collected in the subsequent quarter following installation. The following procedures apply to sampling of monitoring wells:

- Don appropriate personal protective equipment, as outlined in the SSHP. In addition, field team members will don new sampling gloves at each well before beginning sampling.
- Visually examine the exterior of the monitoring well for signs of damage or tampering and record notes on the Groundwater Sampling Data Sheet (Appendix E).
- Unlock the well cap or outer steel casing lid. Visually examine the interior of the monitoring well for signs of damage or tampering and record notes on the Groundwater Sampling Data Sheet (Appendix E).
- Recite the well identification, as labeled on the protective casing, vault cover, or identification tag, and compare to field forms and dedicated equipment tags to ensure appropriate forms and

equipment are being utilized. Document this check on the Groundwater Sampling Data Sheet (Appendix E).

- Take organic vapor readings with the PID at the well head immediately upon opening the cap and record information on the Groundwater Sampling Data Sheet (Appendix E). If high concentrations are detected, the appropriate measures, as outlined in the SSHP, will be taken.
- Measure the static water level and the LNAPL as described in Section 3.2.13.1. If LNAPL is measurable in the well, a clear bailer will be deployed into the well to collect a sample from the top of the water column and confirm the presence of LNAPL. If LNAPL is confirmed within the well, passive samplers will not be deployed and a groundwater sample will be excluded from the well for the sampling event.

3.2.13.3 Collection of Groundwater Samples from Monitoring Wells Using Passive Sampling Techniques

Passive sampling techniques are recommended as a more reliable and sustainable alternative to the dedicated low-flow pump systems. The mechanical issues, corrosion, pump failures, equipment exhaust, and excessive IDW have all contributed to the decline in the reliability of the low-flow pump system to achieve project objectives. Additionally, the passive samplers are only used one time in each well minimizing risk of cross-contamination and eliminating many of the decontamination requirements.

The procedures below will be followed for passive sampling:

- Passive samplers will be deployed in wells a minimum of 3 weeks prior to sampling to allow for adequate equilibration between the passive sampler and the groundwater. All deployments will use dedicated passive equipment.
- The midpoint of the uppermost passive sampler will be set 2 ft below the water level if the top of water measured is within the screened interval. If the top of the water is above the screened interval, the midpoint of the top most passive sampler will be set 2 ft below the top of the screened interval.
- Passive samplers will be retrieved from the wells and sampled per the manufacturer's specifications. All sample aliquots and groundwater quality parameters required as per the QAPjP (Appendix A) will be collected from their respective passive samplers. Field parameters at these wells will not be measured during sampling events until a site-wide in situ program is approved by NMED.
- Dedicated deployable equipment (tethers) will either be retained in dedicated containers (e.g., contractor bags) or replaced down well between each sampling event.

3.2.14 Sample Packaging and Shipping

Sample packaging and shipping requirements are designed to maintain sample integrity from the time a sample is collected until it is received at the analytical laboratory. All chain-of-custody forms, sample labels, custody seals, and other sample documents will be completed as specified in the QAPjP (Appendix A). Specific procedures for packaging and shipping of environmental samples are presented below:

1. Complete sample label with indelible ink and attach to the sample bottle. Place sample bottles in a cooler for shipping.
2. In preparation for shipping samples, tape the drain plug shut so that no fluids (i.e., melted ice) will drain out of the cooler during shipment. A large plastic bag may be used as a liner for the cooler. Place packing material (i.e., bubble wrap) in the bottom of the liner. Place ice at the bottom of the cooler.
3. Place the containers in the lined cooler. Place cardboard separators or bubble wrap between the containers at the discretion of the shipper.
4. All samples for chemical analysis must be cooled and shipped to arrive at the laboratory at ≤ 6 degrees Celsius with ice. Include a temperature blank in each sample container prior to shipment.
5. Tape the liner closed, if used, and use sufficient packing material to prevent sample containers from making contact or rolling around during shipment.
6. Place a copy of the chain-of-custody form inside the cooler.
7. Close and tape the cooler shut with strapping tape (filament-type).
8. Place custody seals on the cooler. Place clear tape over the custody seals to help prevent them from being accidentally torn or ripped off.

Ship the cooler of samples via an overnight carrier. A copy of the shipping bill will be retained with the field records and sent electronically to the Project Chemist.

3.2.15 Site Restoration

Site restoration for drilling and well installation activities will consist of backfilling and compaction, surface restoration/resurfacing, and landscaping restoration. Work areas will be restored to original conditions; and, in the residential areas, pavement of the type and thickness meeting City of Albuquerque Department of Municipal Development requirements will be replaced. Restoration activities are not anticipated for groundwater sampling activities.

3.2.16 Survey

Land surveying activities will occur before, during, and after well installation activities. The surveys will be conducted at locations on Kirtland AFB, adjacent residential neighborhoods, and City of Albuquerque right-of-ways, as required. The surveys will establish northings, eastings, and elevations at all locations. All survey points will be verified, determined, marked, and documented per the provisions specified in the Definition of Land Survey Objective/Measuring Points and Land Survey Campaign among the Kirtland AFB Monitoring Well Network, which is included in draft form in Appendix C. This draft documentation includes an SOP and preliminary work plan for completing a survey of 400 existing monitoring wells within and nearby the Kirtland AFB in southeastern Albuquerque. For the purpose of the resurvey, wells have been divided into two categories as follows: Category I wells include groups or clusters of wells within close proximity and that, therefore, represent minimal groundwater potentiometric surface gradients; and Category II wells include wells that are more distal to one another with larger

groundwater potentiometric surface gradients. Datum specifications (refer to Appendix C for additional detail) are as follows for the two categories:

- New Mexico State Plane Coordinate System, Central Zone, North American Datum of 1983
- Categories I and II horizontal uncertainty at the primary land survey objective point (PLSOP) = <0.03 ft
- North American Vertical Datum 1988
- Category I altitude uncertainty at the PLSOP = < 0.01 ft
- Category II altitude uncertainty at the PLSOP = < 0.15 ft.

Daily reports will consist of the following: a tabulation of the location, identification, coordinates, and elevations of each point surveyed that day.

As the documentation provided in Appendix C is still in draft form, survey work will be conducted throughout the duration of the project according to the version of these specifications current at the time work is being performed.

3.2.17 Analytical Services

Groundwater samples will be collected, labeled, packaged, and shipped to the subcontractor laboratory as indicated below:

- ***Eurofins Lancaster Laboratories Environmental, LLC (ELLE), Lancaster, Pennsylvania***—GWM samples. ELLE maintains a current DoD Environmental Laboratory Accreditation Program certification for the analyses required under this contract (Appendix A, Attachment 1).

3.2.18 Public Notification

The public will be informed through door-to-door notifications at least 7 days prior to mobilizing off-Base for intrusive activities, such as drilling.

4. PROJECT SCHEDULE

The project schedule is provided below:

- Quarterly groundwater monitoring of existing wells (2018 – ongoing) – January, April, July, and October
- Installation of New Data Gap Monitoring Wells – 2018
- Completion of Drilling and New Data Gap Monitoring Well Installation – 180 days from start of mobilization
- Quarterly Groundwater Monitoring of New Data Gap Wells – January, April, July, and October (first quarter following installation)
- Quarterly Groundwater Reporting (2018 – ongoing) – March, June, September, and December.

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5. ORGANIZATIONAL PLAN

5.1 Organizational Structure

The organizational structure for this project is shown in Figure 5-1.

5.2 Responsibilities, Qualifications, and Authority of Key Personnel

Table 5-1 summarizes roles and responsibilities, qualifications, and authorities of project team members for the activities included under this Work Plan.

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6. DATA MANAGEMENT

This section provides the data management process and procedures to be implemented for the field and for handling laboratory data generated from work activities in support of the work included in this Work Plan. The data management will satisfy the requirements of the QAPjP (Appendix A).

6.1 Personnel Roles and Responsibilities Specific to Data Management

Specific data management roles and responsibilities for the Data Management Lead and Field Team Lead are discussed below:

- **Data Management Lead**—Responsible for oversight of transfer of field data to electronic data deliverable (EDD) format for loading to the project database, loading of laboratory EDDs, updating the database as required with current data pulls from the Environmental Resources Program Information Management System (ERPIMS) data repository, and running reports to provide current and historical data from the database. Also responsible for uploading the database with data validation qualifiers following validation, edits resulting from data validation, and delivering the ERPIMS data deliverable to the USAF data management contractor.
- **Field Team Lead (responsibility will be assigned for each task to qualified staff)**—Responsible for the accuracy of all field activity-related documentation and records collected in support of project plan implementation including all information related to field sample collection; field instrumentation and measurements; equipment decontamination; and sample management and shipping documentation, field variance, and corrective action.

6.2 Project Data Types and Records

Field and analytical data will be collected as appropriate in support of activities associated with well drilling and installation and groundwater sampling. The following section describes the types of records and documentation that will be included for current and historical datasets, databases that will be used, database input requirements, and how data will be maintained and archived.

6.2.1 Project Data and Records

Project data will be documented and recorded using various methods as applicable. The following is a list of the various field documentation and records that may be generated during project data gathering activities.

- Air bills and sample shipping documentation
- Analytical laboratory reports
- Chain-of-custody records
- Communication logs/electronic mail
- Corrective action reports
- Documentation of corrective action results

- Documentation of deviations from methods (variances)
- Documentation of internal QA reviews
- Laboratory EDDs
- Field data collection forms, including boring logs, well construction logs, and field parameter logs
- Sampling notes in bound, waterproof field logbooks or on designated field forms
- Field instrumentation calibration logs
- Survey files for well locations
- Identification of QC samples
- Photographs
- Sampling equipment decontamination records
- Sampling location figures (based on targeted and actual coordinates)
- Field variance request forms.

These records will be created in either written (e.g., sampling notes) or electronic formats (e.g., survey files, measurement instrument/data-logger files, field databases, etc.). All records will undergo an independent review either at the laboratory or in the field by the technical leads, QA Officer, or Project Manager. Additional information is provided in the QAPjP (Appendix A).

6.2.2 Laboratory Testing Data

Laboratory samples to be collected in support of the project include groundwater for chemical analysis. Sampling and data generated for IDW are discussed in Section 8, but do not meet the project data quality objectives as discussed in this section. Data deliverables to be provided by the laboratory will be project- and data-type specific. Laboratory data will include:

- ***Chemical Analytical Data***—U.S. Environmental Protection Agency (EPA) Level IV-type data report (in portable document format) and electronic data files in EQuIS® format and ERPIMS Version 6.0.

6.2.3 Chemical Analytical Data

Chemical analytical data will include sample results from groundwater samples generated by the laboratory subcontractor. These data may include both routine and non-routine analytical testing. Chemical analytical data will include Level IV-type data reports as defined in the QAPjP, EQuIS® 6 EDD for validation and loading into the project database, and ERPIMS Version 6.0 EDDs for processing and submittal of validated analytical data to the AFCEC data management contractor.

The laboratory is responsible for ensuring that all analytical data reported in the electronic copy and Level IV-type data report are consistent, accurate, and complete in accordance with their scope. Verification of EDD formatting and completeness will be performed by the EA data management personnel during data review and upload of electronic data files. EDDs and data reports received from the laboratory that contain errors will be returned to the laboratory for correction and resubmittal. All chemical analytical data will be uploaded to the USAF data repository.

6.3 Handling and Management of Project Generated Data

Data handling and management procedures are established to effectively process analytical and measurement data generated during field activities such that the relevant data are readily accessible and accurately maintained. There are multiple activities involved in the recording, storage, processing, and maintenance of project datasets and systems to manage these. In order to ensure that data are accurately recorded and stored, data tracking systems will be implemented. Automated and manual QC checks will be conducted to verify that data have been accurately recorded and appropriately stored. Corrective actions will be taken and documented in the event data have not been properly handled. General data handling and management as well as information on naming conventions, loading, and reporting of laboratory analytical data are discussed in this section.

The following sub-sections describe the data handling and management of data collected during field activities in support of the pilot tests at Kirtland AFB, including onsite field and measurement data and offsite laboratory data. Field measurement and analytical data will be loaded into an EQuIS® database using Microsoft® Excel files and laboratory EDDs provided in the appropriate format per the templates provided by the data management team. These files will be saved and stored in Kirtland AFB project-specific folders located on the EA secure server.

6.3.1 Data Management Processes for Field-Related Data

Three general types of data will be collected and recorded in the field:

- Data to support sample collection and analysis
- Field measurements
- Field observations.

Project data collected during monitoring, investigation, and remediation sampling activities will be managed and stored using the EQuIS® Environmental Data Management System (Version 6.4). The types of field data to be managed in EQuIS® include field sampling parameters collected during well sampling and vapor monitoring, water level measurements, sampling observations and sample location information such as coordinates, etc. Field data will be recorded on the appropriate forms or electronically, and reviewed and transferred to the field data electronic format as appropriate. The EDDs will be reviewed for accuracy and completeness against field records prior to being loaded into the EQuIS® database. The Data Management Lead will be responsible for ensuring that all field data files uploaded into EQuIS and ERPIMS are maintained on the corporate project server along with the ERPIMS submittal files and the project-specific database.

Field data that cannot be integrated into the database (i.e., site photographs, field logbooks, or field forms) will be stored electronically in the project-specific network folders and/or in the project files, along with supporting metadata such as author/creator of data, date, location, and a brief description. The Field Team leads will be responsible for ensuring that all field data files are stored electronically in the project-specific network folders and all paper copies scanned and stored electronically in the project folders.

6.3.2 Analytical Data Management

Procedures for collecting field samples for laboratory analysis and the types of analyses to be conducted during the field activities are provided in the QAPjP (Appendix A). This section provides an overview of the EDD to be used for analytical data, the EDD loading process, field data verification, and analytical data validation. Record-by-record review of hard copy to electronic data transmittals from laboratories will be verified, including validation qualifiers provided by the validation subcontractor.

Data management staff will review data and records received from the field team, subcontractor laboratories, and other subcontractors using the following process to ensure accuracy:

- Review field notes, logbooks, and field forms.
- Verify field coordinates with the Geographic Information System group.
- Provide record-by-record review of hard copy or electronic data transmittals from laboratories to data validators against the records loaded in the database for all validated results.
- For data transmitted through subcontractors (not including the laboratories), check 5-10 percent (%) of loaded data records against data transmittals to verify import procedures.
- For calculated or reported total analyte results, perform calculations on 100% of data to verify concentrations.

The laboratory will be required to submit their results in ERPIMS and EQuIS® EDD formats to be obtained from the laboratory secure website. Designated data management personnel will check and load the EDDs into the EQuIS® and ERPIMS database systems. Any errors in the EDD for a given sample delivery group will prevent loading of data from that sample delivery group and the issue will be communicated to the Laboratory Project Manager for correction and resubmission. Analytical data will be managed in EQuIS® for validation and reporting purposes. The ERPIMS data deliverables will be submitted to the USAF data management subcontractor and processed for upload to the USAF data repository.

One hundred percent of the analytical data generated by the subcontractor laboratories in support of the groundwater samples collected from the newly added wells will undergo EPA Stage 3 validation in accordance with the requirements in the project QAPjP. Validation qualifiers will be applied to the data results in the EQuIS® EDD and uploaded to the project database. Validation qualifiers will be included in the upload to the USAF data repository.

6.4 Data Security

The information systems that will house the BFF pilot test data, including field and analytical data as well as other electronic information, include systems maintained and managed within contractor offices. Servers located in contractor facilities are physically secured in locked buildings and rooms with access limited to authorized personnel.

Corporate servers are electronically secured behind firewalls with multiple layers of anti-malware software that protect the firewall, the local area network, and electronic mail networks. The servers are backed up nightly. Corporate servers and networking equipment are connected to battery-based uninterruptable power supplies with automated shutdown procedures in the event of a power outage.

7. QUALITY ASSURANCE/QUALITY CONTROL

QA/QC activities for groundwater sampling will be conducted in accordance with the processes and procedures documented in the QAPjP (Appendix A).

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8. WASTE MANAGEMENT

IDW generated during the implementation of this project will be managed as specified in this Work Plan. Waste volumes will be minimized to the extent practical and to eliminate the potential for the local population's exposure to IDW during and after work hours. Any characteristically hazardous IDW will be accumulated for no longer than 90 days prior to disposal. Figure 3-2 displays the location of the IDW storage area.

8.1 Water Investigation-Derived Waste

All water generated during well development or during sampling events will be 100% captured and contained during generation. The following categories of water are discussed in the paragraphs below:

- **Non-hazardous water** generated from:
 - Development of GWM wells installed under this Work Plan (i.e., KAFB-106240 through KAFB-106245). The well locations are all outside of the historical EDB plume boundary (Figure 3-1), and the nearest GWM wells to the new well locations have never generated water with hazardous levels of contamination. Although this water is considered non-hazardous, IDW sample results will be used for waste profiling prior to disposal.
 - Purge water or excess water from sampling all wells included in this Work Plan will be held in the IDW storage area pending receipt of analytical data until at least two consecutive sampling events establish a nonhazardous waste profile (do not meet the definition of characteristic hazardous waste (40 CFR Part 261 [2015])).
 - Decontamination water from equipment cleaning across all site activities.
- **Hazardous/potentially hazardous water** generated from:
 - Purge water or excess water from sampling of wells KAFB-106149-484, KAFB-106151-484, KAFB-106152-484, and KAFB-106153-484, for which previous data do not exist, will be assumed to be hazardous until data from two consecutive sampling events document contamination is present at concentrations that are below the characteristic hazardous waste toxicity criteria (40 CFR Part 261.24).
 - Purge water or excess water from sampling of wells for which historical data show water quality fluctuating between non-hazardous and hazardous classification.
 - Purge water or excess water from sampling of wells that had concentrations relatively close to the regulatory standard in 40 CFR Part 261.24 (e.g., water that exhibited benzene above 0.4 milligrams per liter in at least one of the previous two events).

Excess purge water obtained from GWM activities is characterized and disposed of based on the analytical results obtained from individual wells during quarterly sampling. Large volumes of water associated with the installation, development, maintenance, or other activities not pertaining to GWM are sampled from their respective container (e.g. roll-off, Baker tank, etc.) by bailer. The QAPjP in Appendix A presents additional information regarding analytical requirements for all samples.

8.1.1 Non-Hazardous Water

Non-hazardous water generated from well development or groundwater sampling activities may contain concentrations of dissolved iron and manganese that exceed the influent acceptance limits specified in the O&M Plan (USACE, 2017b). Non-hazardous water will be managed as described below depending on dissolved metals concentrations.

8.1.1.1 Non-Hazardous Water with Dissolved Metals Exceeding Groundwater Treatment System Influent Acceptance Limits

IDW water that contains dissolved iron and manganese exceeding the GWTS influent acceptance limits (USACE, 2017b) will be kept segregated by point of origin both during transport and in storage and will not be discharged directly to the GWTS. Upon generation, the water will be placed in dedicated containers (i.e., drums, totes, or storage tanks) and transported to the “pending analysis” storage facility where the drums will be labeled and stored pending laboratory analytical results. This water will be profiled for offsite disposal based on the IDW analytical data, or the analytical data from the sample collected from the well purged.

8.1.1.2 Non-Hazardous Water with Dissolved Metals Less than the Groundwater Treatment System Influent Acceptance Limits

For IDW waste with dissolved iron and manganese concentrations that meet influent acceptance limits (USACE, 2017b), the water will be segregated while in storage until waste profile analytical data are available. Fluids purged or generated at the wellheads will be placed in dedicated containers (i.e., drums, totes, or storage tanks) and transported to the IDW storage area. The quantity of IDW water from each well and the total quantity of water transferred to the GWTS will be recorded. A minimal amount of fines is anticipated to be present in this water and pre-filtering before batching into the GWTS is not anticipated.

If, for any reason, the GWTS cannot accept the purge water as it is generated (e.g., shut down for maintenance), the water will be temporarily stored in the IDW storage area on pallets and properly labeled until it can be discharged to the GWTS.

8.1.2 Hazardous/Potentially Hazardous Water

Purge water or excess water from sampling of newly added wells KAFB-106149-484, KAFB-106151-484, KAFB-106152-484, and KAFB-106153-484 will be considered potentially hazardous. Due to undocumented water quality from these wells, this water will be treated the same way as the hazardous water until proven that it is non-hazardous. The quantity of water generated from each well will be recorded. Characteristically hazardous water generated from any well development or sampling activities will be kept segregated by point of origin both during transport and while accumulated prior to offsite disposal. Upon generation, the water will be placed in dedicated drums and transported to the less than 90-day accumulation area for hazardous waste where the drums will be labeled pending laboratory analytical results. This water will be profiled for disposal based on the analytical data from the sample collected from the well purged and, if proven hazardous, will be disposed of accordingly within the 90-day hold time. A minimal amount of fines is anticipated to be present in this water.

8.2 Soil Investigation-Derived Waste

Soil will be 100% captured and contained at the drill site during well drilling. All necessary equipment will be provided to contain and transport soil IDW back to the IDW storage area for further handling (i.e., characterization, temporary storage, and disposal). IDW soil from drilling sites will be collected, secured, and transported in 20-cubic yard lined roll-off bins to the IDW storage area pending receipt of waste characterization profiling results.

For profiling of solid waste (soil cuttings), each roll-off containing soil will be characterized for disposal at the Kirtland AFB Construction and Demolition (C&D) Landfill with a 5-point composite IDW sample. The samples will be analyzed for the suites outlined in Table 8-1. Soil will have to meet the waste acceptance criteria for the Kirtland C&D Landfill (USAF, 2009).

Once the analytical results for soil IDW are received and reviewed, a Request for Disposal letter will be provided to Kirtland AFB for approval to dispose of the contents of each container. All documentation regarding waste characterization and disposal will be provided in the appendices of the document describing the activities during which waste was generated.

Should the petroleum levels exceed what the Kirtland C&D Landfill is allowed to accept (benzene, toluene, ethylbenzene, and toluene >50 milligrams per kilogram [mg/kg], benzene >10 mg/kg, or total petroleum hydrocarbons >100 mg/kg), it will require characterization as “special waste” and disposed of at an offsite permitted landfill. The QAPjP (Appendix A) presents additional information regarding analytical requirements.

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9. ACCIDENT PREVENTION PLAN/SITE SAFETY AND HEALTH PLAN

The safety requirements for the field implementation of this project are addressed in the companion document, *APP for BFF Expansion of the Dissolved-Phase Plume GWTS Design and the Vadose Zone Treatability Studies (Revision 5)* that also contains the SSHPs (EA, 2017). All field personnel associated with the project will be required to read and understand the elements of the APP, and the document will be available at the project location at all times.

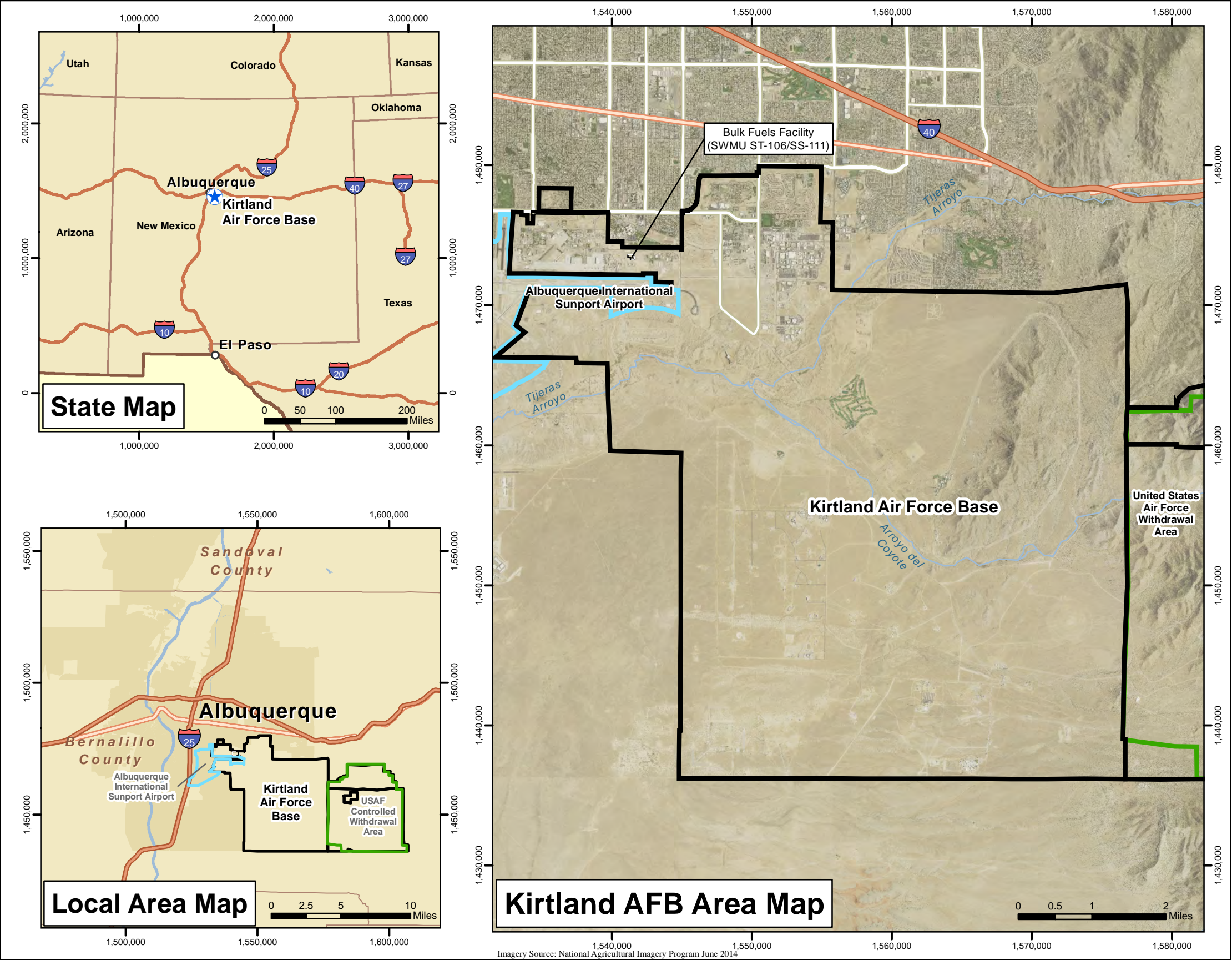
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10. REFERENCES

- Code of Federal Regulations (CFR). 2015. *Title 40, Chapter I, Subchapter I, Part 261, Identification and Listing of Hazardous Waste, Subpart C*. Updated as of October 22.
- EA Engineering, Science, and Technology, Inc., PBC (EA). 2017. *Accident Prevention Plan for the Base Bulk Fuels Facility Expansion of the Dissolved-Phase Plume Groundwater Treatment System Design and the Vadose Zone Treatability Studies, Revision 5, Kirtland Air Force Base, New Mexico*. July.
- New Mexico Environment Department (NMED). 2010. Hazardous Waste Treatment Facility Operating Permit, EPA ID No. NM9570024423, Issued to U.S. Air Force for the Open Detonation Unit Located at Kirtland Air Force Base, Bernalillo County, New Mexico, by the NMED Hazardous Waste Bureau. July.
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- USACE. 2017b. *Operations and Maintenance Plan, Groundwater Treatment System – Annual Update, Bulk Fuels Facility, SWMU ST-106/SS-111, Kirtland Air Force Base, New Mexico*. Prepared by EA Engineering, Science, and Technology, Inc., PBC for the USACE–Albuquerque District under USACE Contract No. W912DR-12-D-0006. September.
- U.S. Air Force (USAF). 2004. *Base-Wide Plans for the Environmental Restoration Program 2004 Update*. Kirtland Air Force Base, New Mexico. April.
- USAF. 2009. Memorandum on Kirtland AFB Landfill Acceptance of Soil and Debris from Restoration Sites and/or Monitoring Well Installation. January.

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FIGURES



Legend

- Kirtland Air Force Base Installation Boundary
- Albuquerque International Sunport Airport
- United States Air Force Controlled Withdrawal Area
- Major Highways
- Highways
- Major Roads
- Rivers
- Source Area



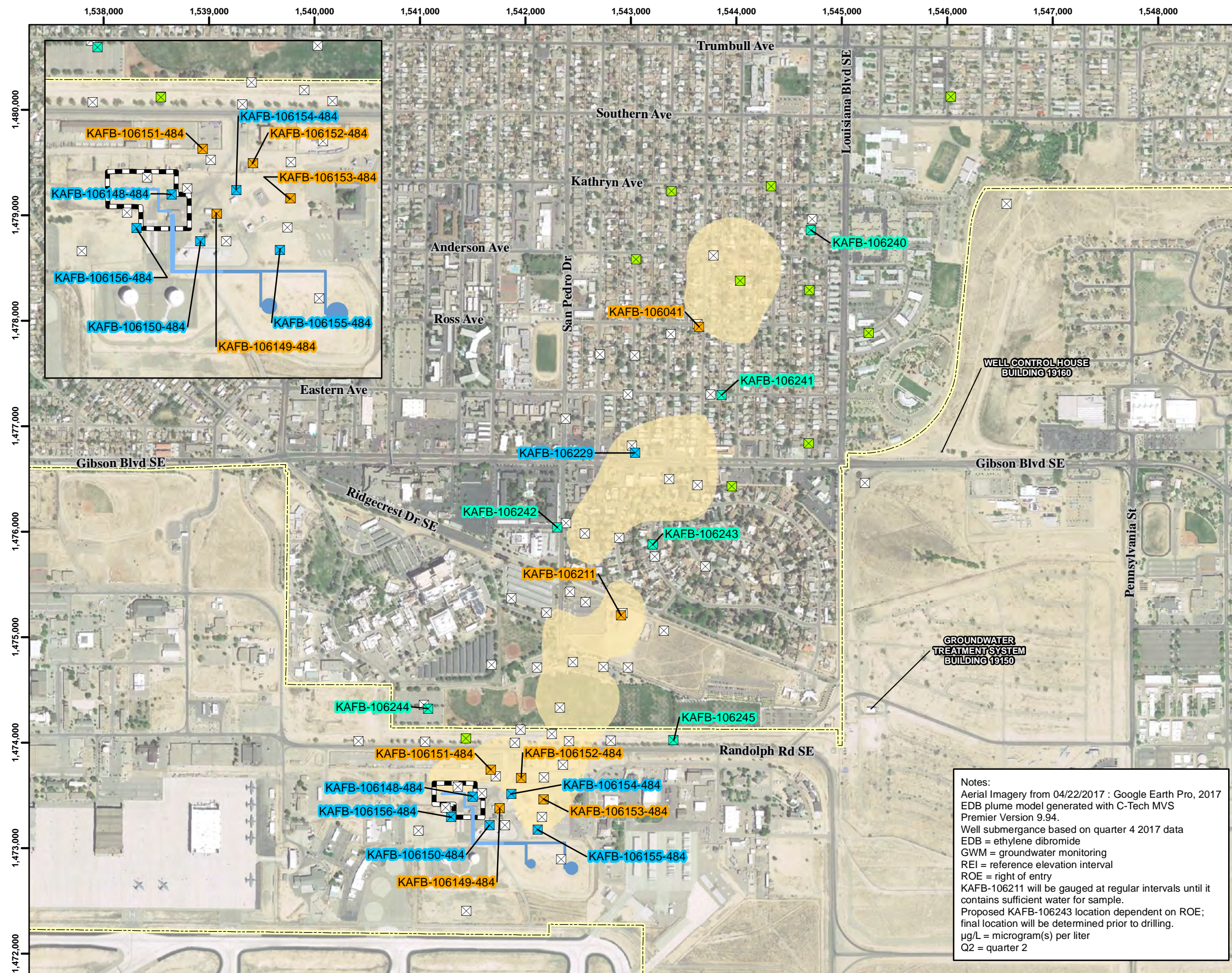
Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

WORK PLAN FOR DATA GAP
MONITORING WELL INSTALLATION
BULK FUELS FACILITY
SOLID WASTE MANAGEMENT UNIT ST-106/SS-111
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 1-1

SITE LOCATION MAP

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Legend

Monitoring Well Additions

- New Monitoring Well (2018)
- Existing Monitoring Well for Sampling and Gauging
- Existing Monitoring Well for Gauging Only
- Existing 4857 REI Groundwater Monitoring Well (screen not submerged)
- Existing 4857 REI Groundwater Monitoring Well (screen submerged)
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Boundary
- EDB Plume with Concentration > 0.05 µg/L, Q2 2017
- Source Area

SITE LOCATION

N

0 500 1,000 2,000

Feet

1 inch = 1,000 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

WORK PLAN FOR DATA GAP

MONITORING WELL INSTALLATION

BULK FUELS FACILITY

SOLID WASTE MANAGEMENT UNIT ST-106/SS-111

KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 3-1

GROUNDWATER MONITORING

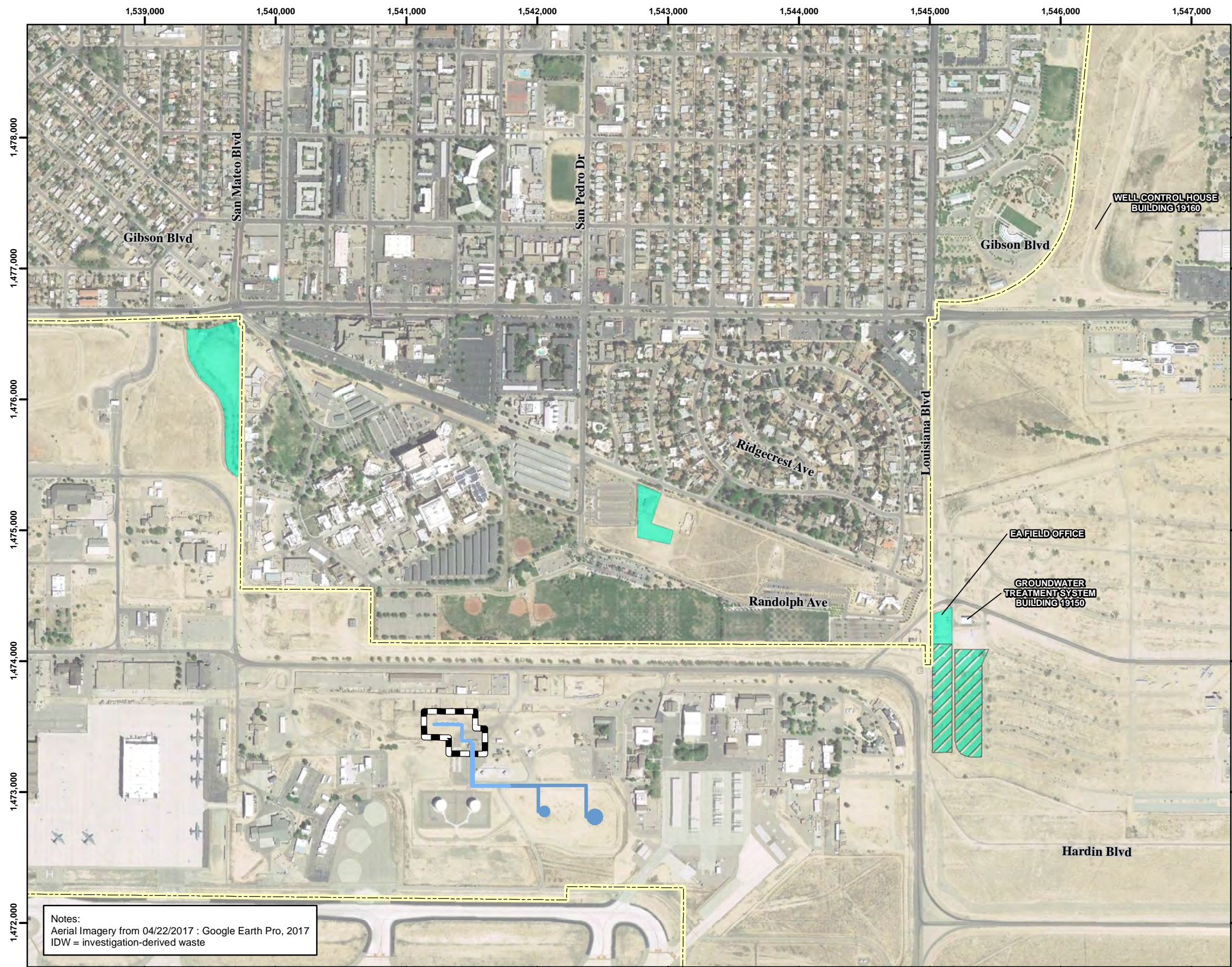
WELL LOCATIONS FOR REFERENCE

ELEVATION INTERVAL 4857








Notes:
 Aerial Imagery from 04/22/2017 : Google Earth Pro, 2017
 EDB plume model generated with C-Tech MVS Premier Version 9.94.
 Well submergence based on quarter 4 2017 data
 EDB = ethylene dibromide
 GWM = groundwater monitoring
 REI = reference elevation interval
 ROE = right of entry
 KAFB-106211 will be gauged at regular intervals until it contains sufficient water for sample.
 Proposed KAFB-106243 location dependent on ROE; final location will be determined prior to drilling.
 µg/L = microgram(s) per liter
 Q2 = quarter 2

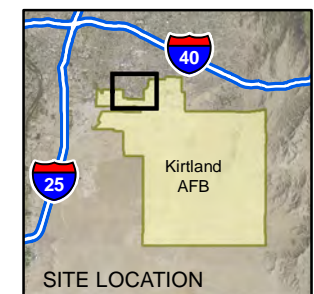
P:\gis\Projects\Kirtland\Figures\DataGap\WellsWorkPlan\3-1 Kirtland DGMW_WP_GWM Locations.mxd 12/19/2017 EA sbusby

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Legend

-  Laydown Area
-  IDW Storage Area
-  Former Aboveground Storage Tank
-  Former Buried Fuel Transfer Line
-  Former Aboveground Fuel Transfer Line
-  Installation Boundary
-  Source Area



0 400 800 1,600

Feet

1 inch = 800 feet

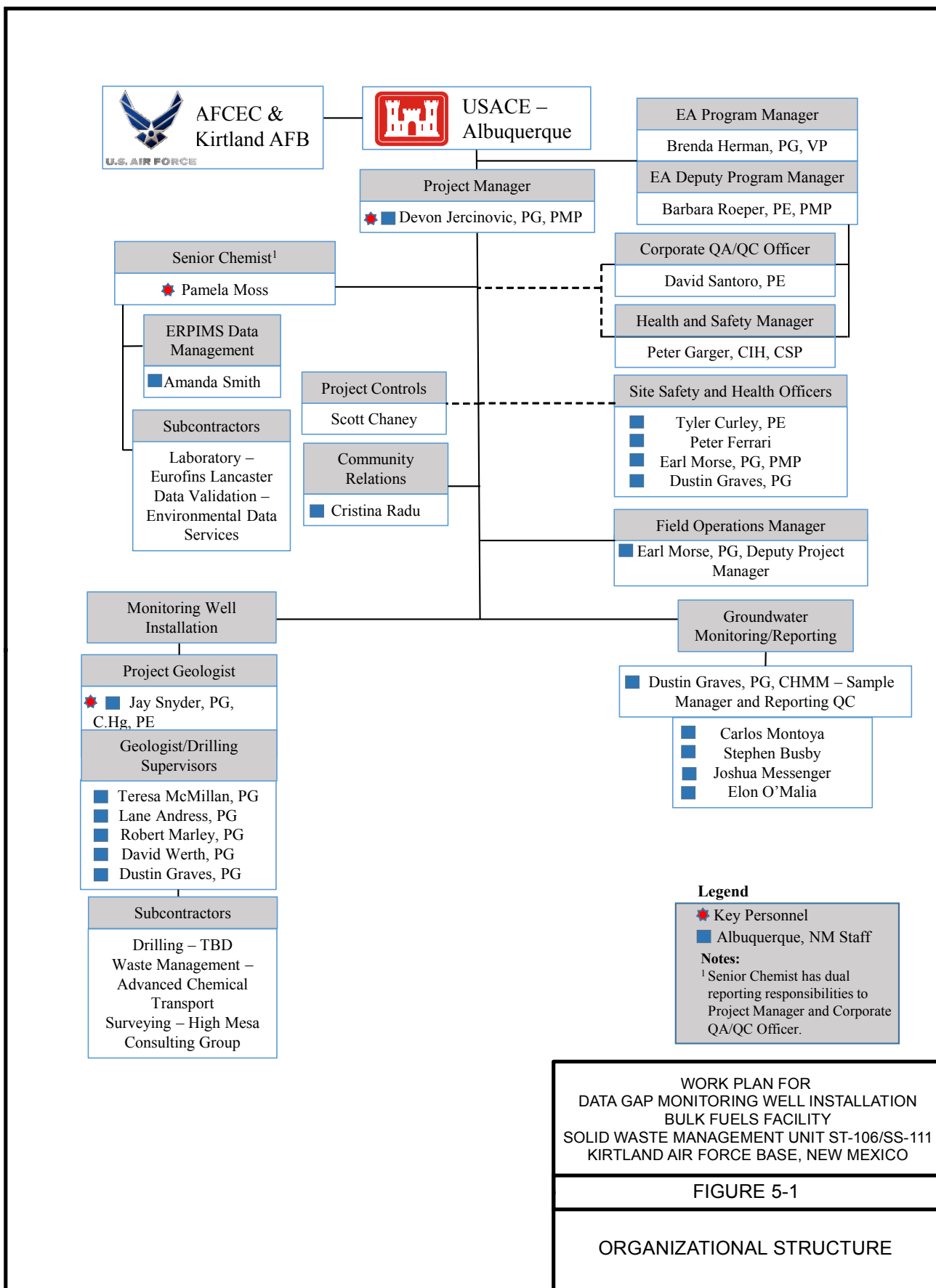
Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

WORK PLAN FOR DATA GAP
MONITORING WELL INSTALLATION
BULK FUELS FACILITY
SOLID WASTE MANAGEMENT UNIT ST-106/SS-111
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 3-2

SITE LAYDOWN AND INVESTIGATION-
DERIVED WASTE STORAGE AREAS

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TABLES

**Table 3-1
Data Gap Groundwater Monitoring Well Design Summary**

Well ID	Nominal Borehole Diameter^a	Completion	Approximate Screen Depths (ft)^b	Screen Lengths (ft)	Approximate Water Table Depths (ft)^c	Design Well Screen Elevations (ft amsl)^d
KAFB-106240 ^e	10-inch	Nested - two wells; 3-inch Schedule 80 PVC each	403.3 - 428.3	25	462.3	4,930 - 4,905
			437.3 - 477.3	40		4,896 - 4,856
KAFB-106241 ^e	10-inch	Nested - two wells; 3-inch Schedule 80 PVC each	395.9 - 420.9	25	454.9	4,930 - 4,905
			429.9 - 469.9	40		4,896 - 4,856
KAFB-106242 ^e	10-inch	Nested - two wells; 3-inch Schedule 80 PVC each	384.3 - 409.3	25	443.4	4,930 - 4,905
			418.3 - 458.3	40		4,896 - 4,856
KAFB-106243 ^e	10-inch	Nested - two wells; 3-inch Schedule 80 PVC each	394.7 - 419.7	25	453.7	4,930 - 4,905
			428.7 - 468.7	40		4,896 - 4,856
KAFB-106244 ^e	10-inch	Nested - two wells; 3-inch Schedule 80 PVC each	415.2 - 440.2	25	474.2	4,930 - 4,905
			449.2 - 489.2	40		4,896 - 4,856
KAFB-106245 ^e	10-inch	Nested - two wells; 3-inch Schedule 80 PVC each	423.2 - 448.2	25	482.2	4,930 - 4,905
			457.2 - 497.2	40		4,896 - 4,856

^a All wells will be drilled via ARCH method.

^b Depth intervals may be modified during drilling based on observed conditions; well screens will be positioned with approximately 15 ft of water column upon completion.

^c Approximate depth to water determined from Q4 2017 data in surrounding groundwater monitoring wells.

^d Approximate groundwater elevation in Q4 2017 = 4,871 ft amsl.

^e Nested wells consist of two well screen intervals: (1) a "dry" interval to accommodate water level rise, and (2) a current water table interval.

amsl = above mean sea level

ARCH = air rotary casing hammer

ft = feet/foot

ID = identification

PVC = polyvinyl chloride

Note: All well screens will be 0.010-inch slot screens, and all filter pack will be 10/20 Colorado silica sand. Details provided on construction diagrams in Appendix B.

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Table 3-2
Data Gap Monitoring Wells for Inclusion in Groundwater Sampling Program

Well ID	Existing/ Proposed	Easting^a	Northing^a	Anticipated Date of Inclusion^c	Comments
KAFB-106041	Existing	1543646	1477944	Q1 2018	GWM well completed above water table in 2011
KAFB-106149-484	Existing	1541756	1473378	Q1 2018	PneuLog SVM well completed above water table in 2011
KAFB-106151-484	Existing	1541674	1473743	Q1 2018	PneuLog SVM well completed above water table in 2011
KAFB-106152-484	Existing	1541962	1473665	Q1 2018	PneuLog SVM well completed above water table in 2011
KAFB-106153-484	Existing	1542176	1473464	Q1 2018	PneuLog SVM well completed above water table in 2011
KAFB-106211 ^b	Existing	1542906	1475206	Q1 2020	Former Air Sparge/SVE well completed above water table in 2014
KAFB-106240	Proposed	1544706	1478862	Q4 2018	Proposed GWM well to be completed as nested well in 2018 (Table 3-1)
KAFB-106241	Proposed	1543860	1477298	Q4 2018	Proposed GWM well to be completed as nested well in 2018 (Table 3-1)
KAFB-106242	Proposed	1542304	1476040	Q3 2018	Proposed GWM well to be completed as nested well in 2018 (Table 3-1)
KAFB-106243	Proposed	1543208	1475876	Q4 2018	Proposed GWM well to be completed as nested well in 2018 (Table 3-1)
KAFB-106244	Proposed	1541078	1474324	Q3 2018	Proposed GWM well to be completed as nested well in 2018 (Table 3-1)
KAFB-106245	Proposed	1543406	1474026	Q3 2018	Proposed GWM well to be completed as nested well in 2018 (Table 3-1)

^a Coordinates are displayed in State Plane New Mexico Central FIPS 3002 (US Feet) North American Datum 1983.

^b Well KAFB-106211 will be included when approximately 5 ft of water column is present in the well (approx. elev. of 4878 ft amsl). Based on a calculated average of 3.3 feet of groundwater rise per year, this well is anticipated for

^c Anticipated date of inclusion is estimated; actual dates are pending NMED approval, contract award, and permit approvals.

amsl = above mean sea level

FIPS = Federal Information Processing Standards

ft = foot/feet

GWM = groundwater monitoring

ID = identification

NMED = New Mexico Environment Department

SVE = soil vapor extraction

SVM = soil vapor monitoring

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Table 3-3
Groundwater Monitoring Sampling Requirements for Data Gap Wells

Analyte	Analysis	Wells^{a,b}	Number of Wells Anticipated for Inclusion in 2018^c
QUARTERLY			
EDB	EPA Method 8011	Newly added wells (as required)	12
BTEX	EPA Method 8260C – BTEX (4 analytes)	Newly installed wells KAFB-106244 and KAFB-106245	2
Total Metals	EPA Method 6010C (calcium, magnesium, potassium, sodium)	Newly added wells (as required)	12
Dissolved Metals	EPA Method 6010C (iron, manganese)	Newly added wells (as required)	12
Total Metals	EPA Method 6020A (arsenic, lead)	Newly added wells (as required)	12
Anions	EPA Method 300.0A (chloride, bromide, sulfate)	Newly added wells (as required)	12
Anions	EPA Method 353.2 (nitrate/nitrite nitrogen)	Newly added wells (as required)	12
Alkalinity - Bicarbonate/Carbonate	Standard Method 2320B	Newly added wells (as required)	12
SEMIANNUAL			
BTEX	EPA Method 8260C – BTEX (4 analytes)	Newly added wells KAFB-106149-484, KAFB-106151-484, KAFB-106152-484, and KAFB-106153-484	4
ANNUAL			
VOCs (select analytes)	EPA Method 8260C	Newly added wells	12

^a Five existing wells (KAFB-106041, KAFB-106149-484, KAFB-106151-484, KAFB-106152-484, and KAFB-106153-484) will be sampled in Q1 2018; well KAFB-106211 will be sampled once sufficient water column is present within the screen (i.e. minimum of 5 feet of water column); six new wells (KAFB-106240 through KAFB-106245) are proposed to be installed and will be sampled in 2018 following well completion (Figure 3-1).

^b All newly added wells will have a minimum of 4 quarters of baseline sampling performed for EDB, metals, anions, and alkalinity.

^c Does not include contingency wells that will be installed in 2018, but will not be added to the active GWM network for several years, pending water table rise of approximately 35 feet.

BTEX = benzene, toluene, ethylbenzene, and xylenes

EDB = ethylene dibromide

EPA = U.S. Environmental Protection Agency

VOC = volatile organic compound

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Table 3-4
Permit Requirements for New Well Installations

	NMED	NMOSE	COA				Kirtland AFB			Veterans Affairs	NM811
Task	RCRA Well Installation Work Plan Approval	Drilling Permit	License Agreement for Site Access	Noise Control Plan	Groundwater Well Permit	Barricade and Traffic Control Plan	332 Civil Engineering Request	Civil Engineering Dig Permit Request	Licensed Survey	Permit for Use of Real Property	Line Locates Ticket
	Permit Expiration (days)										
	NA	NA	NA	30	30	30	90	30	NA	NA	--
Well											
KAFB-106240	X	X	X	X	X	X	NA	NA	X	NA	X
KAFB-106241	X	X	X	X	X	X	NA	NA	X	NA	X
KAFB-106242	X	X	X	X	X	X	NA	NA	X	NA	X
KAFB-106243	X	X	X	X	X	X	NA	NA	X	NA	X
KAFB-106244	X	X	NA	NA	NA	NA	NA	NA	X	X	X
KAFB-106245	X	X	NA	NA	NA	NA	X	X	X	NA	X

AFB = Air Force Base
COA = City of Albuquerque
ID = identification
NA = not applicable
NMED = New Mexico Environment Department
NMOSE = New Mexico Office of the State Engineer
RCRA = Resource Conservation and Recovery Act

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Table 3-5
Data Gap Monitoring Wells for Inclusion in Quarterly Groundwater Gauging Events

Well ID	Easting^a	Northing^a
KAFB-106041	1543646	1477944
KAFB-106148-484	1541500	1473487
KAFB-106149-484	1541756	1473378
KAFB-106150-484	1541661	1473222
KAFB-106151-484	1541674	1473743
KAFB-106152-484	1541962	1473665
KAFB-106153-484	1542176	1473464
KAFB-106154-484	1541868	1473512
KAFB-106155-484	1542116	1473172
KAFB-106156-484	1541299	1473296
KAFB-106211 ^b	1542906	1475206
KAFB-106229	1543042	1476749
KAFB-106240 ^c	1544706	1478862
KAFB-106241 ^c	1543860	1477298
KAFB-106242 ^c	1542304	1476040
KAFB-106243 ^c	1543208	1475876
KAFB-106244 ^c	1541078	1474324
KAFB-106245 ^c	1543406	1474026

^a Coordinates are displayed in State Plane New Mexico Central FIPS 3002 (US Feet) North American Datum 1983.

^b Well KAFB-106211 will be gauged quarterly; however, as of Q4 2017 there is no water in the well screen. This well will be added to quarterly potentiometric maps and data tables when sufficient water is present to render an accurate water level.

^c Proposed wells KAFB-106240 through KAFB-106245 will be included in quarterly gauging events subsequent to respective well installation.

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**Table 5-1
Staff Roles, Responsibilities, and Authorities**

Position/Staff	Qualifications	Responsibilities	Authority Level
Program Manager Brenda Herman, PG	<ul style="list-style-type: none"> • M.S. in Geology • 23 years of program management experience for USACE • Managed \$200 million of USACE/Army projects, including \$21 million of performance-based contracts at AFBs 	<ul style="list-style-type: none"> • As EA Officer, authorized to negotiate/sign contract and commit resources • Primary point-of-contact for USACE on contractual and programmatic items • Ensures consistency in deliverables and cost/performance reporting and progress reporting/invoicing • Coordinates issue resolution as needed with Contracting Officer's Representative and/or Contracting Officer 	<ul style="list-style-type: none"> • Coordinates corrective action at programmatic level
Project Manager Devon Jercinovic, PG, PMP	<ul style="list-style-type: none"> • M.S. in Geology • 30 years of experience in management and technical support for site characterization • Project Manager for \$50 million+ of RCRA/CERCLA investigations and remediation at Kirtland AFB since 1997 • Past New Mexico Environment Department environmental regulator in the former Groundwater and Hazardous Waste Bureau 	<ul style="list-style-type: none"> • Ensures that all work is accomplished with adequate internal controls • Main point of contact for USACE on project-specific matters • Reviews/confirms technical approach from kickoff meeting and throughout project execution to ensure project objectives are met • Assembles and schedules resources • Ensures on-schedule and high quality services are delivered within budget • Manages subcontractors • Coordinates EA's participation in the public meeting and community relations process • Identifies and mitigates risks related to execution of the technical aspects of the work and ensures site safety • Ensures work is performed in accordance with USACE/U.S. Air Force Guidelines, state/federal regulations, and within the bounds of the RCRA, City of Albuquerque, and New Mexico Office of the State Engineer permits • Applies lessons learned from current and past projects • Responsible for front and back end transition activities to ensure continuity on the project • Ensures public relations sensitivities are met 	<ul style="list-style-type: none"> • Full responsibility and authority to execute Task Orders • Approves subcontractor invoices, project charges, and deliverables • Implements corrective action • Stops work for any reason related to the project

Table 5-1
Staff Roles, Responsibilities, and Authorities

Position/Staff	Qualifications	Responsibilities	Authority Level
Corporate QA/QC Officer David Santoro, PE	<ul style="list-style-type: none"> • B.S. in Agricultural Engineering • 53 years of engineering, environmental remediation, and construction experience • Served as Program QA Manager on \$400 million+ of federal projects 	<ul style="list-style-type: none"> • Reports to Program Manager—Independent of the Project Manager • Identifies approved senior technical reviewers and QC staff • Assists in developing and approves project quality certification programs • Monitors work, procedures, and documentation to ensure compliance with quality certification programs • Initiates/provides recommendations to improvements to the quality process • Develops and oversees corrective actions • Conducts independent QC audits 	<ul style="list-style-type: none"> • Evaluates performance of review staff and review process and provides feedback, including recommendations, to project manager • Implements corrective action if the quality of the work is not acceptable
Health and Safety Manager Peter Garger, CIH, CSP	<ul style="list-style-type: none"> • M.S. in Public Health • As Corporate Health and Safety Director, oversees health and safety activities for 450+ employees and 30 federal contracts • Prepared/reviewed over 3,000 APPs/SSHPs • Served as Chief of Industrial Hygiene for USACE—Baltimore Hazardous, Toxic, and Radioactive Waste Branch • 36 years of experience managing and conducting industrial hygiene services 	<ul style="list-style-type: none"> • Oversees development of APP in accordance with Engineer Manual 385-1-1 and Occupational Safety and Health Administration regulations • Assists Project Manager and procurement staff in verification of safety performance of subcontractors • Investigates any incidents, accidents, or safety violations • Performs safety audits 	<ul style="list-style-type: none"> • Approves APPs/SSHPs and all modifications before issuance to the USACE • Manages Health and Safety Program and directs training and required attendance • Investigates safety concerns raised by staff • Investigates any accidents • Stops work for noncompliance/safety violation

**Table 5-1
Staff Roles, Responsibilities, and Authorities**

Position/Staff	Qualifications	Responsibilities	Authority Level
Senior Chemist Pamela Moss	<ul style="list-style-type: none"> • B.S. in Chemistry • 25 years of chemistry experience, including developing and implementing DQOs in accordance with RCRA/CERCLA to ensure performance standards are achieved • Expertise in developing QAPjP, Sampling and Analysis Plan, Field Sampling Plan for DoD • Performed \$35 million+ of project work at Kirtland, Cannon, and Holloman AFBs in New Mexico 	<ul style="list-style-type: none"> • Reports to both the Project Manager and the Corporate QA/QC Manager • Ensures that project implementation is performed in compliance with QA Project Plans • Overall responsibility for chemical data quality and ensures that data meet DQOs • Supports development of project-specific work plans and QAPjP • Monitors implementation of QAPjP, including oversight of laboratory, analytical methods, reporting limits, and data deliverables • Coordinates third-party data validation and reviews data validation results and reports • Prepares data quality reports to document that data are usable and achieve DQOs • Direct interface with analytical laboratory project manager and QC manager 	<ul style="list-style-type: none"> • Coordinates all communication with the analytical laboratory • Coordinates data validation and evaluation • In coordination with the project manager, implements corrective actions related to laboratory performance
Project Geologist Jay Snyder, PG, CHg, PE	<ul style="list-style-type: none"> • M.S. in Geology/Geological Engineering • 28 years geological experience, working with within New Mexico and with New Mexico regulators 	<ul style="list-style-type: none"> • Reports to the Project Manager and serves as the Alternative Project Manager • Overall responsibility for design, implementation, and management of well installation • Reviews all work plan, geological reporting, and data deliverables • Assists with establishing project-specific DQOs • Coordinates with Field Geologists for oversight and quality control • Responsible for providing input for the design of the corrective actions and reviews corrective elements specific to geology or well installation 	<ul style="list-style-type: none"> • Stop drilling work for any reasons related to drilling activities
Geologist/Drilling Supervisor Teresa McMillan, PG	<ul style="list-style-type: none"> • M.S. in Geosciences • 25 years of geological experience within New Mexico, including lead geologist performing drilling and well installation at Kirtland AFB 	<ul style="list-style-type: none"> • Reports to the Project Geologist • Oversees drilling operations during well installations • Manages soil sampling, lithologic logging, and well construction and development • Conducts data analysis and reporting • Manage Subcontractors • Manage investigation-derived waste 	<ul style="list-style-type: none"> • Stop drilling work for any reasons related to drilling activities

**Table 5-1
Staff Roles, Responsibilities, and Authorities**

Position/Staff	Qualifications	Responsibilities	Authority Level
Field Operations Manager Earl Morse, PG	<ul style="list-style-type: none"> • M.S. in Geology • 32 years in environmental field programs (investigation and construction) 	<ul style="list-style-type: none"> • Reports to the Project Manager • Serves as Deputy to Project Manager • Serves as lead Site Safety and Health Officer and performs local safety audits • Waste Management Coordinator • Manages staffing and field resources for all field investigations • Manages all Project-Dedicated Equipment 	<ul style="list-style-type: none"> • Stop work for any reasons related to any field activities
Senior Environmental Scientist – Field Quality Control Cristina Radu	<ul style="list-style-type: none"> • M.S. Environmental Engineering and Water Resources Management • 25 years of environmental experience in New Mexico under New Mexico Environment Department guidance at 40+ sites • 6 years of Kirtland AFB experience, including groundwater monitoring and support in organizing and preparing materials for public meetings 	<ul style="list-style-type: none"> • Reports to the Project Manager • Provides quality assurance (field and office audits) on groundwater monitoring sampling team and sampling activities • Coordinates with the Project Manager and Senior Chemist on any deviations from the QAPjP due to changed field conditions such that DQOs are met • Assists with public relations and community awareness • Assists with development of public meeting materials and organization of the meetings 	<ul style="list-style-type: none"> • Stop work for any reasons related to sampling activities
Hydrogeologist Groundwater Monitoring Dustin Graves, PG, CHMM	<ul style="list-style-type: none"> • M.S. in Geology • 12 years of geological experience with drilling and well installation oversight and groundwater and drinking water sampling • Past experience coordinating Kirtland BFF project tasks 	<ul style="list-style-type: none"> • Reports to the Project Manager • Manages groundwater monitoring sampling team and sampling activities • Coordinates with the Project Manager, Senior Chemist, and Sr. Environmental Scientist to correct any deviations from the QAPjP such that data quality objectives are met • Coordinates with Project Chemists on all quarterly sampling events • Coordinates data transfer with Data Management Team for the Environmental Restoration Program Information Management System • Manages Quarterly Monitoring Reports 	<ul style="list-style-type: none"> • Stop work for any reasons related to any field activities

Table 5-1
Staff Roles, Responsibilities, and Authorities

AFB = Air Force Base
APP = Accident Prevention Plan
B.S. = Bachelor of Science
BFF = Bulk Fuels Facility
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
CHg = Certified Hydrologist
CHMM = Certified Hazardous Materials Manager
CIH = Certified Industrial Hygienist
CSP = Certified Safety Professional
DoD = Department of Defense
DQO = data quality objective
EA = EA Engineering, Science, and Technology, Inc., PBC
M.S. = Master of Science
PE = Professional Engineer
PG = Professional Geologist
PMP = Project Management Professional
QA = quality assurance
QAPjP = Quality Assurance Project Plan
QC = quality control
RCRA = Resource Conservation and Recovery Act
SSHP = Site Safety and Health Plan
USACE = U.S. Army Corps of Engineers

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Table 8-1
Summary of Investigation-Derived Waste Sampling

Analytical Method	Constituent	Frequency	Sample Location
Water Investigation-Derived Waste from Groundwater Monitoring Activities			
All waste profiling for purge water or excess water from sampling generated during groundwater monitoring activities will be based on historical water quality from the previous two quarters of sample analytical results and/or the sample results from the investigation-derived waste.			
Water Investigation-Derived Waste from Drilling			
EPA Method SW8011 ^a	EDB	One per well	Bailer at end of development
EPA Method SW 6010C/7470A	RCRA Metals and Mercury	One per well	Bailer at end of development
EPA Method SW8260C ^a	VOCs	One per well	Bailer at end of development
Soil Investigation-Derived Waste from Installation of Groundwater Monitoring Wells			
EPA Method SW8015D ^a	TPH-DRO/RRO	One per roll-off	5-point composite
EPA Method SW8015D ^a	TPH-GRO	One per roll-off	5-point composite
EPA Method SW8260C ^a	BTEX	One per roll-off	5-point composite

^a Analytical method per EPA SW-846 Test Methods for Evaluating Solid Waste, Third Edition and Updates, 1986.

BTEX = benzene, toluene, ethylbenzene, and total xylenes

DRO = diesel-range organics

EDB = ethylene dibromide (aka 1,2-dibromoethane)

EPA = U.S. Environmental Protection Agency

GRO = gasoline-range organics

RCRA = Resource Conservation and Recovery Act

RRO = residual-range organics

SW = EPA SW-846-Test Methods for Evaluating Solid Waste, 3rd Edition, 1986 and Updates

TPH = total petroleum hydrocarbons

VOC= volatile organic compound

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APPENDIX A

Quality Assurance Project Plan

**KIRTLAND AIR FORCE BASE
ALBUQUERQUE, NEW MEXICO**

**QUALITY ASSURANCE PROJECT PLAN FOR
BULK FUELS FACILITY
GROUNDWATER TREATMENT SYSTEM AND
GROUNDWATER MONITORING**

SOLID WASTE MANAGEMENT UNIT ST-106/SS-111

Revision 3

December 2017

Prepared for

U.S. Army Corps of Engineers
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AFCEC Air Force Civil Engineer Center CHg Certified Hydrogeologist EA EA Engineering, Science, and Technology, Inc., PBC NMED New Mexico Environment Department PE Professional Engineer PG Professional Geologist PMP Project Management Professional USACE U.S. Army Corps of Engineers				

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 - 1-3 Analytical Method Quality Control
 - 1-4 Analytical Instrument and Equipment Maintenance, Testing, and Inspection
 - 1-5 Analytical Instrument Calibration
 - 1-6 Laboratory Accreditation, Quality Manual, and Standard Operating Procedures
- 2 Daniel B. Stephens & Associates
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- 3-3 Field Instrument Quality Control

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ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
BFF	Bulk Fuels Facility
BTEX	benzene, toluene, ethylbenzene, and total xylenes
COC	chain-of-custody
CY	Calendar Year
DL	detection limit
DoD	Department of Defense
DQCR	daily quality control report
DQO	data quality objective
EA	EA Engineering, Science, and Technology, Inc., PBC
EDB	1,2-dibromoethane (also known as ethylene dibromide)
ELLE	Eurofins Lancaster Laboratories Environmental, LLC
EPA	U.S. Environmental Protection Agency
GWTS	groundwater treatment system
ID	identification
IDW	investigation-derived waste
KAFB	Kirtland Air Force Base (as a designator)
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LNAPL	light non-aqueous phase liquid
LOD	limit of detection
LOQ	limit of quantitation
MS	matrix spike
MSD	matrix spike duplicate
NCR	non-conformance report
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Control Commission
No.	Number
QA	quality assurance
QAPjP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RCRA	Resource Conservation and Recovery Act
RPD	relative percent difference

ACRONYMS AND ABBREVIATIONS (concluded)

SOP	standard operating procedure
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TCLP	Toxicity Characteristic Leaching Procedure
USACE	U.S. Army Corps of Engineers
USAF	U.S. Air Force
VOC	volatile organic compound

EXECUTIVE SUMMARY

This Quality Assurance Project Plan (QAPjP) has been prepared by EA Engineering, Science, and Technology Inc., PBC under the U.S. Army Corps of Engineers–Albuquerque District, Contract Number W912DR-12-D-0006, Delivery Order DM01. This QAPjP was developed to support activities for the Bulk Fuels Facility expansion of the dissolved-phase ethylene dibromide (also known as 1,2-dibromoethane) plume groundwater treatment system (GWTS). The work to be conducted under this contract includes: (1) groundwater sampling related to the installation of groundwater extraction and monitoring wells; (2) operation and maintenance of the GWTS including sampling of influent, between tanks, and effluent; and (3) performing groundwater monitoring of the network wells.

This QAPjP was developed for the Kirtland Air Force Base Bulk Fuels Facility GWTS expansion to meet the quality control requirements defined in the Department of Defense Quality Systems Manual (Version 5.0, July 2013).

The QAPjP documents project management procedures and describes data generation and acquisition for field sampling and laboratory analytical processes, laboratory analytical methods, quality assurance/quality control protocols, data validation and usability, assessment and oversight, data management processes, and reporting requirements to be implemented for the project.

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1. INTRODUCTION

Kirtland Air Force Base (AFB) is located in Bernalillo County, in central New Mexico, southeast of and adjacent to the City of Albuquerque and the Albuquerque International Sunport. The approximate area of the base is 52,287 acres. The Bulk Fuels Facility (BFF) site is located in the northwestern part of Kirtland AFB (Figure 1-1). Environmental restoration efforts at the BFF site are being conducted under requirements set forth in the Resource Conservation and Recovery Act (RCRA) Permit Number (No.) NM9570024423 (RCRA Permit) with the New Mexico Environment Department (NMED) serving as the lead regulatory agency (NMED, 2010). This Quality Assurance Project Plan (QAPjP) addresses activities that are continuing the implementation of the RCRA Interim Measures for this site, including expansion of the existing groundwater treatment system (GWTS) for the dissolved-phase portion of the ethylene dibromide (also known as 1,2-dibromoethane [EDB]) plume and installation and sampling of groundwater monitoring wells.

The BFF and associated infrastructure operated from 1953 until 1999. During this time, the fueling area was separated into a tank holding area where bulk shipments of fuel were received and a fuel loading area where individual fuel trucks were filled. Kirtland AFB removed the underground piping at the facility from service in 1999 due to discovery of underground leakage. Even though the fuel leak was identified by Kirtland AFB, the exact history of the leaks or releases is unknown. Releases could have occurred when fuel was transferred from railcars to the pump house. Initially, it was thought the leak only affected surface soil around the identified source area; however, Kirtland AFB learned through characterization activities the leaked fuel had reached the groundwater table and the dissolved-phase fuel contamination migrated northeast and north of Kirtland AFB.

In order to comply with NMED Hazardous Waste Bureau requirements, Interim Measures were implemented for both groundwater and soil. The goals of the groundwater Interim Measure are to protect drinking water supply wells, collapse the EDB plume, and remediate the light non-aqueous phase liquid (LNAPL). The first phase of the groundwater Interim Measure consisted of the installation of three extraction wells and construction of the first treatment train of the GWTS. Under this phase, the GWTS has been expanded with the ultimate goal to accelerate and support site closeout. BFF network monitoring wells are sampled on a quarterly basis for a minimum of one year following installation.

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2. PROJECT MANAGEMENT AND ORGANIZATION

Project management for the BFF GWTS expansion activities and groundwater monitoring will be performed in accordance with the requirements and the authority of the U.S. Army Corps of Engineers (USACE), Contract No. W912DR-12-D-0006, Delivery Order DM01 and other applicable federal and state regulations.

The project team consists of representatives from the USACE; U.S. Air Force (USAF); EA Engineering, Science, and Technology Inc., PBC (EA); and NMED. USAF is the lead federal agency for direction of site activities and decision-making, and the NMED Hazardous Waste Bureau is the lead regulatory agency.

2.1 Project Quality Assurance Organization

The project quality assurance (QA) organization is included on Figure 2-1 and identifies key individuals responsible for ensuring project QA objectives are achieved for the expansion of the GWTS and ongoing well monitoring.

2.2 Personnel Roles and Responsibilities

Personnel roles, responsibilities, and qualifications for key individuals supporting the BFF GWTS activities are identified in Table 2-1.

2.3 Task Description

The tasks to be addressed under this project are related to the expansion of the current GWTS for containment of the dissolved-phase EDB plume associated with the BFF. The QAPjP addresses the quality aspects of the following tasks:

- Installation of groundwater extraction and monitoring wells on Kirtland AFB and downgradient properties
- Installation of conveyance lines from the extraction wellhead vaults to the GWTS building located on Kirtland AFB
- Expansion of the treatment train in the GWTS Building
- Operation and maintenance of the GWTS and groundwater monitoring network sampling and analysis.

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3. DATA GENERATION AND ACQUISITION

3.1 Sampling Design

This section discusses the sampling and analysis design for groundwater and/or soil samples to be collected in support of the BFF expansion of the dissolved-phase plume GWTS. Locations of the existing and proposed groundwater monitoring network wells are depicted on Figure 3-1.

Groundwater and soil samples will be collected, labeled, packaged, and shipped to the subcontractor laboratory as indicated below:

- ***Eurofins Lancaster Laboratories Environmental, LLC (ELLE), Lancaster, Pennsylvania***—Groundwater monitoring samples and well installation soil samples. ELLE maintains a current U.S. Department of Defense (DoD) Environmental Laboratory Accreditation Program certification for the analyses required under this contract. Certification, QA manual and standard operating procedures (SOPs) are included in Attachment 1.
- ***Daniel B. Stephens & Associates***—Soil samples collected for geotechnical analyses to determine soil properties associated with well installations or other requirements as necessary. Certification, QA manual and SOPs are included in Attachment 2.

3.1.1 Well Installation Sampling and Analysis

Soil and groundwater samples may be collected and analyzed in association with the installation of the extraction and groundwater monitoring wells in support of the GWTS expansion and BFF well network.

3.1.1.1 Chemical Analysis for Soil Samples

Depending on the objectives of the borehole drilling and well installation, soil samples may be collected. The sample collection techniques and criteria for collection will be specified in future revisions of the *Work Plan for Bulk Fuels Facility Expansion of the Groundwater Treatment System Design, SWMU ST-106/SS-11, Kirtland Air Force Base, New Mexico, Revision 2* (USACE, 2017a). If samples are collected for chemical analysis, they will be shipped to ELLE and analyzed for soil or waste characterization method parameters listed in Attachment 1, Table 1-1b in accordance with DoD Quality Systems Manual (QSM) Version 5.0 (DoD, 2013), *EPA SW-846 Test Methods for Evaluating Solid Waste, 3rd Edition and Updates* (EPA SW-846) (U.S. Environmental Protection Agency [EPA], 1986) and laboratory-specific SOPs.

3.1.1.2 Chemical Analysis for Groundwater Samples

Groundwater samples will be collected in accordance with either the *Work Plan for Bulk Fuels Facility Expansion of the Groundwater Treatment System Design, SWMU ST-106/SS-11, Kirtland Air Force Base, New Mexico, Revision 2* (USACE, 2017a) or the *Work Plan for Data Gap Monitoring Well Installation Bulk Fuels Facility, SWMU ST-106/SS-11, Kirtland Air Force Base, New Mexico* (USACE, 2017c). Samples for chemical analysis will be shipped to ELLE and analyzed for the analytical methods listed in Attachment 1, Table 1-1 in accordance with the DoD QSM, EPA SW-846 Methods, *EPA Methods for Chemical Analysis of Water and Wastes* (EPA, 1983), *Standard Methods for the Examination of Water and Wastewater* and laboratory SOPs.

3.1.1.3 Geotechnical Analysis for Soil Samples

Samples for geotechnical soil testing will be performed in accordance with the work plan and will be shipped to Daniel B. Stephens & Associates for expedited analysis for particle size-wet sieve analysis including hydrometer analysis in accordance with ASTM International Method D422 (ASTM International, 2007).

EA will provide sonic core boxes and transport the core boxes to a designated Kirtland AFB storage facility currently used to store project cores. All cores will be photographed. EA will prepare digital photo documentation of site(s) and building(s) under investigation, field activities, and sample and other relevant locations. All associated information will undergo independent QA review for accuracy and completeness.

3.1.2 Groundwater Monitoring of Bulk Fuels Facility Network Wells

As of November 2017, the groundwater sampling network consisted of 138 monitoring wells. Based on information that will be collected throughout the implementation of this project, the network will be modified to include additional groundwater monitoring wells based on Hydrogeology Working Group recommendations and agreements with NMED. As the additional groundwater monitoring wells are incorporated into the groundwater network during 2018, the number of wells will increase to 150, not including six contingency wells that are or will be completed above the water table and are not yet part of the active groundwater monitoring network. Monitoring will include measurement of depth to groundwater and the thickness of LNAPL using an electronic oil-water interface probe or similar device; collecting field water quality measurements; and collecting representative groundwater samples for laboratory analysis by ELLE. The gauging of all wells in the network will be performed quarterly. Well sampling and analysis will be conducted quarterly, semiannually, and annually. The frequency and analyses to be conducted for each specific monitoring well is presented in Table 3-1.

Quarterly, all monitoring wells will be gauged in approximately one field week so that potentiometric surface maps can be prepared.

Groundwater sampling of the BFF network including any newly added monitoring wells will be sampled in accordance with the provisions of the work plans. Purge water will be containerized pending analyses and characterization as described in Section 8 of the work plans (USACE, 2017a and 2017c).

3.1.3 Groundwater Treatment System Monitoring

Sampling and analysis will be conducted in conjunction with operation and maintenance of the GWTS to monitor effectiveness of the system and to make adjustments as necessary; sampling procedures and frequency are specified in the GWTS Operation and Maintenance Plan (USACE, 2017b). The sampling and analysis may be modified in the future so that they are performed in accordance with NMED Groundwater Quality Bureau DP-1839.

Flows to the GWTS may be adjusted based on the analytical results and in conjunction with capture zone evaluations to maximize the collapse of the EDB plume.

3.1.4 Investigation-Derived Waste Sampling and Analysis

Investigation-derived waste (IDW) soil and water generated during the installation and testing of new extraction and groundwater monitoring wells may be profiled as non-hazardous, possibly hazardous, or

hazardous waste. In addition to soil and water, waste materials may also include disposable personal protective equipment, disposable sampling equipment (e.g., scoops or bowls), and other inert materials (e.g., plastic, rope, tape, and paper). IDW will be managed and disposed of in accordance with the project-specific Waste Management Plan, Section 8 of the work plans (USACE, 2017a and 2017c).

Based on the analytical results from the previous two consecutive sampling events, non-hazardous water generated from well sampling activities that meet the GWTS IDW purge water acceptance criteria (USACE, 2017b) will not require segregation either at the point of generation or while in storage. The IDW will be discharged to the GWTS through the sump in the building floor. No additional analysis is required.

Based on the analytical results from the previous two consecutive sampling events, suspect or known hazardous water generated from well sampling activities will be kept segregated by point of origin both during transport and in storage. This water will be profiled for disposal based on the analytical data from the sample collected from the well for environmental monitoring.

Water of unknown quality associated with drilling activities will initially be placed in portable tanks located at the wellhead where it is produced. Upon conclusion of the development or when the storage tank reaches capacity, one water sample will be collected from the tank; proper disposal will take place upon receipt of analytical results. The sample will be analyzed for the analytical suites presented in Table 8-1 of the work plans (USACE, 2017a and 2017c). Upon receipt of the analytical results confirming the water is non-hazardous, it will be batched through the GWTS building if it meets the IDW water disposal criteria (USACE, 2017b). A pre-filter to capture fines is anticipated for well development water. If the water is hazardous based on toxicity characteristics, it will be disposed of offsite in accordance with NMED regulations.

Prior to waste disposal, soil IDW generated from the well installation activities will be collected in lined roll-offs and/or U.S. Department of Transportation-approved drums as appropriate except for cores that are collected from certain well installations as specified in the work plan. IDW soil sample analysis may include the list of parameters below or other approved analyses per the Kirtland AFB onsite non-hazardous waste construction and debris landfill disposal requirements:

- Toxicity Characteristic Leaching Procedure (TCLP) volatile organic compounds (VOCs) – EPA Method SW1311/8260C
- TCLP semivolatile organic compounds (SVOCs) – EPA Method SW1311/8270D
- TCLP pesticides – EPA Method SW1311/8081B
- TCLP herbicides – EPA Method SW1311/8151A
- TCLP RCRA metals and mercury – EPA Method SW1311/6010C/7470A
- Ignitability, corrosivity/pH, and reactivity – 40 Code of Federal Regulations Part 261
- Benzene, toluene, ethylbenzene, xylenes (BTEX) – EPA Method SW8260C
- Total VOCs – EPA Method SW8260C
- Total SVOCs – EPA Method SW8270D

- Total pesticides – EPA Method SW8081B
- Total herbicides – EPA Method SW8151A
- Total RCRA metals and mercury – EPA Method SW6010C/7471B
- Total petroleum hydrocarbon gasoline range organics/diesel range organics/residual range organics – EPA Method SW8015D.

All IDW drums and or roll-offs will be labeled and stored at the site until appropriate disposal is determined. Non-hazardous waste will be disposed of at the Kirtland AFB construction and debris landfill or appropriate offsite facility. EA will coordinate with Kirtland AFB for disposal of IDW to the on-Base landfill.

3.1.5 Analytical Method, Sample Containers, and Holding Time Requirements

Soil and water samples collected from well installation activities, groundwater collected from BFF monitoring of network wells, and associated IDW samples will be collected and analyzed in accordance with the guidelines specified for each EPA analytical method, other industry standard methods, and laboratory SOPs. The parameters, sample containers, sample preservation, sample preparation, and analysis holding times are presented on Table 3-2. Analyses in addition to those specified in the work plans are included in this table in case they may be required at some future point during this project.

3.2 Quality Objectives and Criteria for Measurement Data

The data quality objective (DQO) process is designed to ensure the type, quantity, and quality of environmental data used for decision-making are appropriate for the intended application. The DQOs for the data collected in association with the BFF GWTS expansion and groundwater monitoring include the following:

- Support ongoing monitoring of the BFF well network to monitor the BTEX and EDB plumes to ensure that dissolved-phase EDB and BTEX have not impacted the existing drinking water supply wells.
- Collect soil and groundwater samples associated with the installation of the extraction and groundwater monitoring wells to provide useful information for baseline conditions and hydrogeologic interpretation.

Groundwater monitoring associated with the GWTS was initiated in 2016. Additionally, soil and groundwater sampling associated with extraction and groundwater monitoring well installations were conducted in 2017 and will be ongoing in the near future. Monitoring of the BFF well network continued under this QAPjP in 2016 from previous contracts and is ongoing.

3.2.1 Comparison Criteria

Analytical results for groundwater samples will be compared to screening levels derived as directed by the RCRA Permit (NMED, 2010). Concentrations for each analyte will be compared to the lowest of the EPA Maximum Contaminant Level and New Mexico Water Quality Control Criteria (NMWQCC) standard specified in New Mexico Administrative Code Title 20 – Environmental Protection, Chapter 6 –

Water Quality, Part 2 – Ground and Surface Water Protection, Section 20.6.2.3103, Standards for Ground Water of 10,000 milligrams per liter total dissolved solids concentrations or less (New Mexico Administrative Code, 2004). If neither a Maximum Contaminant Level nor NMWQCC standard is specified, then the concentrations will be compared to the EPA Tapwater Regional Screening Level (EPA, 2017) for a risk of 10^{-5} for carcinogenic and a hazard index of 1.0 for non-carcinogenic compounds. Groundwater analytes and screening values are included in Attachment 1, Table 1-1a.

Soil sample data collected from well installations will be used for disposal of the waste and will be compared to EPA residential Regional Soil Screening Levels (EPA, 2017) and NMED Soil Screening Levels for residential receptors (NMED, 2017).

Analytical results for TCLP analyses will be used for waste disposal and the concentrations will be compared to the standards in the Code of Federal Regulations Title 40 Subpart C – Characteristics of Hazardous Waste.

Laboratory analytical methods, reporting limits, and screening criteria are presented in Attachment 1, Tables 1-1a and 1-1b for groundwater and soil samples to be analyzed by ELLE. Analytical methods to be used by ELLE provide reporting limits with sufficient sensitivity to meet the DQOs, and NMWQCC standards with the exceptions noted on Table 1-1a. Project screening levels that are not achievable by laboratory reporting limits are highlighted on this table.

Per the DoD QSM, the laboratory will report groundwater and soil results to the detection limit (DL) and results between the DL and the limit of quantitation (LOQ) will be flagged with a J-qualifier, signifying estimated data. Estimated data are still usable to achieve project DQOs. Values for which no result is reported will be shown as a non-detect value and reported at the limit of detection (LOD) per the QSM.

3.2.2 Project Performance and Acceptance Criteria

To limit uncertainty in obtained environmental data, criteria for the sensitivity, precision, bias, representativeness, completeness, and comparability parameters were developed and are presented in this QAPjP. Measurement errors will be controlled by using appropriate industry standard and DoD-approved sampling and analytical methods, adhering to the DoD QSM, following established SOPs, and conducting data review to verify laboratory processes. Field crews will be trained in the appropriate sample collection procedures and will review the QAPjP before sample collection to limit sampling errors.

Subcontract analytical laboratories will have a copy of the QAPjP and will adhere to DoD QSM guidance to limit measurement errors. Following DoD QSM requirements, laboratories will conduct required DL studies to verify method sensitivity. In addition, laboratories will perform required LOQ studies to verify precision and bias at the LOQ. For each matrix and each method, laboratories will analyze applicable quality control (QC) samples, including laboratory method blanks, surrogates, laboratory control samples (LCS), laboratory control sample duplicates (LCSD), matrix spike (MS) samples, matrix spike duplicates (MSDs), and internal standards to determine that results of these QC samples are within acceptable precision and bias limits. DoD QSM (2013) and laboratory-specific method acceptance criteria for QC samples are presented in Attachment 1, Table 1-3a. The data that meet these criteria will be of definitive quality and usable to achieve project objectives.

3.3 Sampling Methods

Groundwater monitoring and soil sampling activities will be conducted in accordance with sampling methodologies presented in Section 3.2 of the work plans (USACE, 2017a and 2017c) and the Kirtland AFB Basewide SOPs (USAF, 2004).

3.3.1 Equipment Decontamination

It is anticipated that dedicated or disposable sampling equipment will be used to collect groundwater and soil samples to minimize cross-contamination during sampling activities. When non-dedicated equipment is used to collect samples, decontamination of non-dedicated sampling equipment that comes in contact with samples will be performed to prevent the introduction of extraneous material into samples, and to prevent cross contamination between samples. Equipment decontamination will be performed according to the procedure listed in the Kirtland AFB Basewide SOPs (USAF, 2004) and work plans; and decontamination water will be handled in accordance with the work plans (USACE, 2017a and 2017c).

3.4 Sample Handling and Custody

The following sections describe sample packaging and shipment, sample numbering and labeling, and chain-of-custody (COC) requirements associated with collecting water and soil samples.

3.4.1 Sample Packaging and Shipment

Samples will be collected in the appropriate EPA-certified clean sample containers provided by the subcontractor laboratory, and in accordance with the specific work plan procedures. Upon collection, all glass sample containers will be protected with bubble wrap (or the equivalent) to prevent breakage during shipment. A temperature blank will be placed in every cooler shipment containing water and soil samples.

Ice will be added to the cooler containing water and soil samples in sufficient quantity to keep the samples cooled to 6 degrees Celsius (°C) or below for the duration of the shipment to the laboratory. Sample cooler drain spouts will be taped from the inside and outside of the cooler to prevent any leakage. Saturday deliveries will be coordinated with the laboratory, as needed, and marked appropriately on the shipping bill.

If samples are picked up by a laboratory courier service, the COC will be completed and signed by the laboratory courier. The cooler will then be released to the courier for transportation to the laboratory. If a commercial carrier is used, the COC will include the air bill number in the “transfers accepted by” column, and will be sealed in a re-sealable bag. The COC will then be taped to the inside of the sample cooler lid or box. The cooler or box will be taped shut with strapping tape, and three custody seals will be taped across the cooler lid: two seals in the front and one seal in the back. Clear tape will be applied to the custody seals to prevent accidental breakage during shipping. The samples will then be shipped to the analytical laboratory. A copy of the courier air bill will be retained for documentation.

Samples will be shipped to the analytical laboratory via overnight carrier services according to U.S. Department of Transportation regulations. Transportation methods will be selected to ensure the samples arrive at the laboratory in time to permit testing according to established holding time guidelines and project schedules. The receiving laboratory will only accept samples with a properly prepared COC and properly labeled and sealed shipping container(s).

3.4.2 Monitoring Well and Field Sample Identification

Field sample identification (ID) will be assigned consistent with the established Kirtland AFB sample ID nomenclature for monitoring well and field sample IDs. This will ensure that newly generated well installation, investigation, and groundwater monitoring data associated with the BFF site will be recognizable and easily identified once uploaded to the USAF data repository.

3.4.2.1 Well Identification

Monitoring well IDs will follow the format of the base designator (KAFB), the SWMU identifier (106), and the sequential monitoring well number (XXX). Well numbers will follow sequentially those wells that have already been installed at the BFF. The wells will have a sample ID as follows:

Well ID:

- KAFB – Kirtland AFB
- 106 – BFF SWMU
- XXX – sequential well number.

3.4.2.2 Field Sample Identification

Sample IDs for groundwater and soil samples will be assigned with a consistent and sequential sample number such that the laboratory will not be able to distinguish the same samples between sampling events.

The designation for field samples will be as follows:

- Groundwater – GWXXX (well ID) – XXX (last 2 digits of calendar year [CY] and quarter)
- Soil borings – SBXXXX
- IDW soil – 106XXXIDW1, 2, etc. (designated to the well installation ID)
- IDW water – 106XXXWW1 (designated to the associated well installation ID).

3.4.2.3 Field Quality Control Sample Identification

Field duplicate samples will have designations consistent with the sequential field sample IDs such that they will not be distinguishable by the laboratories as being a duplicate sample. MS and MSD, trip blank, field blank, equipment rinsate blank, and source water blank samples will have sample designations as listed below:

- Field duplicate (water) – GWXXX-574 as compared to the parent sample GWXXX-174 (CY 2017 quarter 4. All field duplicates will contain the digit “5” followed by the year and quarter.
- MS/MSD samples will be designated in the comment field on the COC
- Trip blank (VOCs) – TBXXX-X (last 3 digits will be CY and quarter) – sequential number per quarter
- Equipment rinsate blank – ERXXX-X (last 3 digits will be CY and quarter) – sequential number per quarter

- Field blank (only for volatile-type compounds) – FBXXX-X (last 3 digits will be CY and quarter) – sequential number per quarter
- Source water blank – SWBXXX-X (last 3 digits will be CY and quarter – sequential number per quarter).

3.4.3 Sample Custody and Documentation

Sampling information will be recorded on a COC form and sample collection forms for tracking. All entries will be legible and recorded in indelible ink. The custody procedures described herein apply to all laboratories that are involved in the analysis of environmental samples.

3.4.3.1 Chain-of-Custody

An example COC form is included in the appendices of both work plans. In addition to providing a custody exchange record for the samples, the COC serves as a formal request for sample analyses. The COC form will be completed, signed, and distributed as follows:

- One copy will be retained by the sample coordinator for inclusion in the project files.
- One copy will be sent via email to the Project Chemist.
- The original will be sent to the analytical laboratory with the sample shipment.

Upon receipt of samples at the laboratory, the Sample Custodian will inventory each shipment before signing for it, and note on the original COC form any discrepancy in the number of samples, temperature of the cooler, or broken samples. The Project Chemist will be notified immediately of any problems identified with samples received at the laboratory.

The Project Chemist will in turn notify the sample manager and together they will determine the appropriate course of action. The Project Chemist will also notify the Project Manager if the project budget and schedule may be impacted.

The laboratory will initiate an internal COC that will track the sample within the various areas of the laboratory. The relinquishing signature of the Sample Custodian and the custody acceptance signature of the laboratory personnel will document appropriate custody of the sample. This procedure is followed each time a sample changes hands. The laboratory will archive the samples and maintain their custody as required by the contract or until further notification from the Project Chemist, at which time the samples will be disposed of by the laboratory.

3.4.3.2 Field Sample Custody

The COC form will be the controlling document to ensure that sample custody is maintained. Upon collecting a sample, sampling personnel will initiate the COC in the field. Each individual who has the sample(s) in their possession will sign the COC. Each time the sample custody is transferred, the former custodian will sign the COC on the “Relinquished by” line, and the new custodian will sign the COC on the “Received by” line. The date, time, and name of their project or company affiliation will accompany each signature.

The waybill number or courier name will be recorded on the COC form when a commercial carrier is used. The shipping container will be secured with a custody seal, thereby allowing shipping personnel to maintain custody until receipt by the laboratory.

If the Laboratory Sample Custodian determines sample custody to be invalid (e.g., custody seals have been broken), the laboratory will notify the Project Chemist who will in turn contact the sample manager to resolve any discrepancies with field sample documentation. Any corrections required to be made to COC forms will be made by the sample manager and reviewed by the Project Chemist to determine any impact to sample custody, and transferred to the laboratory. Sample receipt discrepancies will be noted by the laboratory upon sample login.

3.4.3.3 Sample Collection Log

The Sample Collection Log form will be used to document all samples collected in the field. A copy of this form can be found in Appendices of the work plans (USACE, 2017a and 2017c). All entries will be recorded in indelible ink. The sample team will cross out the unused portion and sign each page.

3.4.3.4 Groundwater Purge Log

The Groundwater Purge Log form (for low-flow sampling) or the Groundwater Sample Data Sheet (for passive sampling) will be used to document the well ID, well observations, purge volume calculations (if applicable), sampling equipment, and measurement of field parameters (if sampled via low-flow technology) for each groundwater monitoring well. A copy of these forms can be found in the appendices of the work plans (USACE, 2017a and 2017c). All entries will be recorded in indelible ink. These field forms will undergo an independent review by the other field team personnel or designee before shipping the samples to the subcontractor laboratory.

3.4.3.5 Document Corrections

Changes or corrections on any project field or analytical documentation will be made by crossing out the item with a single line, initialing by the person performing the correction, and dating the correction. The original item, although erroneous, will remain legible beneath the cross out.

The new information will be written above the crossed-out item. Corrections will be written clearly and legibly with indelible ink.

3.5 Analytical Methods

Analytical methods, container, and preservative requirements for groundwater and soil samples are summarized in Table 3-2. The required target analytes for groundwater and soil, including method, applicable regulatory limits, and laboratory reporting limits are presented in Attachment 1, Tables 1-1a and 1-1b for groundwater and soil, respectively.

3.6 Quality Control

This section discusses field and laboratory QC requirements.

3.6.1 Field Quality Control Samples

Field QC samples will be collected and analyzed in conjunction with project samples to assess the precision and accuracy of the sampling program. Field QC samples for this project may include MS/MSD samples, blind field duplicates, QA split samples if required by the client, equipment rinsate samples, trip and ambient blanks for VOC samples, and temperature blanks, as discussed below. Field

QC samples will be designated as specified in Section 3.4.2.3 of this document. Field QC samples will be collected as appropriate for the sample matrix and as applicable to method requirements.

3.6.1.1 Matrix Spike Samples

MS/MSD samples will be collected at one pair per 20 groundwater, drinking water, or soil field samples. MS/MSD samples will be performed for analyses that match the respective field sample including VOCs, EDB, dissolved iron, dissolved manganese, total lead, and total arsenic, as applicable. MS/MSD analyses will not be performed on IDW samples or for anions, cations, and alkalinity analyses, as MS/MSD analysis for these methods and matrix is not applicable. Accuracy for these analyses will be assessed through a review of field and laboratory duplicates (when applicable). Field personnel will collect extra volume for water and soil for MS/MSD analysis and designate the MS/MSD sample on the COC form (appendices of both work plans).

3.6.1.2 Field Duplicates

Field duplicate pairs consist of two samples of the same matrix (a primary and a duplicate) collected at the same time and location to the extent possible, using the same sampling techniques. The purpose of field duplicate samples is to evaluate sampling precision. Field duplicate samples will be collected for groundwater and soil sampling associated with extraction well installations. No field duplicates will be collected for IDW waste characterization purposes. Field duplicate samples will be collected at a frequency of 10% and will be analyzed for the same analytical parameters as their corresponding primary samples. Field duplicate samples will be submitted to the laboratory as blind field samples and sample identification will be such that samples will not contain designators to indicate the samples are field duplicates. For this project, the acceptance criteria for field duplicate precision is established at less than or equal to 35% for groundwater samples and 50% for soil samples. Field duplicate precision will be calculated when target analytes are detected above the reporting limit (LOQ) in both the primary and duplicate samples.

3.6.1.3 Performance Evaluation Samples

Performance evaluation samples will be implemented by the client or designee if deemed necessary. Performance evaluation samples are independent clean matrix samples that are spiked with project-specific target compounds and introduced into the sampling program by the field team.

Performance evaluation samples are then submitted to the project laboratory for analysis as blind samples to be evaluated by the USAF upon receipt of data deliverables. The results will serve as an independent QA check for the field sampling and analytical method protocol precision.

3.6.1.4 Equipment Rinsate Blanks

Equipment rinsate blanks are used to evaluate the effectiveness of the decontamination procedure and to identify potential cross-contamination during sampling events. When dedicated or disposable sampling equipment is used for sample collection, equipment rinsate blanks will not be collected. However, if non-disposable sampling equipment is used, equipment rinsate blanks will be collected at 1 per 20 samples per sampling tool set or more frequently, if field conditions deem it necessary. Equipment rinsate blanks consist of laboratory grade water collected from the final rinse of the decontamination process and placed in appropriate pre-cleaned containers supplied by the analytical laboratory. The equipment rinsate blanks will be analyzed for VOCs, EDB, and total metals (arsenic, lead, iron, and manganese). Results from these analyses will provide sufficient information to evaluate the effectiveness of equipment

decontamination procedures and to determine if data qualifiers should be applied to detections of constituents associated with the sampling tools.

3.6.1.5 Trip Blanks

Trip blank samples will accompany each cooler containing groundwater and soil samples for VOC and EDB analysis, as applicable and corresponding to the field sample analyses to be performed with the associated blanks. Trip blanks are 40-milliliter volatile organic analysis vials provided by the laboratory, that contain laboratory-grade analyte-free water, which are kept with the field samples during sampling and shipping to the subcontractor laboratory. Results of trip blank samples will be used to determine if samples have been contaminated with VOCs during sampling or shipping to the laboratory.

3.6.1.6 Field Blanks

Ambient blanks will be collected for VOC analysis only. They serve as a check on environmental contamination from airborne contaminants at the sampling location. The ambient blank is prepared by pouring distilled or laboratory grade water into a clean sample container either at the laboratory or in the field, and exposing this blank in the field at the time of sample collection and at a particular sample location. Ambient blanks will be collected for groundwater and soil samples for VOC analysis as deemed necessary based on site conditions.

3.6.1.7 Source Water Blanks

A sample will be collected of each batch of water used for the last rinse of decontaminated sampling equipment that comes in direct contact with sampling media, such as the non-dedicated pumps. Source water blanks will be analyzed for VOCs, EDB, and total metals (arsenic, lead, iron, and manganese), as applicable and corresponding to the field sample analyses to be performed.

3.6.1.8 Temperature Blanks

Each cooler containing soil and groundwater samples will be shipped with a temperature blank. A temperature blank is a sample container filled with tap water and shipped in the cooler to the offsite laboratory. The laboratory will record the temperature of the blank upon receipt of the samples. The temperature blank is to ensure the temperature of the samples when received at the laboratory is less than or equal to 6°C.

3.6.2 Laboratory Quality Control Samples

To ensure acceptable data quality, laboratory QC analysis will be performed for each method and for each matrix. Laboratory QC samples will include method blanks, initial and continuing calibration blanks, surrogates for organic analyses, LCSs, internal standards, and duplicates as applicable to the analytical method. Analytical method, QC samples and acceptance criteria, and corrective action are presented in Attachment 1-3. These QC requirements are consistent with the DoD QSM or method-specific SOP. The DoD QSM and laboratory in-house control limits are presented in Attachment 1-2.

3.7 Instrument/Equipment Testing, Inspection, and Maintenance

Field instrument and QC requirements are presented on Table 3-3 and field and analytical instrument testing, inspection, and maintenance requirements are presented in Attachment 1-4. Field instrumentation will be calibrated according to manufacturer's specifications.

3.8 Instrument/Equipment Calibration and Frequency

This section discusses calibration requirements, frequencies, and corrective actions for each method. For laboratory instrumentation, these calibration requirements are established in accordance with the DoD QSM requirements. Calibration is a reproducible reference point to which all sample measurements can be correlated. Instrumentation calibration is necessary for accurate sample quantitation. Calibrations establish the dynamic range of an instrument, establish response factors to be used for quantitation, and demonstrate instrument sensitivity. Analytical instrument calibration requirements are presented in tabular format in Attachment 1-5.

3.9 Inspection/Acceptance of Supplies and Consumables

The accuracy of sample target analyte quantitation is directly related to the accuracy of the standards used for instrument calibration. To ensure the highest quality standard, primary reference standards used by laboratories are obtained from reliable commercial sources. Inorganic standards must be traceable to the National Institute of Standards and Technology and organic standards must be traceable to National Institute of Standards and Technology, or American Association of Laboratory Accreditation vendors when available. When standards are received at the laboratory, the date received, supplier, lot number, purity and concentration, and expiration date are recorded in a standard preparation logbook. Vendor certifications sent with the standards are also filed and are available upon request.

Standards purchased by the laboratory may be in a pure form, in a stock, or working standard solution. All standards made are given a standard identification number and have the following information recorded in a standards logbook: source of standard used to prepare dilution, preparer's initials, initial concentration, final concentration, solvent, source and lot number of solvent, volume of final solution, and volume of standard diluted. Records must unambiguously trace the preparation of standards, their use in calibration, and the quantitation of sample results. After preparation and before routine use, the identity and concentration of standards are verified. Verification procedures include a check for chromatographic purity (if applicable) and verification of the concentration of the standard using a standard prepared at a different time or obtained from a different source. Reagents are also examined for purity by subjecting an aliquot or subsample to the analytical method in which it will be used. Standards are routinely checked for signs of deterioration (e.g., discoloration, formation of precipitates, and changes in concentration) and are discarded if deterioration is suspected or their expiration date has passed. Expiration dates may be taken from the vendor recommendation, the analytical methods, or from internal research.

3.10 Other Field Measurement Activities

Other field measurement activities to be conducted in support of the GWTS expansion or groundwater monitoring are identified in Section 3.2 of the NMED approved work plans (USACE, 2017a and 2017c) in addition to any conditions associated with the approvals. Additionally, well design must be approved by NMED in advance of field construction. These activities will be monitored and documented in accordance with the work plans and Kirtland AFB Basewide Plan SOPs. This section describes types of data that may be generated from GWTS expansion field activities aside from sampling and analysis. These measurement activities include items such as boring logs from drilling operations and well installations, well development records, and other field type testing that will be performed in conjunction with the GWTS expansion and groundwater monitoring activities.

3.10.1 Soil Boring Logs and Well Reports

Soil boring logs will be generated for each new well that is installed in association with the BFF monitoring network expansion. Soil boring logs will be provided in well completion reports.

3.10.1.1 Soil Boring Logs

At the completion of a well, the qualified field geologist logging the hole will turn in the field boring log and well construction field form to the Project Geologist. The logs will be reviewed for completeness and consistency. If any discrepancies or errors are noted in the logs during review, the Project Geologist will contact the field geologist for corrections. Any missing information or less than standard areas in the logging will be identified and communicated to the field geologist before the start of the next well. Additionally, the Project Geologist will perform random checks on the field logging by visiting the field geologist during borehole advancement and well construction to ensure that logs are complete and accurate.

3.10.1.2 Well Reports

Upon completion of the boring advancement and well construction, the field logs will be entered into software for logging and construction information and to generate a log to be included in the well report for a given well. Each boring log will be reviewed against the field log as a QC review to ensure that all information on the field log is accurately and completely transferred to the electronic log. Well development documentation will be reviewed daily (during well development activities) by the Project Geologist and/or Project Hydrogeologist to verify the well development requirements have been met.

3.10.2 Surveying

Each of the newly installed wells will be surveyed following well completion for inclusion in the well reports. EA personnel will accompany the surveying team to provide field oversight and to ensure that wells are surveyed in accordance with the project and Kirtland AFB requirements. All survey points will be verified, determined, marked, and documented per the provisions specified in the Definition of Land Survey Objective/Measuring Points and Land Survey Campaign among the Kirtland AFB Monitoring Well Network. Processed data are required to be delivered to EA within 10 days of data collection as a Grid file. The file will be imported into Microsoft Excel and parsed to get X, Y, Ground Elevation, Top of Outer Casing Elevation, and Measuring Point Elevation. The data will then be imported into the geographic information system project database where it will be checked and plotted to determine if there are any anomalies in the data. If anomalies are identified in the elevations or offset, the well(s) information will be re-evaluated.

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4. DATA VALIDATION AND USABILITY

4.1 Analytical Data Review, Verification, and Validation

The laboratory analyst who generates the analytical data will have the primary responsibility for the correctness and completeness of data. Each step of this verification and review process will involve the evaluation of data quality based on both the results of the QC data and the professional judgment of those conducting the review. This application of technical knowledge and experience to the evaluation of data is essential in ensuring that data of known quality are generated consistently. All data generated and reduced will follow well-documented laboratory protocols.

4.1.1 Level 1: Laboratory Technical (Peer) Data Review

Analysts will review the quality of their work based on an established set of guidelines, including the QC criteria established in each method and as stated within the laboratory-specific QA manuals, included in Attachments 1-6 and 2-1. This review will, at a minimum, ensure the following conditions have been met:

- Sample preparation information is correct and complete.
- Analysis information is correct and complete.
- Appropriate SOPs have been followed (included in Attachments 1-6 and 2-1).
- Calculations are verified.
- There are no data transposition errors.
- Analytical values are correct and complete.
- QC sample results are within established control limits.
- Blank and LCS results are within appropriate QC limits.
- Special sample preparation and analytical requirements have been met.
- Documentation is complete (e.g., any anomalies and holding times have been documented and forms have been completed).

4.1.2 Level 2: Laboratory Technical Data Review

A supervisor or data review specialist whose function is to provide an independent review of data packages will perform this review. This review will also be conducted according to an established set of guidelines and will be structured to verify the Level 1 data review. This review will, at a minimum, ensure the following conditions have been met as applicable to specific types of analyses:

- Appropriate laboratory SOPs have been followed.
- Calibration data are scientifically sound and appropriate to the method.
- QC samples results are within established guidelines.
- Qualitative identification of contaminants is correct.
- Manual integrations are justified and documented.
- Quantitative results and calculations are correct.
- Data are qualified correctly.
- Documentation is complete.
- The data package is complete and complies with contract requirements.

The Level 2 laboratory review will be structured so that all calibration data and QC sample results are reviewed and analytical results from at least 10% of the samples are checked back to the sample

preparation and analytical bench sheets. If no problems are found with the data package, the review will be considered complete. If discrepancies are identified, additional data evaluation is required to be performed by the laboratory.

4.1.3 Level 3: Administrative Quality Assurance Data Review

The Laboratory QA Manager will review 10% of all data packages as appropriate to specific types of analyses. This review should be similar to the review as provided in Level 2, except that it will provide a total overview of the data package to ensure its consistency and compliance with project requirements. All errors noted will be corrected and documented.

4.2 Analytical Data Verification and Validation

The EA Project Chemist or designated third party subcontractor will use established data validation procedures to perform EPA Stage 3 data review for 100% of the groundwater and soil analytical data including groundwater data generated from newly installed wells. IDW analytical data will undergo a data review for accuracy and completeness.

The data review and validation will be performed using the QC criteria specified in the following analytical method and data validation guidelines:

- Project-specific QAPjP
- DoD QSM for Environmental Laboratories, Version 5.0 (May 2013)
- EPA Test Methods for Evaluating Solids Waste, Physical/Chemical Methods (SW 846, Third Edition and updates) (EPA, 1986)
- American Public Health Organization, Standard Methods for the Examination of Water and Wastewater, 22nd Edition (2005)
- EPA Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020 (EPA, 1983)
- EPA Contract Laboratory Program, National Functional Guidelines for Superfund Organic Methods Data Review (EPA, 2014a)
- EPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Data Review (EPA, 2014b)
- Laboratory-specific SOPs.

The following QC elements will be included in the EPA Stage 3 data review:

- Sample extraction and analysis holding times
- Laboratory method blanks
- Surrogate spike recoveries
- LCS/LCSD recoveries
- MS/MSD recoveries
- Relative percent difference (RPD)
- Initial calibrations

- Continuing calibrations
- Trip, rinsate, and ambient field blank results
- Field duplicate sample precision.

Data will be validated and flagged with the following data qualifiers as applicable:

- **J+ qualifier** denotes the analyte was positively identified, but the associated numerical value is estimated with a potential high bias.
- **J- qualifier** denotes the analyte was positively identified, but the associated numerical value is estimated with a potential low bias.
- **U qualifier** denotes the analyte was analyzed for, but was not detected above the method detection limit.
- **UJ qualifier** denotes the analyte was not detected above the reported sample LOQ. However, the reported LOQ is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- **R qualifier** denotes the data are unusable due to deficiencies in the ability to analyze the sample and meet QC criteria and DQOs.

As a result of the data validation process, EPA qualifiers will be generated and applied to the affected sample results that exceed the established QC criteria. EPA Stage 3 data review findings will be summarized and documented with each quarterly monitoring report.

4.3 Reconciliation with User Requirements

Based on data review and data qualification, the Project Chemist will determine if the project DQOs have been met, and data completeness will be evaluated. To reconcile the collected data with project DQOs and to establish and document data usability, the data will be reviewed against data quality indicators discussed below.

The Project Chemist or designee will prepare a data quality assessment report for each of the monitoring events. The data quality assessment report will document:

- Implementation of sampling design and analysis according to the approved QAPjP (sample completeness and representativeness).
- Proper frequency of field QC samples and the adequacy of field decontamination procedures
- Accuracy and precision of the data
- Data comparability, if applicable
- Data usability for project decisions.

4.3.1 Data Quality Indicators

This section defines the data quality indicators and their use for assessment of data quality.

4.3.1.1 Precision

Precision measures the reproducibility of measurements under a given set of conditions. The following equation illustrates the method for calculating RPD to assess method precision:

$$\text{Precision as RPD} = \frac{\text{Absolute (Result - Duplicate Result)}}{\text{Average (Result + Duplicate Result)}} \times 100\%$$

The laboratory uses MS/MSD samples to assess the precision of analytical procedures. According to USACE requirements, analytical laboratories perform MS/MSD on the project samples. This allows determining whether matrix interferences may be present.

In addition, laboratory LCS/LCSD samples can be used to determine analytical method precision when MS/MSD samples are not practical due to the nature of sample or analytical method used. Laboratories will use precision limits specified in the DoD QSM for both LCS and MS analyses (DoD, 2013). When precision limits are not available in the DoD QSM, laboratories may use statistically-based acceptability limits for RPDs established for each method of analysis and sample matrix. The laboratory will review the QC samples to ensure that internal QC data achieve limits of acceptability. Any suspect trends will be investigated and corrective actions taken.

4.3.1.2 Accuracy

Accuracy measures the bias of an analytical system by comparing the difference of a measurement with a reference value. The percent recovery of an analyte, which has been added to the environmental samples at a known concentration before extraction and analysis, provides a quantitation tool for analytical accuracy. The spiking solutions used for accuracy determinations are not used for instrument calibrations. The following equation illustrates how accuracy is evaluated:

$$\text{Accuracy as Percent Recovery} = \frac{\text{Spiked Sample Result} - \text{Sample Result}}{\text{Spiked Sample True Value}} \times 100\%$$

Percent recoveries for MS, MSD, and LCS serve as a measure of analytical accuracy. Surrogate standards are added to all samples, blanks, MS, MSD, and LCS analyzed for gas chromatography and mass spectrometry analytical methods to evaluate accuracy of the method and help to determine matrix interferences.

Laboratories will use LCS limits specified in the DoD QSM for both LCS and MS analyses (DoD, 2013). When LCS limits are not available in the DoD QSM, the laboratory may use in-house, statistically-based, control limits or control limits specified in EPA methods.

4.3.1.3 Representativeness

Unlike precision and accuracy, which can be expressed in quantitative terms, representativeness is a qualitative parameter. Representativeness is the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. A qualitative parameter depends on proper design of the sampling program.

Field personnel will be responsible for ensuring that samples are representative of field conditions by collecting and handling samples according to the QAPjP and work plan. Errors in sample collection,

packaging, preservation, or COC procedures may result in samples being judged non-representative and may form a basis for rejecting the data.

Data generated by the laboratory must be representative of the laboratory database of accuracy and precision measurements for analytes in different matrices. Laboratory procedures for sample preparation will ensure that aliquots used for analysis are representative of the whole sample. Aliquots to be analyzed for volatile (if any) parameters will be removed before the laboratory composites/homogenizes the samples, to avoid losing volatile compounds during mixing.

4.3.1.4 Comparability

Comparability is a qualitative parameter expressing the confidence where one data set can be compared with another, whether it was generated by a single laboratory or during laboratory studies. The use of standardized field and analytical procedures ensures comparability of analytical data. In addition, quarterly data will be reviewed by the Project Chemist and Data Management Team to compare analytical results to historical results and determine if the new data are similar concentrations, represent expected concentrations trends, or are anomalous. Anomalous data will be flagged for discussion with field sampling team and the appropriate laboratory. Corrective actions will be identified and presented to the USACE and Air Force Civil Engineer Center (AFCEC), and may include additional review of laboratory quality assurance, re-analysis if holding times are viable, and/or resampling of the parameter the following quarter.

Sample collection and handling procedures will adhere to EPA-approved protocols. Laboratory procedures will follow standard analytical protocols, use standard units, and standardized report formats, follow the calculations as referenced in approved analytical methods, and use a standard statistical approach for QC measurements.

4.3.1.5 Completeness

Completeness goals for each sampling round are defined in the following section.

Contractual Completeness

The contractual completeness goal is set at 95% for all methods and is calculated as defined below. The following QC elements are evaluated for the purpose of determining completeness calculation:

- Holding time
- Laboratory blank contamination
- Initial calibration verification
- Continuing calibration verification
- LCSs.

$$\text{\% Contract Completeness} = \frac{\text{Number of Unqualified Results}^*}{\text{Number of Results Reported}} \times 100\%$$

** Determined by subtracting the results qualified based on contractual deficiencies from the total number of results.*

Analytical Completeness

The analytical completeness goal is set at 90% for all methods and is calculated as defined below. The following QC elements will be considered analytical deficiencies for the purposes of the analytical completeness calculation.

- Holding time
- Laboratory blank contamination
- Field blank contamination (trip, equipment, ambient, and rinsate)
- Initial calibration verification
- Continuing calibration verification
- LCS recovery
- MS recovery
- MS precision
- Surrogate recovery.

$$\begin{array}{l} \text{\% Analytical} \\ \text{Completeness} \end{array} = \frac{\text{Number of Unqualified Results}^*}{\text{Number of Results Reported}} \times 100\%$$

** Determined by subtracting results qualified for any of the deficiencies from the total number of results.*

Technical Completeness

Following data validation, the technical completeness goal is set at 95% for all methods and is calculated as defined below. Results considered unusable (or rejected) for the intended purpose based on contractual or technical deficiencies will be included for the purposes of the technical completeness calculation.

$$\begin{array}{l} \text{\% Technical} \\ \text{Completeness} \end{array} = \frac{\text{Number of Useable Results}^*}{\text{Number of Results Reported}} \times 100\%$$

** Technical completeness (i.e., usability) will be determined by subtracting results rejected for any reason from the total number of results reported.*

4.3.2 Project-Required Reporting Limits – Sensitivity

Following the DoD QSM requirements, the laboratory will determine the DLs for each method, instrument, analyte, and matrix by using the procedure described in Title 40 Code of Federal Regulations Part 136B. The method DL is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero.

Following DL studies, the laboratory will establish the reporting limit or LOQ for each method, analyte, matrix, and instrument in accordance with the DoD QSM requirements. The LOQ is the lowest concentration of a substance that produces a quantitative result within specific limits of precision and bias. The laboratory will perform LOQ verifications to verify precision and bias at the LOQ. The LOQ is greater than the LOD and must be within the calibration range prior to sample analysis. For this project, the laboratory will report positive results down to the DL and results between the DL and LOQ will be flagged with a J-qualifier and reported as estimated data.

5. ASSESSMENT AND OVERSIGHT

Performing assessments and conducting QA oversight of project activities are vital to verifying that project objectives are being met and assuring the continued quality of the work performed. Assessments will take the form of field surveillances. QA oversight includes inspections of work performed, verification of field documentation, and site walk-downs. QA activities are performed internally by EA project or corporate QA personnel and by USACE designated personnel.

5.1 Quality Assurance Assessments

Independent assessments shall be planned and conducted to measure item and service quality, evaluate the adequacy of work performance, and promote improvement. The purpose of these assessments is to evaluate the performance of work processes with regard to regulatory, contract, and project requirements and expectations of the client. The group performing independent assessments shall have sufficient authority and freedom from the line to carry out its responsibilities. Persons conducting independent assessments must be technically qualified and knowledgeable in the areas assessed.

The EA QA functional line is responsible for performing independent quality assessments as necessary. The EA QA/QC Officer is part of the QA functional line, which is organizationally independent from the Kirtland AFB project personnel as shown in the organization chart (Figure 2-1).

The independent assessment program may include periodic field surveillances of BFF field activities (e.g., drilling, sampling, waste management, etc.). Special emphasis will focus on areas with the highest risk and the greatest benefit from improvement.

The surveillance processes will consist of monitoring or observing an item, activity, system, or process to verify that it conforms to specified requirements. These types of assessments are intended to facilitate the frequent monitoring of work in progress to determine and document compliance with established requirements and procedures.

5.2 Quality Assurance Oversight

QA oversight will be performed onsite on a daily basis and is intended to be an interactive part of the field work performed. QA oversight will be performed by the Site Safety/QC Lead, or designee. QA oversight includes inspections of work performed, verification of field documentation, and site walk-downs.

5.2.1 Inspections

Inspection activities will be used to monitor project activities and materials to ensure compliance with established requirements. The objective of inspections is to determine whether the properties, composition, and performance of activities or materials are within established requirements. Inspections shall be performed periodically during the work process to prevent unintended use or installation, provide monitoring, minimize delays in work, and identify non-conformances while they are still correctable without impacting work. A Construction QA Plan is included in the work plan for specific construction activities (e.g., dual-walled pipe acceptance, installation, and testing).

5.2.2 Verification of Field Documentation

Field documentation (e.g., Field Activity Daily Logs, Sample Collection Logs, etc.) will be reviewed and verified for accuracy and completeness on a regular basis. This verification process is an informal

process performed as part of the Daily Quality Control Report (DQCR) preparation, allowing for the quick and efficient correction of documentation deficiencies. The DQCR form is included in Attachment 3.

5.2.3 Site Walk-downs

Site walk-downs are informal observations of fieldwork being performed. The intent of a site walk-down is to verify the work is being performed as planned in a safe and orderly manner. Any deficiencies identified during a walk-down are immediately pointed out to the field crew and corrected. Walk-downs are performed on a daily basis by the Site Safety/QC Lead, but may also be performed by the EA Field Chemical QA/QC Manager, Construction Manager, Project QA Manager, Project Manager, or any other senior EA personnel.

5.3 Non-Conformances and Response Actions

EA processes for detecting, preventing, and correcting quality problems are discussed in this section. The Project QA/QC staff focuses on continuous improvement of the products and services provided by EA with emphasis on the processes that generate products and deliver services. Items and processes that do not meet established criteria shall be identified, controlled, and corrected, as applicable. Personnel at all levels are responsible for identifying problems and process improvement opportunities and are encouraged to offer solutions.

5.3.1 Problem Identification/Reporting

It is the responsibility of all EA and subcontractor personnel to assess activities and inspect items used within the project to verify that each meets specified requirements and to document incidences of non-conforming items, activities, or conditions on a Non-Conformance Report (NCR) (Attachment 3). It is the responsibility of the project management staff to promptly report, respond to, and resolve non-conforming conditions and to foster a “no-fault” attitude that encourages the identification of non-conforming items and processes. Personnel who identify a non-conforming condition that is potentially hazardous to workers, the public, or the environment or that jeopardizes the integrity of the program or project have the responsibility and authority to suspend work and report the condition to the responsible manager.

5.3.2 Control and Disposition of Non-Conforming Items

Items that do not meet specified requirements, known as non-conforming items, shall be identified by marking, tagging, or other methods that do not adversely affect their end use. Non-conforming items shall be segregated, when practical, by placing them in a clearly identified and designated hold area until proper disposition. If segregation is impractical or impossible due to physical conditions, then other administrative controls and precautions should be employed to preclude inadvertent use of non-conforming items.

5.3.3 Non-Conforming Activities

Activities or documentation identified as out of compliance with requirements shall be documented as a non-conformance for the purpose of identification of corrective actions and evaluation of the effect on the project objectives. When the integrity of the work is left in question, the work should be performed again, if possible. When not possible, limitations of the results of the work must be documented in the final report of the work.

5.3.4 Cause Analysis

Cause analysis will be performed whenever the understanding of the basic underlying cause is important to the prevention of similar or related problems or when the non-conformance relates to safety. The extent of the cause analysis should be based on the possible negative consequences of a repeat occurrence of a problem. A cause analysis will be used to gain an understanding of the deficiency, its causes, and the necessary corrective actions to prevent recurrence. This analysis should be a systematic process of investigation that uncovers the most basic cause. A summary of the cause analysis shall be documented on the NCR.

5.3.5 Corrective Actions

Responsible managers shall develop and document corrective actions, as applicable, for identified non-conformances. Corrective actions should be targeted at the primary causes of the problem rather than the resulting conditions or secondary causes. These actions shall be reviewed for adequacy and effectiveness in correcting the problem and approved by the Corporate QA/QC Manager or designee.

5.3.6 Improvements and Efficiencies

It is important to identify and report process improvements and efficiency gains. Successful techniques and processes will be evaluated by the EA Project Manager, or designee, to determine the potential for performance improvements in other areas or projects.

5.4 Reports to Management

Reports to management may include assessment reports, DQCRs, inspection reports, and NCRs (Attachment 3).

5.4.1 Assessment Reports

Surveillance activities will be documented in surveillance reports. Surveillance reports will identify the project activities that were observed/reviewed, the associated requirements documents, and the results of the surveillances, including deficiencies identified and noteworthy practices. Surveillance reports will be prepared/approved by the EA QA Manager and presented to the Project Manager within 30 days of performance. Surveillance checklists used during the performance of the surveillance may be included with the final surveillance report. A copy of the final surveillance report shall be placed in the project files and provided to the USACE.

5.4.2 Daily Quality Control Reports

The Corporate QA/QC Officer, or designee, will be responsible for the preparation and submittal of the DQCRs to USACE. The DQCR will be posted to the Project SharePoint site.

The DQCR will provide an overview of project activities performed each day, including those performed by subcontractors and suppliers. The DQCRs will present an accurate and complete picture of project and QC activities, including inspections accomplished, forecasted activities for the following day, and deficiencies/problems encountered. These reports will be precise, factual, legible, and objective. Copies of supporting documentation, such as daily logs, inspection checklists, sample collection logs, COC forms, and waste manifests should also be attached.

Each DQCR is to be assigned and tracked by a unique number identifying the current project and date. DQCRs with attachments are to be maintained on the project SharePoint site as part of the project files.

5.4.3 Non-Conformance Reports

Non-conformance reporting will be documented on NCR forms including a description of the non-conforming item or activity, a summary of the corrective action to be taken, assignment of who is responsible for completing the corrective action, and verification that the corrective action has been completed. Non-conformance reports will be tracked by the EA QA/QC Manager and evaluated by the EA Project Manager. A copy of the NCR will be placed in the project files. NCRs will be provided in appendices of the relevant report.

6. DATA MANAGEMENT

Data management is discussed in Section 6.0 of the work plans (USACE, 2017a and 2017c), to which this QAPjP is included as an appendix. The work plans provide the data management process and procedures to be implemented for the field and for handling laboratory data generated from work activities in support of the BFF expansion of the dissolved-phase plume GWTS project activities and groundwater monitoring.

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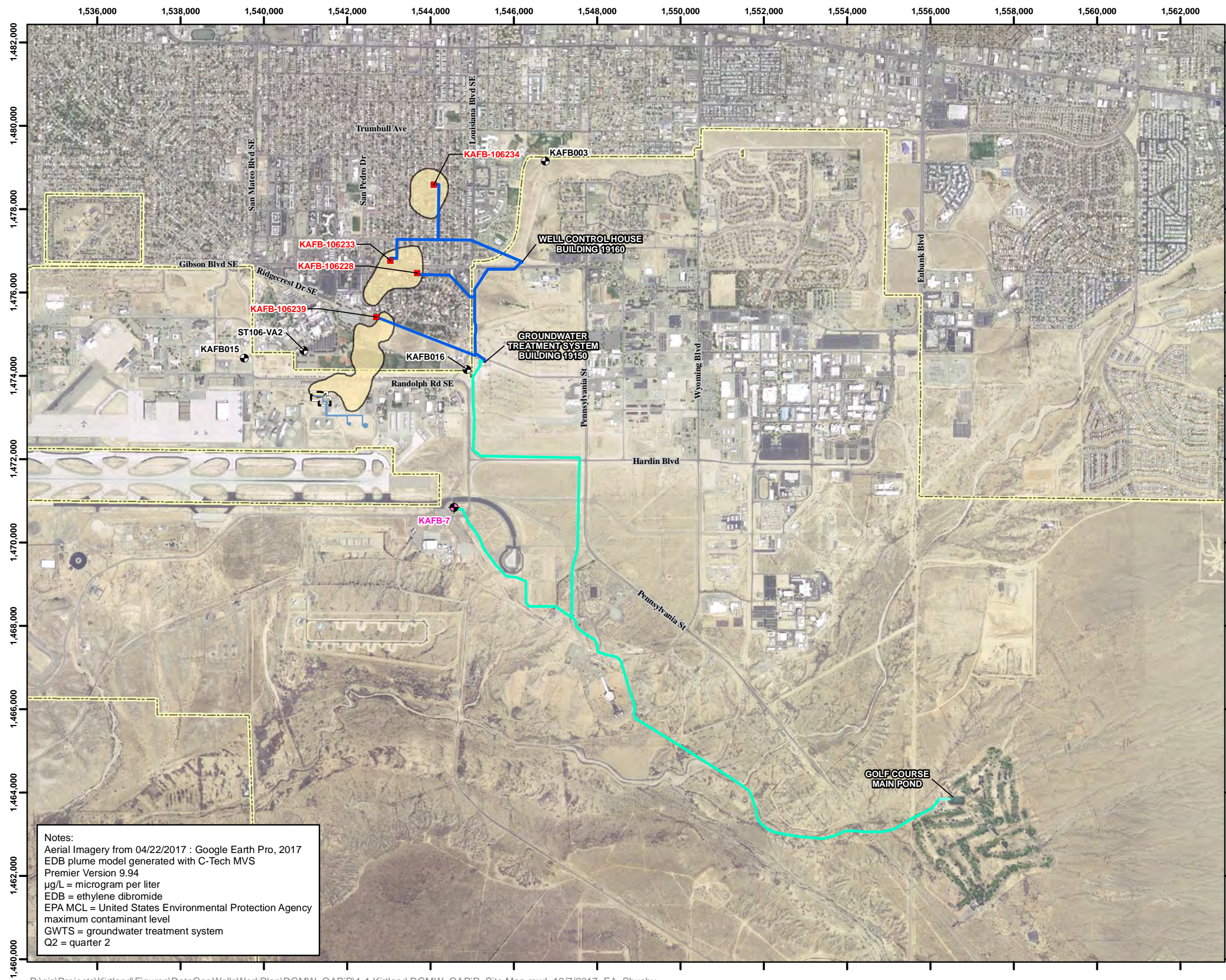
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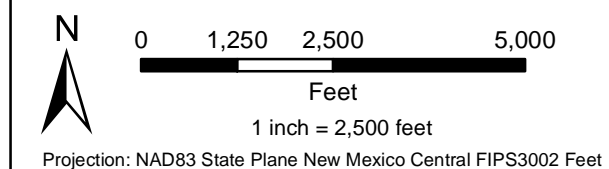
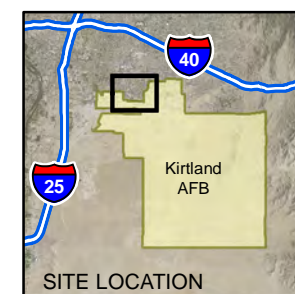
FIGURES

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Legend

- Extraction Well
- Injection Well KAFB-7
- Drinking Water Supply Well
- Former Aboveground Storage Tank
- Former Fuel Transfer Line
- GWTS Influent Piping
- GWTS Effluent Piping
- Installation Boundary
- Q2 2017 EDB Plume with Concentration > 0.05 µg/L (EPA MCL)
- Source Area

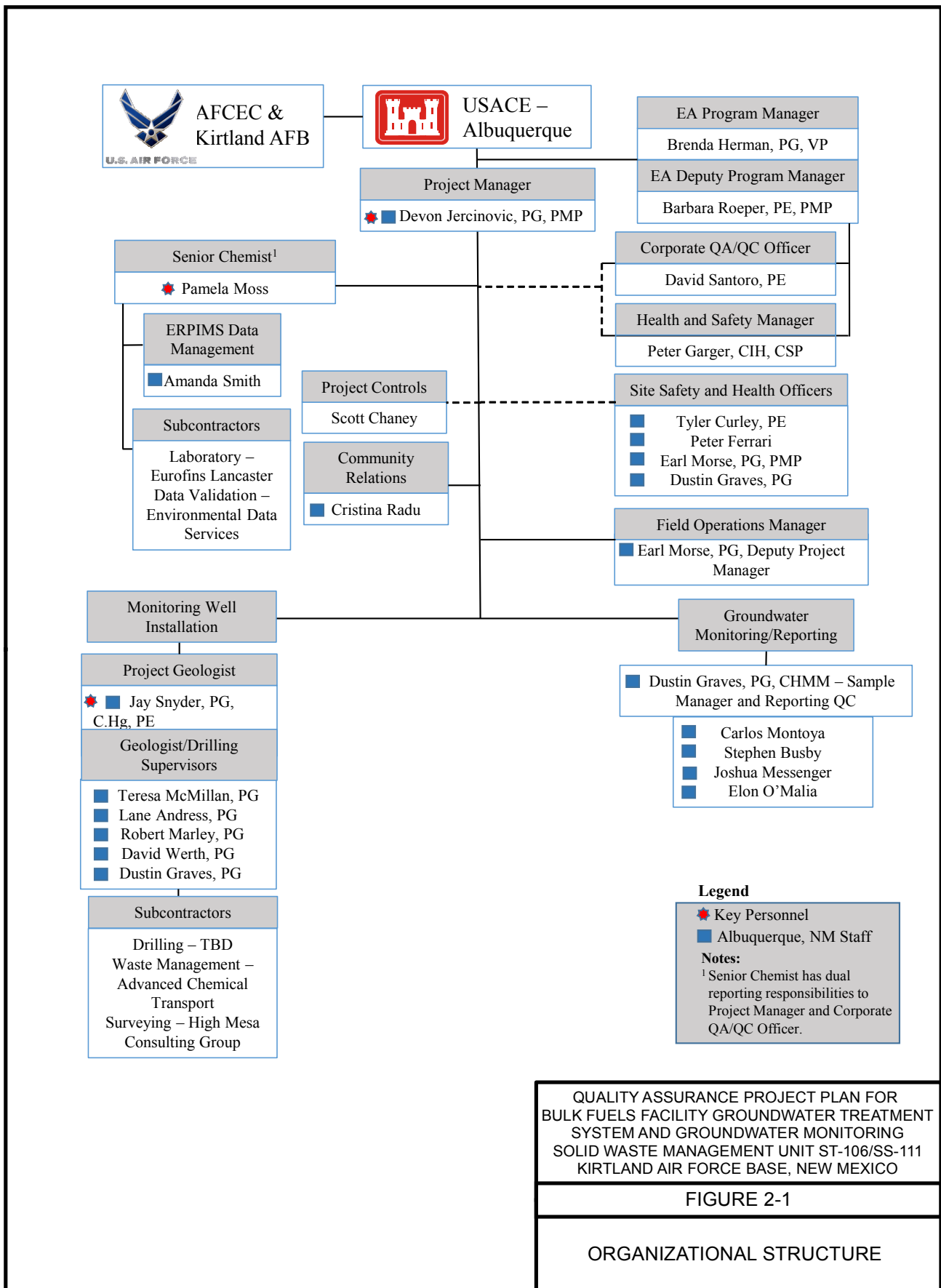


QUALITY ASSURANCE PROJECT PLAN FOR
BULK FUELS FACILITY GROUNDWATER TREATMENT
SYSTEM AND GROUNDWATER MONITORING
SOLID WASTE MANAGEMENT UNIT ST-106/SS-111
KIRTLAND AIR FORCE BASE, NEW MEXICO

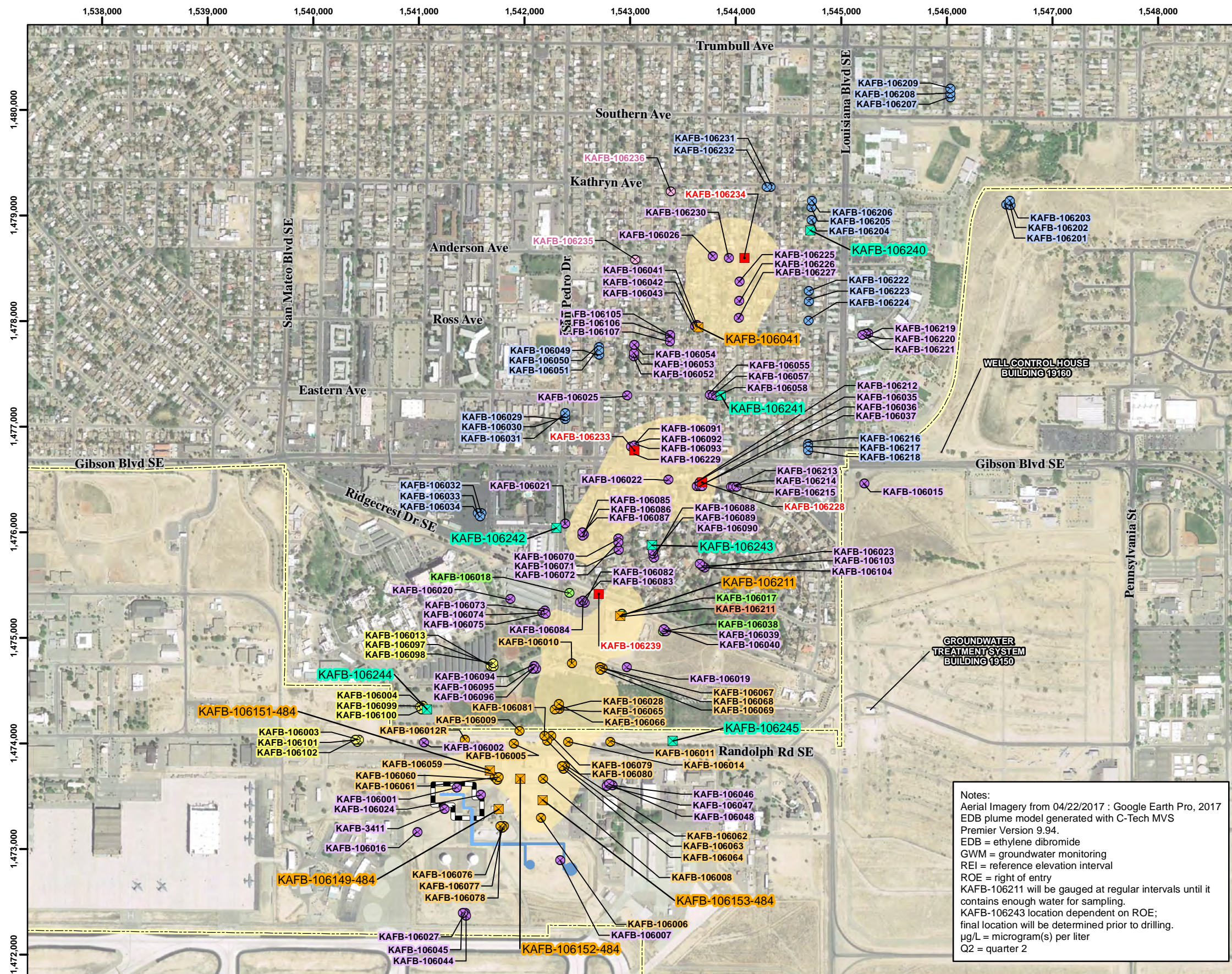
FIGURE 1-1

SITE MAP

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Legend

- Newly Installed Monitoring Well - Q4 2016
- Groundwater Monitoring Well
- Signal Monitoring Well
- Source Area Monitoring Well
- VA Proximal Monitoring Well
- Downgradient Proximal Monitoring Well
- Extraction Well

Monitoring Well Additions - 2018

- Proposed Monitoring Well
- Existing Monitoring Well for Sampling

- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Boundary
- EDB Plume with Concentration > 0.05 µg/L, Q2 2017
- Source Area

SITE LOCATION

N

0 500 1,000 2,000

Feet

1 inch = 1,000 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

QUALITY ASSURANCE PROJECT PLAN FOR
BULK FUELS FACILITY GROUNDWATER TREATMENT
SYSTEM AND GROUNDWATER MONITORING
SOLID WASTE MANAGEMENT UNIT ST-106/SS-111
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 3-1

GROUNDWATER MONITORING NETWORK,
AND EXTRACTION WELL LOCATIONS
FOR REFERENCE ELEVATION INTERVAL 4857

Notes:
Aerial Imagery from 04/22/2017 : Google Earth Pro, 2017
EDB plume model generated with C-Tech MVS
Premier Version 9.94.
EDB = ethylene dibromide
GWM = groundwater monitoring
REI = reference elevation interval
ROE = right of entry
KAFB-106211 will be gauged at regular intervals until it
contains enough water for sampling.
KAFB-106243 location dependent on ROE;
final location will be determined prior to drilling.
µg/L = microgram(s) per liter
Q2 = quarter 2

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TABLES

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Table 2-1
Staff Roles, Responsibilities, and Authorities

Position/Staff	Qualifications	Responsibilities	Authority Level
Program Manager Brenda Herman, PG	<ul style="list-style-type: none"> • M.S. in Geology • 23 years of program management experience for USACE • Managed \$200 million of USACE/Army projects, including \$21 million of performance-based contracts at AFBs 	<ul style="list-style-type: none"> • As EA Officer, authorized to negotiate/sign contract and commit resources • Primary point-of-contact for USACE on contractual and programmatic items • Ensures consistency in deliverables and cost/performance reporting and progress reporting/invoicing • Coordinates issue resolution as needed with Contracting Officer's Representative and/or Contracting Officer 	<ul style="list-style-type: none"> • Coordinates corrective action at programmatic level
Project Manager Devon Jercinovic, PG, PMP	<ul style="list-style-type: none"> • M.S. in Geology • 30 years of experience in management and technical support for site characterization • Project Manager for \$50 million+ of RCRA/CERCLA investigations and remediation at Kirtland AFB since 1997 • Past New Mexico Environment Department environmental regulator in the former Groundwater and Hazardous Waste Bureau 	<ul style="list-style-type: none"> • Ensures that all work is accomplished with adequate internal controls • Main point of contact for USACE on project-specific matters • Reviews/confirms technical approach from kickoff meeting and throughout project execution to ensure project objectives are met • Assembles and schedules resources • Ensures on-schedule and high quality services are delivered within budget • Manages subcontractors • Coordinates EA's participation in the public meeting and community relations process • Identifies and mitigates risks related to execution of the technical aspects of the work and ensures site safety • Ensures work is performed in accordance with USACE/U.S. Air Force Guidelines, state/federal regulations, and within the bounds of the RCRA, City of Albuquerque, and New Mexico Office of the State Engineer permits • Applies lessons learned from current and past projects • Responsible for front and back end transition activities to ensure continuity on the project • Ensures public relations sensitivities are met 	<ul style="list-style-type: none"> • Full responsibility and authority to execute Task Orders • Approves subcontractor invoices, project charges, and deliverables • Implements corrective action • Stops work for any reason related to the project

Table 2-1
Staff Roles, Responsibilities, and Authorities

Position/Staff	Qualifications	Responsibilities	Authority Level
Corporate QA/QC Officer David Santoro, PE	<ul style="list-style-type: none"> • B.S. in Agricultural Engineering • 53 years of engineering, environmental remediation, and construction experience • Served as Program QA Manager on \$400 million+ of federal projects 	<ul style="list-style-type: none"> • Reports to Program Manager—Independent of the Project Manager • Identifies approved senior technical reviewers and QC staff • Assists in developing and approves project quality certification programs • Monitors work, procedures, and documentation to ensure compliance with quality certification programs • Initiates/provides recommendations to improvements to the quality process • Develops and oversees corrective actions • Conducts independent QC audits 	<ul style="list-style-type: none"> • Evaluates performance of review staff and review process and provides feedback, including recommendations, to project manager • Implements corrective action if the quality of the work is not acceptable
Health and Safety Manager Peter Garger, CIH, CSP	<ul style="list-style-type: none"> • M.S. in Public Health • As Corporate Health and Safety Director, oversees health and safety activities for 450+ employees and 30 federal contracts • Prepared/reviewed over 3,000 APPs/SSHPs • Served as Chief of Industrial Hygiene for USACE—Baltimore Hazardous, Toxic, and Radioactive Waste Branch • 36 years of experience managing and conducting industrial hygiene services 	<ul style="list-style-type: none"> • Oversees development of APP in accordance with Engineer Manual 385-1-1 and Occupational Safety and Health Administration regulations • Assists Project Manager and procurement staff in verification of safety performance of subcontractors • Investigates any incidents, accidents, or safety violations • Performs safety audits 	<ul style="list-style-type: none"> • Approves APPs/SSHPs and all modifications before issuance to the USACE • Manages Health and Safety Program and directs training and required attendance • Investigates safety concerns raised by staff • Investigates any accidents • Stops work for noncompliance/safety violation

Table 2-1
Staff Roles, Responsibilities, and Authorities

Position/Staff	Qualifications	Responsibilities	Authority Level
Senior Chemist Pamela Moss	<ul style="list-style-type: none"> • B.S. in Chemistry • 25 years of chemistry experience, including developing and implementing DQOs in accordance with RCRA/CERCLA to ensure performance standards are achieved • Expertise in developing QAPjP, Sampling and Analysis Plan, Field Sampling Plan for DoD • Performed \$35 million+ of project work at Kirtland, Cannon, and Holloman AFBs in New Mexico 	<ul style="list-style-type: none"> • Reports to both the Project Manager and the Corporate QA/QC Manager • Ensures that project implementation is performed in compliance with QA Project Plans • Overall responsibility for chemical data quality and ensures that data meet DQOs • Supports development of project-specific work plans and QAPjP • Monitors implementation of QAPjP, including oversight of laboratory, analytical methods, reporting limits, and data deliverables • Coordinates third-party data validation and reviews data validation results and reports • Prepares data quality reports to document that data are usable and achieve DQOs • Direct interface with analytical laboratory project manager and QC Manager 	<ul style="list-style-type: none"> • Coordinates all communication with the analytical laboratory • Coordinates data validation and evaluation • In coordination with the project manager, implements corrective actions related to laboratory performance
Project Geologist Jay Snyder, PG, CHg, PE	<ul style="list-style-type: none"> • M.S. in Geology/Geological Engineering • 28 years geological experience, working with within New Mexico and with New Mexico regulators 	<ul style="list-style-type: none"> • Reports to the Project Manager and serves as the Alternative Project Manager • Overall responsibility for design, implementation, and management of extraction/injection well installation • Reviews all work plan, geological reporting, and data deliverables • Assists with establishing project-specific DQOs • Coordinates with Field Geologists for oversight and quality control • Responsible for providing input for the design of the corrective actions and reviews corrective elements specific to geology or well installation 	<ul style="list-style-type: none"> • Stop drilling work for any reasons related to drilling activities
Geologist/Drilling Supervisor Teresa McMillan, PG	<ul style="list-style-type: none"> • M.S. in Geosciences • 25 years of geological experience within New Mexico, including lead geologist performing drilling and well installation at Kirtland AFB 	<ul style="list-style-type: none"> • Reports to the Project Geologist • Oversees drilling operations during well installations • Manages soil sampling, lithologic logging, and well construction and development • Conducts data analysis and reporting • Manage Subcontractors • Manage investigation-derived waste 	<ul style="list-style-type: none"> • Stop drilling work for any reasons related to drilling activities

Table 2-1
Staff Roles, Responsibilities, and Authorities

Position/Staff	Qualifications	Responsibilities	Authority Level
GWTS Expansion Chief Engineer Lee Becker, PE	<ul style="list-style-type: none"> • M.S. in Civil Engineering • 46 years of GWTS design, construction and operation experience 	<ul style="list-style-type: none"> • Reports to the Project Manager • Oversees the design and construction activities related to the GWTS expansion • As New Mexico Engineer of Record will sign design documents 	<ul style="list-style-type: none"> • Stop work for any reasons related to construction activities
Field Operations Manager Earl Morse, PG	<ul style="list-style-type: none"> • M.S. in Geology • 32 years in environmental field programs (investigation and construction) 	<ul style="list-style-type: none"> • Reports to the Project Manager • Serves as Deputy to Project Manager • Serves as lead Site Safety and Health Officer and performs local safety audits • Waste Management Coordinator • Manages staffing and field resources for all field investigations • Manages all Project-Dedicated Equipment 	<ul style="list-style-type: none"> • Stop work for any reasons related to any field activities
Senior Environmental Scientist – Field Quality Control Cristina Radu	<ul style="list-style-type: none"> • M.S. Environmental Engineering and Water Resources Management • 25 years of environmental experience in New Mexico under New Mexico Environment Department guidance at 40+ sites • 6 years of Kirtland AFB experience, including groundwater monitoring and support in organizing and preparing materials for public meetings 	<ul style="list-style-type: none"> • Reports to the Project Manager • Provides quality assurance (field and office audits) on groundwater monitoring sampling team and sampling activities • Coordinates with the Project Manager and Senior Chemist on any deviations from the QAPjP due to changed field conditions such that DQOs are met • Assists with public relations and community awareness • Assists with development of public meeting materials and organization of the meetings 	<ul style="list-style-type: none"> • Stop work for any reasons related to sampling activities

Table 2-1
Staff Roles, Responsibilities, and Authorities

Position/Staff	Qualifications	Responsibilities	Authority Level
Hydrogeologist Groundwater Monitoring Dustin Graves, PG, CHMM	<ul style="list-style-type: none"> • M.S. in Geology • 12 years of geological experience with drilling and well installation oversight and groundwater and drinking water sampling • Past experience coordinating Kirtland BFF project tasks • 	<ul style="list-style-type: none"> • Reports to the Project Manager • Manages groundwater monitoring sampling team and sampling activities • Coordinates with the Project Manager, Senior Chemist, and Senior Environmental Scientist to correct any deviations from the QAPjP such that data quality objectives are met • Coordinates with Project Chemists on all Quarterly sampling events • Coordinates data transfer with Data Management Team for the Environmental Restoration Program Information Management System • Manages Quarterly Monitoring Reports 	Stop work for any reasons related to any field activities
Construction Management Superintendent Matthew Bowman, PE, CCM	<ul style="list-style-type: none"> • B.S. Environmental Engineering • 15 years in remediation construction management and remediation site supervision, including federal Department of Defense sites • CCM 	<ul style="list-style-type: none"> • Reports to Senior Engineer in charge of the GWTS Installation and Operations • Manages construction operations for conveyance/pumping/treatment systems • Leads construction planning activities • Coordinates construction logistics, construction subcontractors, and staff • Manages construction controls and systems for schedule, costs, safety, and quality • Anticipates construction challenges and implements proactive solutions to safely meet schedule and budget objectives while delivering high quality results 	<ul style="list-style-type: none"> • Supervises all construction management staff • Defines qualifications and requirements of technical staff at Task Order level • Evaluates performance of technical staff and provides feedback, including recommendations, to Project Manager • Stops work for noncompliance/safety violation

Table 2-1
Staff Roles, Responsibilities, and Authorities

AFB = Air Force Base
APP = Accident Prevention Plan
B.S. = Bachelor of Science
CCM = Certified Construction Manager
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
CHg = Certified Hydrologist
CHMM = Certified Hazardous Materials Manager
CIH = Certified Industrial Hygienist
CSP = Certified Safety Professional
DoD = Department of Defense
DQO = data quality objective
EA = EA Engineering, Science, and Technology, Inc., PBC
GWTS = groundwater treatment system
M.S. = Master of Science
PE = Professional Engineer
PG = Professional Geologist
PMP = Project Management Professional
QA = quality assurance
QAPjP = Quality Assurance Project Plan
QC = quality control
RCRA = Resource Conservation and Recovery Act
SSHP = Site Safety and Health Plan
USACE = U.S. Army Corps of Engineers

Table 3-1
Groundwater Monitoring Sampling Requirements

Analyte	Analysis	Well Locations	Number of Wells ^a
QUARTERLY			
EDB	EPA Method 8011	Newly installed or added wells (as required) ^a	18
EDB	EPA Method 8011	Proximal wells (9 VA wells; 26 downgradient wells)	35
EDB	EPA Method 8011	Source area wells KAFB-106005, KAFB-106009, and KAFB-106012R	3
BTEX	EPA Method 8260C – BTEX (4 analytes)	VA proximal wells	9
BTEX	EPA Method 8260C – BTEX (4 analytes)	Newly installed wells KAFB-106244 and KAFB-106245	2
BTEX	EPA Method 8260C – BTEX (4 analytes)	Source area wells KAFB-106005, KAFB-106009, and KAFB-106012R	3
Total Metals	EPA Method 6010C (calcium, potassium, magnesium, sodium)	Newly installed or added wells (as required) ^a ; Source area wells KAFB-106005, KAFB-106009, and KAFB-106012R	21
Dissolved Metals	EPA Method 6010C (iron, manganese)	Newly installed or added wells (as required) ^a ; Source area wells KAFB-106005, KAFB-106009, and KAFB-106012R	21
Total Metals	EPA Method 6020A (arsenic ^b , lead)	Newly installed or added wells (as required) ^a ; Source area wells KAFB-106005, KAFB-106009, and KAFB-106012R	21
Anions	EPA Method 300.0A (chloride, bromide, sulfate)	Newly installed or added wells (as required) ^a ; Source area wells KAFB-106005, KAFB-106009, and KAFB-106012R	21
Anions	EPA Method 353.2 (nitrate/nitrite nitrogen)	Newly installed or added wells (as required) ^a ; Source area wells KAFB-106005, KAFB-106009, and KAFB-106012R	21
Alkalinity – Bicarbonate/ Carbonate	Standard Method 2320B	Newly installed or added wells (as required) ^a ; Source area wells KAFB-106005, KAFB-106009, and KAFB-106012R	21

Table 3-1
Groundwater Monitoring Sampling Requirements

Analyte	Analysis	Well Locations	Number of Wells ^a
SEMIANNUAL			
BTEX	EPA Method 8260C – BTEX (4 analytes)	Source area wells	26
BTEX	EPA Method 8260C – BTEX (4 analytes)	Newly added wells KAFB-106-149-484, KAFB-106151-484, KAFB-106152-484, and KAFB-106153-484	4
BTEX+Naphthalene	EPA Method 8260C – BTEX, Naphthalene (5 analytes)	Signal wells ^c	3
EDB	EPA Method 8011	Groundwater monitoring network wells ^a	150
Total Metals	EPA Method 6020A (arsenic ^b , lead)	Groundwater monitoring network wells ^a	150
Total Metals	EPA Method 6010C (calcium, potassium, magnesium, sodium)	Groundwater monitoring network wells ^a	150
Dissolved Metals	EPA Method 6010C (iron, manganese)	Groundwater monitoring network wells ^a	150
Anions	EPA Method 300.0A (chloride, bromide, sulfate)	Groundwater monitoring network wells ^a	150
Anions	EPA Method 353.2 (nitrate/nitrite nitrogen)	Groundwater monitoring network wells ^a	150
Alkalinity – Bicarbonate/Carbonate	Standard Method 2320B	Groundwater monitoring network wells ^a	150
ANNUAL			
Volatile Organic Compounds (select analytes) ^d	EPA Method 8260C	Groundwater monitoring network wells ^a	150

^a Does not include 6 contingency wells that are currently installed, or will be installed above the water table and are not yet part of the active groundwater monitoring network. These contingency wells are nested (or will be nested) with other groundwater monitoring wells that have established location identifications.

^b Arsenic was added to the analyte list for EPA Method 6020A to provide information on redox chemistry.

^c Elevated detections above regulatory standards in signal wells indicate review by the team to evaluate additional sampling requirements.

^d Only select volatile organic compounds that will be analyzed in the groundwater samples for as part of monitoring optimization.

All newly installed or added wells will have a minimum of 4 quarters of baseline sampling performed for EDB, metals, anions, and alkalinity.

Field parameters will continue to be collected during all sampling events for wells sampled that quarter and include: temperature, pH, specific conductivity, dissolved oxygen, oxidation reduction potential, and turbidity (alkalinity discontinued).

Wells KAFB-106026 and KAFB-106230 will no longer be sampled due to safety concerns. Final data were obtained from 106026 in Q4 2015. Final data for 106230 were obtained in Q2 2016.

BTEX = benzene, toluene, ethylbenzene, and total xylenes

EDB = ethylene dibromide

EPA = U.S. Environmental Protection Agency

KAFB = Kirtland Air Force Base designator

VA = Veterans Administration

Table 3-2
Analytical Parameter, Matrix, Method, Sample Container, Preservation, and Holding Time Requirements

Parameter	Matrix	Preparation/ Analysis Method	Bottle Type	Preservative	Preparation Holding Time	Analytical Holding Time
Volatile Organic Compounds	Water	SW5030B/8260C	3 x 40-mL glass	HCl to pH < 2; Cool ≤6°C	NA	14 days
Volatile Organic Compounds – Benzene, toluene, ethylbenzene, xylenes, naphthalene	Water	SW5030B/8260C	3 x 40-mL glass	HCl to pH < 2; Cool ≤6°C	NA	14 days
Ethylene Dibromide	Water	SW8011	2 x 40-mL glass	HCl to pH < 2; Cool ≤6°C	NA	14 days
Anions (Chloride, Bromide, Sulfate)	Water	E300.0A	1 x 250-mL glass or HDPE	None; Cool ≤6°C	NA	28 days
Nitrate/Nitrite Nitrogen	Water	E353.2	2 x 250-mL glass or HDPE	Sulfuric acid to pH <2; Cool ≤6°C	NA	28 days
Alkalinity – Bicarbonate/Carbonate	Water	SM2320B	1 x 250-mL glass or HDPE	None; Cool ≤6°C	NA	14 days
Total and Dissolved Metals	Water	SW3005A/6010C SW3020A/6020A	1 x 250-mL HDPE	Nitric acid to pH <2; Cool ≤6°C	180 days	180 days
Total Mercury	Water	SW7470A	1 x 250-mL HDPE	Nitric acid to pH <2; Cool 6°C	28 days	28 days
Flashpoint	Water	SW1010A	1 x 250-mL HDPE	None; Cool ≤6°C	NA	NA
pH	Water	SW9040C	1 x 250-mL HDPE	None; Cool ≤6°C	NA	Upon receipt
Volatile Organic Compounds	Soil	SW5035A/8260C	3 x EnCore/ Terracore samplers; 1 x 4-oz glass	None; Cool ≤6°C	48 hours to preserve or preserved in field	14 days
Semivolatile Organic Compounds	Soil	SW3546/8270D	1 x 8-oz glass	None; Cool ≤6°C	14 days	40 days
Ethylene Dibromide	Soil	SW8011	1 x 8-oz glass	None; Cool ≤6°C	14 days	14 days
Metals	Soil	SW3050B/6010C/ 6020A	1 x 8-oz glass	None; Cool ≤6°C	180 days	180 days
Mercury	Soil	SW7471B	1 x 8-oz glass	None; Cool ≤6°C	28 days	28 days
Ignitability	Soil	40CFR Part 261	1 x 8-oz glass	None; Cool ≤6°C	NA	NA
Reactivity – Cyanide/Sulfide	Soil	40CFR Part 261	1 x 8-oz glass	None; Cool ≤6°C	28 days	28 days
Pesticides	Soil	SW3546/8081B	1 x 8-oz glass	None; Cool ≤6°C	14 days	40 days
Herbicides	Soil	SW3550C/8151A	1 x 8-oz glass	None; Cool ≤6°C	14 days	40 days
Total Petroleum Hydrocarbon-Diesel/Residual Range	Soil	SW3546/8015D	1 x 8-oz glass	None; Cool ≤6°C	14 days	40 days
Total Petroleum Hydrocarbon-Gasoline Range	Soil	SW5035A/8015D	1 x 4-oz glass	None; Cool ≤6°C	NA	14 days
Toxicity Characteristic Leaching Procedure	Soil	SW1311	8-oz glass per parameter/method	NA	NA	NA

Table 3-2
Analytical Parameter, Matrix, Method, Sample Container, Preservation, and Holding Time Requirements

Parameter	Matrix	Preparation/ Analysis Method	Bottle Type	Preservative	Preparation Holding Time	Analytical Holding Time
Particle size-wet sieve analysis including hydrometer analysis	Soil	ASTM International D-422	1 x gallon plastic bag	None	NA	NA

°C = degrees Celsius

E = EPA Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1983 and Updates.

HCl = hydrochloric acid

HDPE = high density polyethylene

mL = milliliter

NA = not applicable

oz = ounce

SM = Standard Methods for Examination of Water and Wastewater, 22nd Edition.

SW = EPA SW846 – Test Methods for Evaluating Solid Waste, 3rd Edition, 1986 and Updates.

Table 3-3
Field Instrument Quality Control

Field Equipment	Calibration Verification Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	Standard Operating Procedure Reference
Water level meter or oil/water interface probe	Operate in accordance with manufacturer's instructions	Daily before use and when there is no audible signal	Battery check is positive	Replace battery	Field personnel	Manufacturer's Operation Manual
Photoionization Detector	Check calibration to 100 parts per million isobutylene Check calibration when temperature is outside of -20–50 °C (-4–122 °F) range Check calibration when humidity is greater than 95%	Calibrate probe once per week; verify once per day before first use	± 10% of standard value	Recalibrate	Field personnel	Manufacturer's Operation Manual and personal communication with Manufacturer's Technical Support ^a
YSI (or equivalent) water quality meter with flow cell	Check calibration against two of the following three traceable standards with nominal pH of 4.0, 7.0, and 10.0 Check calibration of outside of range - 10–60 °C (14–140 °F)	Calibrate probe once per week and then verify once per day before first use	± 0.2 pH units	Recalibrate	Field personnel	Manufacturer's Operation Manual
	Check calibration against specific conductance standard Check calibration of outside of range - 10–60 °C (14–140 °F)	Calibrate probe once per week and then verify once per day before first use	± 0.5% of standard value or 0.001 mS/cm, whichever is greater	Recalibrate	Field personnel	Manufacturer's Operation Manual
	Check calibration against dissolved oxygen (ambient air) Check calibration of outside of range -5–45 °C (23–113 °F)	Calibrate once per day before first use	± 2% of reading or 2% of air saturation, whichever is greater	Recalibrate	Field personnel	Manufacturer's Operation Manual
	Check calibration against oxygen reduction potential standards Check calibration of outside of range - 10–60 °C (14–140 °F)	Calibrate probe once per week and then verify once per day before first use	± 20 mV standard value	Recalibrate	Field personnel	Manufacturer's Operation Manual
Turbidity Meter	Calibrate with primary standard of 10 nephelometric turbidity units	Calibrate every 3 months; verify once a week reading is within acceptable value	±10%	Recalibrate	Field personnel	Manufacturer's Operation Manual
Gram scale	Calibrate according to manufacturer's instructions	Daily before use and when unstable readings occur	Within calibration standard range	Recalibrate	Field personnel	Manufacturer's Operation Manual

Table 3-3
Field Instrument Quality Control

Field Equipment	Calibration Verification Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	Standard Operating Procedure Reference
Trimble Global Positioning System Unit	Validate accuracy using nearby benchmark	Daily calibration	Refer to manufacturer's instructions	Refer to manufacturer's instructions	Field personnel	Manufacturer's Operation Manual
^a Personal communication with RAE Systems technical support on 31 August 2016. °C = Degree Celsius °F = Degree Fahrenheit						

ATTACHMENTS

Attachment 1 – Eurofins Lancaster Laboratories Environmental, LLC

Attachment 2 – Daniel B. Stephens & Associates

Attachment 3 – Quality Control Forms

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ATTACHMENT 1 – EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL, LLC

Table 1-1: Method Reporting Limits

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Attachment 1, Table 1-1a
Method Reporting Limits and Screening Criteria for Water

Analyte	Analytical Method	CASRN	Units	NMWQCC ¹		EPA Tapwater		Project Screening Level ⁴	Achievable Laboratory Limits ⁵		
					EPA MCL ²	RSL ³	c/nc		LOQ	LOD	DL
Volatile Organic Compounds/BTEX/Naphthalene											
1,1,1,2-Tetrachloroethane	SW8260C	630-20-6	µg/L	NS	NS	5.7	c	5.7	1.0	1.0	0.5
1,1,1-Trichloroethane	SW8260C	71-55-6	µg/L	60	200	8000	nc	60	1.0	1.0	0.5
1,1,2,2-Tetrachloroethane	SW8260C	79-34-5	µg/L	10	NS	0.76	c	10	1.0	1.0	0.5
1,1,2-Trichloroethane*	SW8260C	79-00-5	µg/L	10	5	2.8	c	5.0	1.0	1.0	0.5
1,1-Dichloroethane	SW8260C	75-34-3	µg/L	25	NS	27	c	25	1.0	1.0	0.5
1,1-Dichloroethene	SW8260C	75-35-4	µg/L	5	7	280	nc	5.0	1.0	1.0	0.5
1,1-Dichloropropene	SW8260C	563-58-6	µg/L	NS	NS	NS	-	NS	5.0	2.0	1.0
1,2,3-Trichlorobenzene	SW8260C	87-61-6	µg/L	NS	NS	7.0	nc	7.0	5.0	2.0	1.0
1,2,3-Trichloropropane	SW8260C	96-18-4	µg/L	NS	NS	0.0075	c	5.0	5.0	2.0	1.0
1,2,4-Trichlorobenzene	SW8260C	120-82-1	µg/L	NS	70	11	c	70	5.0	2.0	1.0
1,2,4-Trimethylbenzene	SW8260C	95-63-6	µg/L	NS	NS	56	nc	56	5.0	2.0	1.0
1,2-Dibromo-3-chloropropane	SW8260C	96-12-8	µg/L	NS	0.2	0.0033	c	5.0	5.0	4.0	2.0
1,2-Dibromoethane (EDB)*	SW8260C	106-93-4	µg/L	0.1	0.05	0.075	c	1.0	1.0	1.0	0.5
1,2-Dibromoethane (EDB)*	SW8011	106-93-4	µg/L	0.1	0.05	0.075	c	0.05	0.03	0.02	0.01
1,2-Dichlorobenzene	SW8260C	95-50-1	µg/L	600	600	300	nc	600	5.0	2.0	1.0
1,2-Dichloroethane*	SW8260C	107-06-2	µg/L	10	5	1.7	c	5.0	1.0	1.0	0.5
1,2-Dichloropropane	SW8260C	78-87-5	µg/L	NS	5	8.5	c	5.0	1.0	1.0	0.5
1,3-Dichloropropane	SW8260C	142-28-9	µg/L	NS	NS	370	nc	370	1.0	1.0	0.5
1,3-Dichlorobenzene	SW8260C	541-73-1	µg/L	600	600	300	nc	600	5.0	2.0	1.0
1,3,5-Trimethylbenzene*	SW8260C	108-67-8	µg/L	NS	NS	120	nc	120	5.0	2.0	1.0
1,4-Dichlorobenzene	SW8260C	106-46-7	µg/L	NS	75	4.8	c	75	5.0	2.0	1.0
2-Butanone (Methyl Ethyl ketone)*	SW8260C	78-93-3	µg/L	NS	NS	5600	nc	5600	10	8.0	3.0
2-Chlorotoluene*	SW8260C	95-49-8	µg/L	NS	NS	240	nc	240	5.0	2.0	1.0
2,2-Dichloropropane	SW8260C	594-20-7	µg/L	NS	NS	NS	-	NS	1.0	1.0	0.5
2-Hexanone*	SW8260C	591-78-6	µg/L	NS	NS	38	nc	38	10	8	3
4-Chlorotoluene	SW8260C	106-43-4	µg/L	NS	NS	250	nc	250	5	2	1
4-Methyl-2-pentanone (Methyl Isobutyl Ketone)*	SW8260C	108-10-1	µg/L	NS	NS	1200	nc	1200	10	8	3
Acetone*	SW8260C	67-64-1	µg/L	NS	NS	14000	nc	14000	20	20	6.0
Acrolein	SW8260C	107-02-8	µg/L	NS	NS	0.042	nc	100	100	100	40
Acrylonitrile	SW8260C	107-13-1	µg/L	NS	NS	0.52	c	20	20	10	4.0
Benzene*	SW8260C	71-43-2	µg/L	10	5	4.5	c	5.0	1.0	1.0	0.5
Bromobenzene	SW8260C	108-86-1	µg/L	NS	NS	62	nc	62	5.0	2.0	1.0
Bromochloromethane	SW8260C	74-97-5	µg/L	NS	NS	83	nc	83	5.0	2.0	1.0
Bromodichloromethane ⁶	SW8260C	75-27-4	µg/L	NS	80	1.3	c	80	1.0	1.0	0.5
Bromoform ⁶	SW8260C	75-25-2	µg/L	NS	80	33	c	80	4.0	1.0	0.5
Bromomethane	SW8260C	74-83-9	µg/L	NS	NS	7.5	nc	7.5	1.0	1.0	0.5
Carbon Disulfide*	SW8260C	75-15-0	µg/L	NS	NS	810	nc	810	5.0	2.0	1.0
Carbon Tetrachloride	SW8260C	56-23-5	µg/L	10	5	4.5	c	5.0	1.0	1.0	0.5
Chlorobenzene	SW8260C	108-90-7	µg/L	NS	100	78	nc	100	1.0	1.0	0.5
Chloroethane (Ethyl Chloride)	SW8260C	75-00-3	µg/L	NS	NS	21000	nc	21000	1.0	1.0	0.5
Chloroform ⁶	SW8260C	67-66-3	µg/L	100	80	2.2	c	80	1.0	1.0	0.5
Chloromethane*	SW8260C	74-87-3	µg/L	NS	NS	190	nc	190	1.0	1.0	0.5
cis-1,2-Dichloroethene	SW8260C	156-59-2	µg/L	NS	70	36	nc	70	1.0	1.0	0.5
cis-1,3-Dichloropropene	SW8260C	10061-01-5	µg/L	NS	NS	4.7	c	4.7	1.0	1.0	0.5
Dibromochloromethane	SW8260C	124-48-1	µg/L	NS	80	1.7	c	80	1.0	1.0	0.5
Dibromomethane	SW8260C	74-95-3	µg/L	NS	NS	8.0	nc	8.0	1.0	1.0	0.5
Dichlorodifluoromethane*	SW8260C	75-71-8	µg/L	NS	NS	200	nc	200	4.0	1.0	0.5
Ethylbenzene*	SW8260C	100-41-4	µg/L	750	700	15	c	700	1.0	1.0	0.5
Hexachlorobutadiene	SW8260C	87-68-3	µg/L	NS	NS	1.4	c	5.0	5.0	4.0	2.0
Isopropylbenzene (Cumene)*	SW8260C	98-82-8	µg/L	NS	NS	450	nc	450	5.0	2.0	1.0
Methyl tert-Butyl Ether*	SW8260C	1634-04-4	µg/L	NS	NS	140	c	140	1.0	1.0	0.5
Methylene Chloride*	SW8260C	75-09-2	µg/L	100	5	110	c	5.0	4.0	4.0	2.0
n-Butylbenzene*	SW8260C	104-51-8	µg/L	NS	NS	1000	nc	1000	5.0	2.0	1.0
n-Propylbenzene*	SW8260C	103-65-1	µg/L	NS	NS	660	nc	660	5.0	2.0	1.0
Naphthalene* ⁷	SW8260C	91-20-3	µg/L	30 ⁸	NS	1.7	c	30	5.0	2.0	1.0
p-Isopropyltoluene*	SW8260C	99-87-6	µg/L	NS	NS	NS	nc	NS	5.0	2.0	1.0
sec-Butylbenzene*	SW8260C	135-98-8	µg/L	NS	NS	2000	nc	2000	5.0	2.0	1.0
Styrene	SW8260C	100-42-5	µg/L	NS	100	1200	nc	100	5.0	2.0	1.0
tert-Butylbenzene*	SW8260C	98-06-6	µg/L	NS	NS	690	nc	690	5.0	2.0	1.0
Tetrachloroethene	SW8260C	127-18-4	µg/L	20	5	110	c	5.0	1.0	1.0	0.5
Toluene*	SW8260C	108-88-3	µg/L	750	1000	1100	nc	750	1.0	1.0	0.5
trans-1,2-Dichloroethene	SW8260C	156-60-5	µg/L	NS	100	360	nc	100	1.0	1.0	0.5
trans-1,3-Dichloropropene	SW8260C	10061-02-6	µg/L	NS	NS	4.7	c	4.7	1.0	1.0	0.5
Trichloroethene*	SW8260C	79-01-6	µg/L	100	5	4.9	c	5.0	1.0	1.0	0.5
Trichlorofluoromethane*	SW8260C	75-69-4	µg/L	NS	NS	1100	nc	1100	1.0	1.0	0.5
Vinyl Acetate	SW8260C	108-05-4	µg/L	NS	NS	410	nc	410	10	4.0	2.0
Vinyl Chloride	SW8260C	75-01-4	µg/L	1	2	0.19	c	1.0	1.0	1.0	0.5
m,p-Xylene*	SW8260C	179601-23-1	µg/L	NS	10,000	190	nc	10,000	1.0	1.0	0.5
o-Xylene*	SW8260C	95-47-6	µg/L	NS	10,000	190	nc	10,000	1.0	1.0	0.5
Xylene (Total)*	SW8260C	1330-20-7	µg/L	620	10,000	190	nc	620	1.0	1.0	0.5
Metals - Total											
Arsenic	SW6020A	7440-38-2	mg/L	0.1	0.01	0.00052	c	0.01	0.004	0.002	0.00054
Calcium	SW6010C	7440-70-2	mg/L	NS	NS	NS	-	NS	0.004	0.050	0.033
Lead	SW6020A	7439-92-1	mg/L	0.05	0.015	0.015	-	0.015	0.002	0.00025	0.00013
Magnesium	SW6010C	7439-95-4	mg/L	NS	NS	NS	-	NS	0.2	0.05	0.017
Potassium	SW6010C	7440-09-7	mg/L	NS	NS	NS	-	NS	1.0	5.0	0.192
Sodium	SW6010C	7440-23-5	mg/L	NS	NS	NS	-	NS	2.0	0.5	0.167
Metals - Dissolved											
Iron	SW6010C	7439-89-6	mg/L	1.0	NS	NS	nc	1.0	0.4	0.05	0.033
Manganese	SW6010C	7439-96-5	mg/L	0.2	NS	NS	nc	0.2	0.01	0.0013	0.0008
Miscellaneous											
Alkalinity - Bicarbonate/Carbonate	SM 2320B	NS	mg/L	NS	NS	NS	-	NS	2.0	2.0	0.7
Ammonia Nitrogen	SM 4500NH3B/C	7664-41-7	mg/L	NS	NS	NS	-	NS	0.6	0.6	0.2
Bromide	E300.0A	24959-67-9	mg/L	NS	NS	NS	-	NS	2.5	2.5	1.25
Chloride	E300.0A	16887-00-6	mg/L	250	250	NS	-	250	2.0	2.0	1.0
Flashpoint ⁹	SW-846 1010A	NS	degrees F	NS	NS	NS	-	<140	50	50	50
Nitrate/Nitrite Nitrogen	E353.2	NS	mg/L	NS	1.0 ⁸	NS	-	1.0 ⁸	1.0	0.1	0.4
pH	SW-846 9040C	NS	S. U.	6-9	6.5-8.5	NS	-	6-9	0.01	0.01	0.01
Sulfate	EPA 300.0A	18785-72-3	mg/L	600	250	NS	-	250	5.0	5.0	1.5
Sulfide	SM 4500S2F	18496-25-8	mg/L	NS	NS	NS	-	NS	2.0	2.0	0.675

Attachment 1, Table 1-1a
Method Reporting Limits and Screening Criteria for Water

¹ NMWQCC standards per the New Mexico Administrative Code Title 20.6.2.3101A, Standards for Ground Water of 10,000 mg/L Total Dissolved Solids Concentration or Less (NMAC 2004). For metals, the NMWQCC standard applies to dissolved metals and total mercury.

² EPA National Primary Drinking Water Regulations, Maximum Contaminant Levels and Secondary Maximum Contaminant Levels, Title 40CFR Part 141, 143 (May 2009).

³ EPA Regional Screening Levels for Tapwater (June 2017) for hazard index = 1.0 for noncarcinogens and a 10⁻⁵ cancer risk level for carcinogens.

⁴ The project screening level was selected to satisfy the requirements of the Kirtland AFB Hazardous Waste Permit No. NM9570024423 as the lowest of 1) NMWQCC standard or 2) EPA MCL. If no MCL or NMWQCC standard exists for any analyte, then the project screening level will be the EPA Tapwater RSL. Project screening levels below the LOD are highlighted and the screening level is set at the LOQ.

⁵ Achievable laboratory limits are for Eurofins Lancaster Laboratories Environmental, LLC, Lancaster PA.

⁶ The EPA RSL for tapwater is for total trihalomethanes.

⁷ NMWQCC specifies a standard for the sum of naphthalene and mononaphthalenes (1-methylnaphthalene and 2-methylnaphthalene). Conservatively, this standard is shown for each of the three compounds.

⁸ MCL for nitrite is listed; the MCL for nitrate is 10 mg/L.

⁹ The project screening level for flashpoint is based on RCRA hazardous waste criteria.

* VOCs included in the Bulk Fuels Facility network groundwater monitoring and treatment system monitoring.

µg/L = Microgram(s) per liter.

AFB = Air Force Base.

BTEX = Benzene, toluene, ethylbenzene, and total xylenes.

c = Carcinogenic.

CASRN = Chemical Abstracts Service Registry Number.

DL = Detection limit.

EPA = U.S. Environmental Protection Agency.

LOD = Limit of detection.

LOQ = Limit of quantitation.

mg/L = Milligram(s) per liter.

MCL = Maximum Contaminant Level.

nc = Noncarcinogenic.

NMAC = New Mexico Administrative Code.

NMWQCC = New Mexico Water Quality Control Commission

NS = Not specified.

RCRA = Resource Conservation and Recovery Act.

RSL = Regional Screening Level.

S.U. = Standard units

VOC = Volatile organic compound.

Cell highlight indicates the LOQ is higher than the project screening level.

**Attachment 1, Table 1-1b
Method Reporting Limits and Criteria for Soil**

Analyte	CASRN	Units	EPA ¹		NMED ²		Project Screening Level ³	Achievable Laboratory Limits ⁴		
			c/nc	Residential RSL	c/nc	Residential SSL		LOQ	LOD	DL
Volatile Organic Compounds										
1,2-Dibromoethane (EDB)	106-93-4	mg/kg	c	0.36	c	0.668	0.36	0.0005	0.0004	0.0002
Benzene	71-43-2	mg/kg	c	12	c	17.7	12	0.005	0.002	0.0005

¹ EPA Regional Screening Levels (RSLs) for residential use scenario for hazard index = 1.0 for noncarcinogens and a 10⁻⁵ cancer risk level for carcinogens. June 2017.

² Residential land use SSLs from the NMED Risk Assessment Guidance for Site Investigations and Remediation, Appendix A, Table A-1, NMED Soil Screening Levels (SSL). March 2017.

³ The project screening level was selected to satisfy the requirements of the Kirtland AFB Hazardous Waste Facility Permit No. NM9570024423 as the lowest of the EPA residential RSL or the NMED residential SSL. If no RSL or SSL is specified for an analyte, then no project screening level is noted.

⁴ Achievable laboratory limits are for Eurofins Lancaster Laboratories Environmental, Lancaster PA.

c = Carcinogenic.

CASRN = Chemical Abstracts Service Registry Number.

DL = Detection limit.

EPA = U.S. Environmental Protection Agency.

LOD = Limit of detection.

LOQ = Limit of quantitation.

mg/kg = Milligram(s) per kilogram.

nc = Noncarcinogenic.

NMED = New Mexico Environment Department.

RSL = Regional Screening Level.

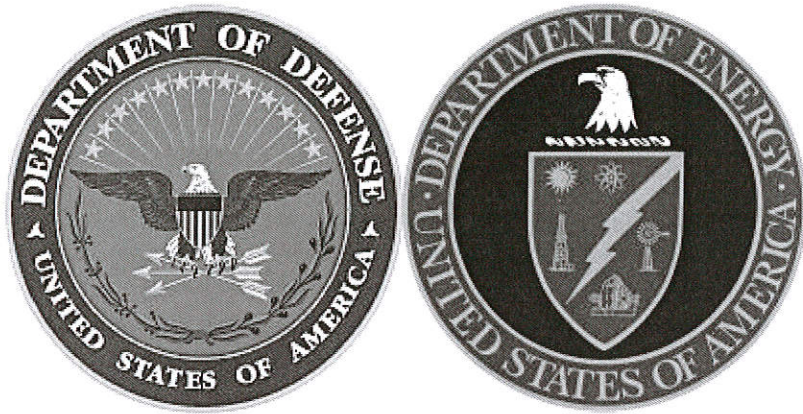
SSL = Soil Screening Level.

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ATTACHMENT 1 – EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL, LLC

Table 1-2: Method Control Limits

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Department of Defense (DoD)
Department of Energy (DOE)
Consolidated
Quality Systems Manual (QSM) for
Environmental Laboratories

Based on ISO/IEC 17025:2005(E)

and

The NELAC Institute (TNI) Standards, Volume 1, (September 2009)

DoD Quality Systems Manual Version 5.0
DOE Quality Systems for Analytical Services Version 3.0
July 2013

Table 3. Method 6010 Solid Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
7429-90-5	Aluminum	6258	96.7	7.5	74	119
7440-36-0	Antimony	5997	96.4	5.7	79	114
7440-38-2	Arsenic	9530	96.2	4.9	82	111
7440-39-3	Barium	9236	98.3	5	83	113
7440-41-7	Beryllium	6799	97.8	5.1	83	113
7440-42-8	Boron	2312	93	7.1	72	114
7440-43-9	Cadmium	9466	97.5	5.3	82	113
7440-70-2	Calcium	6347	98.1	5.8	81	116
7440-47-3	Chromium	9598	98.9	4.6	85	113
7440-48-4	Cobalt	6725	98.7	4.5	85	112
7440-50-8	Copper	7839	99.1	6	81	117
7439-89-6	Iron	5746	99.7	6.1	81	118
7439-92-1	Lead	10160	96.8	5.1	81	112
7439-93-2	Lithium	551	98.8	4.5	85	112
7439-95-4	Magnesium	6283	96.1	6.1	78	115
7439-96-5	Manganese	6732	99.1	4.9	84	114
7439-98-7	Molybdenum	4424	98.7	5.7	82	116
7440-02-0	Nickel	7412	98.1	4.9	83	113
7723-14-0	Phosphorus	189	103.1	3.8	92	114
7440-09-7	Potassium	6574	98.3	5.8	81	116
7782-49-2	Selenium	8862	94.5	5.6	78	111
7440-22-4	Silver	9105	97.3	5	82	112
7440-23-5	Sodium	5825	100.1	5.8	83	118
7440-24-6	Strontium	2573	98.5	5	83	114
7440-28-0	Thallium	6416	96.8	4.6	83	111

Table 3. Method 6010 Solid Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
7440-31-5	Tin	2780	100.1	6.6	80	120
7440-32-6	Titanium	2107	98.2	5.2	83	114
7440-61-1	Uranium	109	97.4	5.2	82	113
7440-62-2	Vanadium	6934	98.3	5.4	82	114
7440-66-6	Zinc	7882	97.4	5	82	113

Table 4. Method 6010 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
7429-90-5	Aluminum	11532	100	4.8	86	115
7440-36-0	Antimony	10737	100.2	4.2	88	113
7440-38-2	Arsenic	14123	99.9	4.3	87	113
7440-39-3	Barium	14476	100.3	4.1	88	113
7440-41-7	Beryllium	11552	100.4	4	89	112
7440-69-9	Bismuth	147	95.8	3.2	86	105
7440-42-8	Boron	3871	98.8	4.8	85	113
7440-43-9	Cadmium	13922	100.8	4.1	88	113
7440-70-2	Calcium	11382	100	4.2	87	113
7440-47-3	Chromium	15027	101.1	3.9	90	113
7440-48-4	Cobalt	11824	101.2	4.2	89	114
7440-50-8	Copper	12910	100.2	4.6	86	114
7439-89-6	Iron	13797	100.7	4.7	87	115
7439-92-1	Lead	14391	99.3	4.4	86	113
7439-93-2	Lithium	938	100.7	5.3	85	117
7439-95-4	Magnesium	11423	98.8	4.8	85	113
7439-96-5	Manganese	12767	101.9	4.1	90	114

Table 4. Method 6010 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
7439-98-7	Molybdenum	8251	101.1	4	89	113
7440-02-0	Nickel	12699	100.5	4.1	88	113
7440-05-3	Palladium	492	99.8	4	88	112
7723-14-0	Phosphorus	203	100.5	4.2	88	113
7440-09-7	Potassium	11006	99.9	4.7	86	114
7782-49-2	Selenium	13264	98.5	5.2	83	114
7440-21-3	Silicon	1525	100.6	6.1	82	119
7440-22-4	Silver	13770	99.1	5.1	84	115
7440-23-5	Sodium	10893	100.9	4.7	87	115
7440-24-6	Strontium	3782	101.3	3.8	90	113
7704-34-9	Sulfur	145	100.7	3.9	89	112
7440-28-0	Thallium	10063	99.5	4.7	85	114
7440-31-5	Tin	4502	101.3	4.4	88	115
7440-32-6	Titanium	5625	101.1	3.4	91	111
7440-61-1	Uranium	223	101.3	5.8	84	119
7440-62-2	Vanadium	12032	100.2	3.6	90	111
7440-66-6	Zinc	13549	100.6	4.6	87	115

Table 5. Method 6020 Solid Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
7429-90-5	Aluminum	919	101	7.7	78	124
7440-36-0	Antimony	1911	98.2	8.7	72	124
7440-38-2	Arsenic	3686	99.8	6	82	118
7440-39-3	Barium	2598	100.6	5	86	116
7440-41-7	Beryllium	2457	100.3	6.6	80	120

Table 5. Method 6020 Solid Matrix						
CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
7440-42-8	Boron	581	101.1	9	74	128
7440-43-9	Cadmium	2893	99.6	5.4	84	116
7440-70-2	Calcium	835	102.2	5.4	86	118
7440-47-3	Chromium	2420	100.8	6	83	119
7440-48-4	Cobalt	2005	99.7	5.1	84	115
7440-50-8	Copper	2548	101.3	5.8	84	119
7439-89-6	Iron	1131	102.7	7.1	81	124
7439-92-1	Lead	3228	101	5.7	84	118
7439-93-2	Lithium	162	97.8	7.5	75	120
7439-95-4	Magnesium	868	101.6	7.1	80	123
7439-96-5	Manganese	1830	100.3	5.1	85	116
7439-97-6	Mercury	226	99.9	8.8	74	126
7439-98-7	Molybdenum	1188	98.1	5.1	83	114
7440-02-0	Nickel	2617	101.4	5.8	84	119
7440-09-7	Potassium	803	102.3	5.7	85	119
7782-49-2	Selenium	3104	99.2	6.6	80	119
7440-22-4	Silver	2488	100.1	5.9	83	118
7440-23-5	Sodium	818	102.2	7.7	79	125
7440-24-6	Strontium	676	101.7	8.9	75	129
7440-28-0	Thallium	2589	100.1	5.9	83	118
7440-29-1	Thorium	341	98.4	5.7	81	116
7440-31-5	Tin	886	101.3	6.6	82	121
7440-32-6	Titanium	512	100.2	5.7	83	117
7440-61-1	Uranium	833	101.1	6.1	83	120
7440-62-2	Vanadium	1677	99.1	5.7	82	116
7440-66-6	Zinc	2352	100.1	6.2	82	119

Table 6. Method 6020 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
7429-90-5	Aluminum	3145	100.6	5.4	84	117
7440-36-0	Antimony	5172	100.9	5.3	85	117
7440-38-2	Arsenic	6404	100.1	5.3	84	116
7440-39-3	Barium	4452	99.9	4.8	86	114
7440-41-7	Beryllium	4297	102	6.3	83	121
7440-42-8	Boron	1460	101.5	9.6	73	130
7440-43-9	Cadmium	5699	100.8	4.7	87	115
7440-70-2	Calcium	2085	102.3	5.2	87	118
7440-47-3	Chromium	5569	100.6	5.1	85	116
7440-48-4	Cobalt	3885	100.7	4.7	86	115
7440-50-8	Copper	5092	101.4	5.4	85	118
7439-89-6	Iron	3135	102.4	5.2	87	118
7439-92-1	Lead	6868	101.7	4.5	88	115
7439-93-2	Lithium	461	102.3	8	78	126
7439-95-4	Magnesium	2399	100.4	5.9	83	118
7439-96-5	Manganese	4330	101.1	4.7	87	115
7439-97-6	Mercury	328	97.2	9	70	124
7439-98-7	Molybdenum	2908	99.3	5.4	83	115
7440-02-0	Nickel	5095	100.8	5.3	85	117
7440-09-7	Potassium	2154	101.2	4.7	87	115
7782-49-2	Selenium	5797	100.1	6.7	80	120
7440-22-4	Silver	4956	100.8	5.1	85	116
7440-23-5	Sodium	2313	100.7	5.3	85	117
7440-24-6	Strontium	1170	99.9	5.9	82	118
7440-28-0	Thallium	5352	99.3	5.6	82	116

Table 6. Method 6020 Water Matrix						
CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
7440-29-1	Thorium	313	103.7	5.7	87	121
7440-31-5	Tin	1509	100.6	4.8	86	115
7440-32-6	Titanium	1538	98.6	5.3	83	115
7440-33-7	Tungsten	130	103.5	6.2	85	122
7440-61-1	Uranium	1860	103.3	5.4	87	120
7440-62-2	Vanadium	3375	100.5	5	86	115
7440-66-6	Zinc	4253	101	6	83	119

Table 7. Method 6850 Solid Matrix <i>Not Applicable</i>						
CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
14797-73-0	Perchlorate	575	102.5	6.1	84	121

Table 8. Method 6850 Water Matrix <i>Not Applicable</i>						
CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
14797-73-0	Perchlorate	790	101.6	5.8	84	119

Table 9. Method 7196 Solid Matrix <i>Not Applicable</i>						
CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
18540-29-9	Hexavalent Chromium [Cr (VI)]	2688	96.7	4.3	84	110

Table 10. Method 7196 Water Matrix <i>Not Applicable</i>						
CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
18540-29-9	Hexavalent Chromium [Cr (VI)]	1576	100.5	3.6	90	111

Table 11. Method 7470 - 7471 series Solid Matrix						
CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
7439-97-6	Mercury	6471	102	7.5	80	124

Table 12. Method 7470 - 7471 series Water Matrix						
CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
7439-97-6	Mercury	10530	100.5	6.3	82	119

Table 13. Method 8015 (MOD) Solid Matrix						
CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
460-00-4	4-Bromofluorobenzene	1263	100.7	11.1	67	134
303-04	Diesel Range Organics (DRO)	2184	85.2	15.7	38	132
307-27	Gasoline Range Organics (GRO)	1134	100.3	7.2	79	122
307-51	Motor Oil	658	72.2	11.2	39	106
84-15-1	o-Terphenyl	314	87.4	14.1	45	130

Table 14. Method 8015 (MOD) Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
460-00-4	4-Bromofluorobenzene	756	101	10.8	69	133
303-04	Diesel Range Organics (DRO)	1757	83.7	16	36	132
307-27	Gasoline Range Organics (GRO)	971	99.9	7.3	78	122
307-51	Motor Oil	573	76.9	12.1	41	113
84-15-1	o-Terphenyl	299	90.5	11.4	56	125
630-02-4	Octacosane	130	101.1	13.8	60	142

Table 15. Method 8081 Solid Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
789-02-6	2,4'-DDT	110	100.1	11.9	64	136
53-19-0	2,4-DDD	111	102.8	9.2	75	130
3424-82-6	2,4-DDE	111	102.2	9.5	74	131
72-54-8	4,4'-DDD	2995	97.7	13.9	56	139
72-55-9	4,4'-DDE	2938	95.3	13	56	134
50-29-3	4,4'-DDT	2470	95.8	15.1	50	141
309-00-2	Aldrin	2985	90.5	15.2	45	136
319-84-6	alpha-BHC	3021	90.9	15.3	45	137
5103-71-9	alpha-Chlordane	2681	93.7	13.2	54	133
319-85-7	beta-BHC	2989	93.1	14.3	50	136
57-74-9	Chlordane	229	95.7	17.7	43	149
319-86-8	delta-BHC	2943	93.3	15.3	47	139
60-57-1	Dieldrin	2987	95.7	13.4	56	136
959-98-8	Endosulfan I	984	92.2	13.2	53	132

Table 15. Method 8081 Solid Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
33213-65-9	Endosulfan II	2913	93.1	13.5	53	134
1031-07-8	Endosulfan sulfate	2954	95.9	13.5	55	136
72-20-8	Endrin	3076	98.1	13.9	57	140
7421-93-4	Endrin Aldehyde	3004	86	17	35	137
53494-70-5	Endrin Ketone	2953	95.5	13.5	55	136
58-89-9	gamma-BHC [Lindane]	3153	92.1	14.4	49	135
5103-74-2	gamma-Chlordane	2749	94.3	13.7	53	135
76-44-8	Heptachlor	3144	91.6	14.9	47	136
1024-57-3	Heptachlor Epoxide	3093	93.9	13.9	52	136
118-74-1	Hexachlorobenzene	319	91.6	11.4	57	126
72-43-5	Methoxychlor	3021	97.6	15.2	52	143
2385-85-5	Mirex	303	96.4	10.6	65	128
877-09-8	Tetrachloro-m-xylene	1482	85.3	14.6	42	129
8001-35-2	Toxaphene	532	86.7	17.9	33	141

Table 16. Method 8081 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
72-54-8	4,4'-DDD	3112	99.6	14.4	56	143
72-55-9	4,4'-DDE	3062	96	12.9	57	135
50-29-3	4,4'-DDT	2681	97	15.3	51	143
309-00-2	Aldrin	3021	89.5	14.7	45	134
319-84-6	alpha-BHC	3070	95.8	13.9	54	138
5103-71-9	alpha-Chlordane	2736	94.3	11.6	60	129
319-85-7	beta-BHC	3068	96.3	13.3	56	136
57-74-9	Chlordane	150	101.2	13	62	140

Table 16. Method 8081 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
319-86-8	delta-BHC	3035	97.2	15	52	142
60-57-1	Dieldrin	3078	98	12.6	60	136
959-98-8	Endosulfan I	968	93.8	10.7	62	126
33213-65-9	Endosulfan II	3047	93.4	13.7	52	135
1031-07-8	Endosulfan sulfate	3013	97.2	11.9	62	133
72-20-8	Endrin	3635	98.7	13	60	138
7421-93-4	Endrin aldehyde	3018	91.1	13.5	51	132
53494-70-5	Endrin Ketone	2908	95.9	12.6	58	134
58-89-9	gamma-BHC [Lindane]	3693	96.4	12.5	59	134
5103-74-2	gamma-Chlordane	3008	95.8	13.2	56	136
76-44-8	Heptachlor	3597	91.9	12.8	54	130
1024-57-3	Heptachlor Epoxide	3574	96.9	12.1	61	133
118-74-1	Hexachlorobenzene	134	82.1	18.1	27.8	136.5
72-43-5	Methoxychlor	3569	99	15.2	54	145
2385-85-5	Mirex	340	88.8	12.6	51	127
877-09-8	Tetrachloro-m-xylene	1510	84.1	13.3	44	124
8001-35-2	Toxaphene	421	83.9	16.8	33	134

Table 17. Method 8082 Solid Matrix*Not Applicable*

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
12674-11-2	Aroclor 1016	6847	90.1	14.5	47	134
11097-69-1	Aroclor 1254	406	101.2	11.4	67	135
11096-82-5	Aroclor 1260	7975	96.6	14.4	53	140
877-09-8	Tetrachloro-m-xylene	2379	86.7	14.4	44	130

Table 18. Method 8082 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
12674-11-2	Aroclor 1016	3356	87.1	13.8	46	129
11097-69-1	Aroclor 1254	184	80.1	15.4	34	127
11096-82-5	Aroclor 1260	3538	89.4	14.8	45	134

Table 19. Method 8141 Solid Matrix*Not Applicable*

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
86-50-0	Azinphos-methyl	325	96.7	19.6	38	156
35400-43-2	Bolstar [Sulprofos]	270	93.5	15.1	48	139
786-19-6	Carbophenothion	237	96.6	12.5	59	134
2921-88-2	Chlorpyrifos	333	93.3	15.5	47	140
56-72-4	Coumaphos	321	98.4	20.5	37	160
8065-48-3	Demeton	254	80.2	12.4	43	117
333-41-5	Diazinon	328	87.9	15.2	42	134
62-73-7	Dichlorvos [DDVP]	322	90.6	17.2	39	142
60-51-5	Dimethoate	264	77.5	20.6	16	139
298-04-4	Disulfoton	332	86	19.5	28	145
2104-64-5	EPN	300	90.6	15.5	44	137
563-12-2	Ethion	160	99.3	13.5	59	140
13194-48-4	Ethoprop	325	87.8	13.5	47	128
52-85-7	Fampphur	192	90.6	14.6	47	134
115-90-2	Fensulfothion	324	87.1	20	27	147
55-38-9	Fenthion	325	88.7	14.9	44	134
121-75-5	Malathion	322	91.2	15.2	46	137
298-00-0	methyl Parathion	330	93.6	14.8	49	138

Table 21. Method 8151 Solid Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
93-76-5	2,4,5-T	1106	84.6	17.7	31	138
93-72-1	2,4,5-TP [Silvex]	1179	86.1	14.3	43	129
94-75-7	2,4-D	1256	86	19.3	28	144
94-82-6	2,4-DB	1030	88.2	17.9	34	142
19719-28-9	2,4-Dichlorophenylacetic Acid	1041	74	15.9	27	122
100-02-7	4-Nitrophenol	208	76.7	20	17	137
50594-66-6	Acifluorfen	206	79.8	18	26	134
1861-32-1	Dacthal (DCPA)	147	72.5	15.6	26	119
1918-00-9	Dicamba	1070	85.2	15.7	38	132
120-36-5	Dichloroprop	1033	91.4	21	28	155
94-74-6	MCPA	935	81.5	17.8	28	135
93-65-2	MCPP	807	88.7	18	35	143

Dinoseb - 88-85-7 2-(1-methylpropyl)-4,6-dinitrophenol

Table 22. Method 8151 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
93-76-5	2,4,5-T	1758	94.8	17.5	42	147
93-72-1	2,4,5-TP [Silvex]	2289	92.9	13.8	51	134
94-75-7	2,4-D	2396	98.4	17.7	45	152
94-82-6	2,4-DB	1427	94.1	19.7	35	153
19719-28-9	2,4-Dichlorophenylacetic Acid	905	85	17.7	32	138
100-02-7	4-Nitrophenol	245	89.8	17.4	38	142
50594-66-6	Acifluorfen	262	95.5	16.2	47	144
133-90-4	Chloramben	230	79.5	18.5	24	135
1861-32-1	Dacthal (DCPA)	160	76.2	13.6	36	117
75-99-0	Dalapon	1220	79	20	19	139

1918-00-9	Dicamba	1434	95.3	15.2	50	141
120-36-5	Dichloroprop	1404	102	18.8	46	159
94-74-6	MCPA	1284	89.2	18.2	35	144
93-65-2	MCPP	1137	95.2	20.7	33	157
7085-19-0	Mecoprop	126	97.4	21.2	34	161
87-86-5	Pentachlorophenol	1149	97.5	13.8	56	139

Table 23. Method 8260 Solid Matrix						
CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
630-20-6	1,1,1,2-Tetrachloroethane	11115	101.1	7.8	78	125
71-55-6	1,1,1-Trichloroethane	12156	101.6	9.4	73	130
79-34-5	1,1,2,2-Tetrachloroethane	11670	97	8.9	70	124
79-00-5	1,1,2-Trichloroethane	11772	99.7	7.2	78	121
76-13-1	1,1,2-Trifluoro-1,2,2-trichloroethane [Freon-113]	9760	100.8	11.7	66	136
75-34-3	1,1-Dichloroethane	11856	100.4	8.1	76	125
75-35-4	1,1-Dichloroethene	12352	100.3	10.1	70	131
563-58-6	1,1-Dichloropropene	10793	100.5	8.3	76	125
87-61-6	1,2,3-Trichlorobenzene	10572	97.8	10.6	66	130
96-18-4	1,2,3-Trichloropropane	10925	99.1	8.8	73	125
526-73-8	1,2,3-Trimethylbenzene	1948	99.8	6	82	118
120-82-1	1,2,4-Trichlorobenzene	10980	98	10.4	67	129
95-63-6	1,2,4-Trimethylbenzene	11085	98.7	7.9	75	123
96-12-8	1,2-Dibromo-3-chloropropane	11380	96.6	11.7	61	132
106-93-4	1,2-Dibromoethane	11408	100.1	7.3	78	122
95-50-1	1,2-Dichlorobenzene	11785	99.1	7.2	78	121
107-06-2	1,2-Dichloroethane	12328	100.5	9.2	73	128

Table 23. Method 8260 Solid Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
17060-07-0	1,2-Dichloroethane-d4	5951	103.1	10.8	71	136
540-59-0	1,2-Dichloroethene	7748	99.9	7.3	78	122
78-87-5	1,2-Dichloropropane	12145	99.5	7.8	76	123
354-23-4	1,2-Dichlorotrifluoroethane [Freon 123a]	1269	97.8	11.3	64	132
108-70-3	1,3,5-Trichlorobenzene	4723	99.4	9.6	71	128
108-67-8	1,3,5-Trimethylbenzene	11080	98.4	8.4	73	124
541-73-1	1,3-Dichlorobenzene	11619	98.9	7.4	77	121
142-28-9	1,3-Dichloropropane	10713	99.1	7.3	77	121
542-75-6	1,3-Dichloropropene	3714	101.6	8.1	77	126
106-46-7	1,4-Dichlorobenzene	11848	97.5	7.6	75	120
105-05-5	1,4-Diethylbenzene	1896	96.6	5.9	79	114
123-91-1	1,4-Dioxane	7698	96.4	13.7	55	138
544-10-5	1-Chlorohexane	2543	100.4	9.8	71	130
594-20-7	2,2-Dichloropropane	10703	99.7	11.1	67	133
78-93-3	2-Butanone [MEK]	11514	99.6	16.3	51	148
126-99-8	2-Chloro-1,3-butadiene	6667	99	11.3	65	133
110-75-8	2-Chloroethyl vinyl ether	6957	96.1	17.6	43	149
95-49-8	2-Chlorotoluene	10838	98.5	7.9	75	122
591-78-6	2-Hexanone	11004	99.1	15.4	53	145
79-46-9	2-Nitropropane	4969	98.3	17.1	47	150
67-63-0	2-Propanol [Isopropyl alcohol]	1696	99.8	13.4	60	140
460-00-4	4-Bromofluorobenzene	6267	98.9	6.8	79	119
106-43-4	4-Chlorotoluene	10785	98.3	8.6	72	124
108-10-1	4-Methyl-2-pentanone [MIBK]	11364	99.6	11.6	65	135
67-64-1	Acetone	11089	99.6	21.4	36	164

Table 23. Method 8260 Solid Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
75-05-8	Acetonitrile	5697	98.5	14.8	54	143
107-02-8	Acrolein [Propenal]	7528	101.1	18	47	155
107-13-1	Acrylonitrile	8293	99.7	11.4	65	134
107-05-1	Allyl chloride	6908	101.1	11.2	68	135
71-43-2	Benzene	12853	99.2	7.4	77	121
100-44-7	Benzyl chloride	2743	92.1	9.4	64	120
108-86-1	Bromobenzene	10974	99.3	7.3	78	121
74-97-5	Bromochloromethane	11023	101.4	7.8	78	125
75-27-4	Bromodichloromethane	11850	101	8.5	75	127
75-25-2	Bromoform	11890	99.1	10.8	67	132
74-83-9	Bromomethane	11416	98.3	15	53	143
75-15-0	Carbon disulfide	11132	97.9	11.5	63	132
56-23-5	Carbon tetrachloride	12090	102.3	10.7	70	135
108-90-7	Chlorobenzene	12382	99.7	6.9	79	120
124-48-1	Chlorodibromomethane	11852	100.2	8.7	74	126
75-00-3	Chloroethane	11444	98.8	13.3	59	139
67-66-3	Chloroform	12344	100.3	7.6	78	123
74-87-3	Chloromethane	11876	93.3	14.3	50	136
156-59-2	cis-1,2-Dichloroethene	11645	99.9	7.6	77	123
10061-01-5	cis-1,3-Dichloropropene	11805	99.8	8.7	74	126
1476-11-5	cis-1,4-Dichloro-2-butene	977	106	12.4	69	143
110-82-7	Cyclohexane	8827	98.9	10.6	67	131
108-94-1	Cyclohexanone	3764	93.2	20.9	30	156
1868-53-7	Dibromofluoromethane	2142	98.1	6.8	78	119
74-95-3	Dibromomethane	10913	101.1	7.9	78	125
75-71-8	Dichlorodifluoromethane [Freon-12]	11467	88.9	20.1	29	149

Table 23. Method 8260 Solid Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
75-43-4	Dichlorofluoromethane	717	100.8	18	47	155
60-29-7	Diethyl ether	6283	99.6	9.6	71	129
108-20-3	Diisopropyl ether	8542	98.3	9.7	69	127
64-17-5	Ethanol	3958	102.2	18.9	45	159
141-78-6	Ethyl acetate	4516	95.4	14.5	52	139
97-63-2	Ethyl methacrylate	7075	98.9	9.9	69	129
637-92-3	Ethyl tert-butyl ether	7514	98.9	9.1	72	126
100-41-4	Ethylbenzene	12427	99.1	7.7	76	122
462-06-6	Fluorobenzene	689	97.3	5.4	81	114
142-82-5	Heptane	5420	93.4	14.9	49	138
87-68-3	Hexachlorobutadiene	10264	98.1	12.4	61	135
67-72-1	Hexachloroethane	3265	102.5	10.1	72	133
110-54-3	Hexane	7116	93.6	16.1	45	142
74-88-4	Iodomethane	9457	100.9	10.1	71	131
78-83-1	Isobutyl alcohol	6162	97.5	12.6	60	135
108-21-4	Isopropyl acetate [Acetic acid]	2885	94.2	12.2	58	131
98-82-8	Isopropylbenzene	11596	100.8	11.1	68	134
179601-23-1	m/p-Xylene [3/4-Xylene]	10612	100.4	7.7	77	124
126-98-7	Methacrylonitrile	6736	99.2	11.1	66	132
79-20-9	Methyl acetate	8320	98.7	15.2	53	144
80-62-6	Methyl methacrylate	7050	98.4	11.9	63	134
1634-04-4	Methyl tert-butyl ether [MTBE]	11253	98.9	8.7	73	125
108-87-2	Methylcyclohexane	8565	99.4	11.2	66	133
75-09-2	Methylene chloride	12024	98.9	9.7	70	128
123-86-4	n-Butyl acetate	2981	95.1	11	62	128
71-36-3	n-Butyl alcohol	4800	92.9	12.6	55	131

Table 23. Method 8260 Solid Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
104-51-8	n-Butylbenzene	10921	98.7	9.7	70	128
103-65-1	n-Propylbenzene	10947	98.9	8.8	73	125
91-20-3	Naphthalene	10602	95.6	11.2	62	129
95-47-6	o-Xylene	11940	100	7.7	77	123
99-87-6	p-Isopropyltoluene [p-Cymene]	10953	100.3	9	73	127
76-01-7	Pentachloroethane	5957	102	11.1	69	135
107-12-0	Propionitrile [Ethyl cyanide]	6734	101	11.1	68	134
135-98-8	sec-Butylbenzene	10960	99	8.8	73	126
100-42-5	Styrene	11809	100.2	8	76	124
994-05-8	tert-Amyl methyl ether [TAME]	7153	99.8	8.9	73	126
75-65-0	tert-Butyl alcohol	7492	100.5	10.7	68	133
98-06-6	tert-Butylbenzene	10974	98.8	8.6	73	125
127-18-4	Tetrachloroethene	12091	100.5	9.2	73	128
109-99-9	Tetrahydrofuran	8039	98	12.4	61	135
108-88-3	Toluene	12499	99.3	7.3	77	121
2037-26-5	Toluene-d8	6232	100.7	5.2	85	116
156-60-5	trans-1,2-Dichloroethene	11849	99.2	8.6	74	125
10061-02-6	trans-1,3-Dichloropropene	11805	100.9	9.8	71	130
110-57-6	trans-1,4-Dichloro-2-butene	8307	98.6	12.3	62	136
79-01-6	Trichloroethene	12440	100.2	7.6	77	123
75-69-4	Trichlorofluoromethane [Freon-11]	11530	101	13.1	62	140
108-05-4	Vinyl acetate	7260	100.3	16.9	50	151
75-01-4	Vinyl chloride	12129	95.6	13.2	56	135
1330-20-7	Xylenes [total]	8623	100.7	7.7	78	124

Table 24. Method 8260 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
630-20-6	1,1,1,2-Tetrachloroethane	24511	101.1	7.6	78	124
71-55-6	1,1,1-Trichloroethane	28223	102.7	9.6	74	131
79-34-5	1,1,2,2-Tetrachloroethane	27450	96.4	8.3	71	121
79-00-5	1,1,2-Trichloroethane	27338	99.5	6.5	80	119
76-13-1	1,1,2-Trifluoro-1,2,2-trichloroethane [Freon-113]	21122	103	11.1	70	136
75-34-3	1,1-Dichloroethane	28154	101.3	8	77	125
75-35-4	1,1-Dichloroethene	29436	101	10	71	131
563-58-6	1,1-Dichloropropene	23631	102	7.8	79	125
87-61-6	1,2,3-Trichlorobenzene	24271	98.7	10.1	69	129
96-18-4	1,2,3-Trichloropropane	24525	97.5	8	73	122
526-73-8	1,2,3-Trimethylbenzene	2965	100.9	6.2	82	120
120-82-1	1,2,4-Trichlorobenzene	25290	99.8	10.1	69	130
95-63-6	1,2,4-Trimethylbenzene	27917	99.6	8	76	124
96-12-8	1,2-Dibromo-3-chloropropane	24955	94.9	11.1	62	128
106-93-4	1,2-Dibromoethane	29096	99	7.2	77	121
95-50-1	1,2-Dichlorobenzene	27583	99.4	6.5	80	119
107-06-2	1,2-Dichloroethane	32965	100.3	9.2	73	128
17060-07-0	1,2-Dichloroethane-d4	8673	99.5	6.1	81	118
540-59-0	1,2-Dichloroethene	18667	100.2	7.1	79	121
78-87-5	1,2-Dichloropropane	27787	100.1	7.2	78	122
354-23-4	1,2-Dichlorotrifluoroethane [Freon 123a]	3144	103.1	10.9	70	136
108-70-3	1,3,5-Trichlorobenzene	10037	102.1	9.2	75	130
108-67-8	1,3,5-Trimethylbenzene	27820	99.5	8.1	75	124

Table 24. Method 8260 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
106-99-0	1,3-Butadiene	1202	100.6	19.2	43	158
541-73-1	1,3-Dichlorobenzene	26951	99.7	6.5	80	119
142-28-9	1,3-Dichloropropane	23811	99.1	6.5	80	119
542-75-6	1,3-Dichloropropene	9784	99.9	7.6	77	123
106-46-7	1,4-Dichlorobenzene	27715	98.3	6.5	79	118
105-05-5	1,4-Diethylbenzene	1980	98.4	6.4	79	118
123-91-1	1,4-Dioxane	17866	99	13.4	59	139
544-10-5	1-Chlorohexane	5790	99.6	8	76	124
540-84-1	2,2,4-Trimethylpentane [Isooctane]	5432	95.2	12.3	58	132
594-20-7	2,2-Dichloropropane	23775	99.7	13.2	60	139
75-85-4	2-Butanol	4332	92.7	9.1	66	120
78-93-3	2-Butanone [MEK]	26659	99.6	14.6	56	143
126-99-8	2-Chloro-1,3-butadiene	15673	100	11.7	65	135
110-75-8	2-Chloroethyl vinyl ether	18225	94.7	14.7	51	139
95-49-8	2-Chlorotoluene	23750	100	7.2	79	122
591-78-6	2-Hexanone	25368	97.9	13.5	57	139
91-57-6	2-Methylnaphthalene	3754	79.4	20.9	17	142
79-46-9	2-Nitropropane	10213	92.6	14.5	49	136
67-63-0	2-Propanol [Isopropyl alcohol]	2034	98.8	14.4	56	142
624-95-3	3,3-Dimethyl-1-butanol	6491	90.9	13.9	49	133
460-00-4	4-Bromofluorobenzene	9971	99.7	4.9	85	114
106-43-4	4-Chlorotoluene	23616	99.9	7.4	78	122
108-10-1	4-Methyl-2-pentanone [MIBK]	25796	98.5	10.6	67	130
67-64-1	Acetone	25006	99.5	20.1	39	160
75-05-8	Acetonitrile	13308	95.8	15.2	50	142

Table 24. Method 8260 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
107-02-8	Acrolein [Propenal]	16380	96.8	19.3	39	155
107-13-1	Acrylonitrile	20173	99	11.9	63	135
107-05-1	Allyl chloride	15758	99	10.4	68	130
71-43-2	Benzene	34376	99.4	6.9	79	120
100-44-7	Benzyl chloride	10675	90.1	15.9	42	138
108-86-1	Bromobenzene	23762	99.7	6.7	80	120
74-97-5	Bromochloromethane	24356	100.8	7.5	78	123
75-27-4	Bromodichloromethane	26888	101.8	7.8	79	125
75-25-2	Bromoform	27675	97.8	10.8	66	130
74-83-9	Bromomethane	26717	97	14.7	53	141
75-15-0	Carbon disulfide	25719	98.8	11.5	64	133
56-23-5	Carbon tetrachloride	28870	103.8	10.7	72	136
108-90-7	Chlorobenzene	29802	100	6.1	82	118
124-48-1	Chlorodibromomethane	27424	100	8.5	74	126
75-45-6	Chlorodifluoromethane	7197	84.4	14.9	40	129
75-00-3	Chloroethane	27069	99	13	60	138
67-66-3	Chloroform	29373	101.1	7.5	79	124
74-87-3	Chloromethane	27697	94.5	15	50	139
156-59-2	cis-1,2-Dichloroethene	27935	100.1	7.5	78	123
10061-01-5	cis-1,3-Dichloropropene	27197	99.5	8	75	124
1476-11-5	cis-1,4-Dichloro-2-butene	1524	101.5	14.9	57	146
110-82-7	Cyclohexane	20438	100.4	10	71	130
1868-53-7	Dibromofluoromethane	5702	99.1	6.5	80	119
74-95-3	Dibromomethane	24473	101.1	7.3	79	123
75-71-8	Dichlorodifluoromethane [Freon-12]	25410	92	20.1	32	152

Table 24. Method 8260 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
75-43-4	Dichlorofluoromethane	1504	101.5	9.8	72	131
60-29-7	Diethyl ether	17189	98.6	10.2	68	129
108-20-3	Diisopropyl ether	22989	97.5	10.3	67	128
64-17-5	Ethanol	9543	99.2	17.1	48	151
141-78-6	Ethyl acetate	9208	96.8	13.9	55	138
97-63-2	Ethyl methacrylate	16674	98.7	9	72	126
637-92-3	Ethyl tert-butyl ether	19841	98.3	9.4	70	127
100-41-4	Ethylbenzene	33325	99.8	7	79	121
462-06-6	Fluorobenzene	1373	97.9	6.1	80	116
142-82-5	Heptane	11878	94.4	15	49	140
87-68-3	Hexachlorobutadiene	23535	100.1	11.3	66	134
67-72-1	Hexachloroethane	8718	102.9	10.3	72	134
110-54-3	Hexane	15545	95.5	15.9	48	143
74-88-4	Iodomethane	20229	100	10.4	69	131
78-83-1	Isobutyl alcohol	14123	97.7	11.7	63	133
108-21-4	Isopropyl acetate [Acetic acid]	7216	97.8	11.6	63	133
98-82-8	Isopropylbenzene	28636	101.5	9.9	72	131
179601-23-1	m/p-Xylene [3/4-Xylene]	28168	100.5	6.9	80	121
126-98-7	Methacrylonitrile	15982	97.9	11.6	63	133
79-20-9	Methyl acetate	19698	96	13.2	56	136
80-62-6	Methyl methacrylate	16524	97.7	10.2	67	128
1634-04-4	Methyl tert-butyl ether [MTBE]	29660	97.3	8.8	71	124
108-87-2	Methylcyclohexane	20025	101.8	10.1	72	132
75-09-2	Methylene chloride	27659	99.4	8.3	74	124
123-86-4	n-Butyl acetate	7247	96.8	9.4	69	125

Table 24. Method 8260 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
71-36-3	n-Butyl alcohol	10122	95.1	12	59	131
104-51-8	n-Butylbenzene	24088	101.1	8.8	75	128
109-60-4	n-Propyl acetate	602	100.8	8.3	76	126
103-65-1	n-Propylbenzene	24419	101	8.5	76	126
91-20-3	Naphthalene	27847	94.6	11.3	61	128
95-47-6	o-Xylene	31776	100	7.2	78	122
99-87-6	p-Isopropyltoluene [p-Cymene]	24335	102	8.5	77	127
76-01-7	Pentachloroethane	11688	101.1	10.7	69	133
109-66-0	Pentane	3915	74.8	19.7	16	134
107-12-0	Propionitrile [Ethyl cyanide]	15701	99.9	12	64	136
135-98-8	sec-Butylbenzene	24191	101.1	8.1	77	126
100-42-5	Styrene	26985	100.5	7.6	78	123
994-05-8	tert-Amyl methyl ether [TAME]	19726	98.1	10.1	68	128
75-65-0	tert-Butyl alcohol	21112	98.6	10.1	68	129
762-75-4	tert-Butyl formate	6651	98.1	11.1	65	132
98-06-6	tert-Butylbenzene	23919	101	7.7	78	124
127-18-4	Tetrachloroethene	29017	101.3	9.3	74	129
109-99-9	Tetrahydrofuran	18021	95	12.8	57	133
108-88-3	Toluene	33510	100.1	6.8	80	121
2037-26-5	Toluene-d8	9809	100.4	3.8	89	112
156-60-5	trans-1,2-Dichloroethene	27663	99.5	8.2	75	124
10061-02-6	trans-1,3-Dichloropropene	27134	100	8.9	73	127
110-57-6	trans-1,4-Dichloro-2-butene	19320	91.5	16.1	43	140
79-01-6	Trichloroethene	30150	101.1	7.3	79	123
75-69-4	Trichlorofluoromethane	26108	103	12.8	65	141

Table 24. Method 8260 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
	[Freon-11]					
108-05-4	Vinyl acetate	18941	100.2	15.3	54	146
75-01-4	Vinyl chloride	29472	97.4	13.2	58	137
1330-20-7	Xylenes [total]	23426	100.1	7	79	121

Table 25. Method 8270 Solid Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
92-52-4	1,1-Biphenyl	1645	78.5	13	40	117
95-94-3	1,2,4,5-Tetrachlorobenzene	1810	77.8	13.7	37	119
120-82-1	1,2,4-Trichlorobenzene	3577	75.7	13.9	34	118
95-50-1	1,2-Dichlorobenzene	3352	74.6	14	33	117
528-29-0	1,2-Dinitrobenzene [1,2-DNB]	203	79.4	11.9	44	115
122-66-7	1,2-Diphenylhydrazine [Azobenzene]	2039	83	13.9	41	125
99-35-4	1,3,5-Trinitrobenzene [1,3,5-TNB]	154	89.2	10.7	57	121
541-73-1	1,3-Dichlorobenzene	3288	72.6	14.1	30	115
99-65-0	1,3-Dinitrobenzene [1,3-DNB]	598	84.6	14	43	127
106-46-7	1,4-Dichlorobenzene	3793	73.1	13.9	31	115
100-25-4	1,4-Dinitrobenzene	248	84.4	15.7	37	132
130-15-4	1,4-Naphthoquinone	150	81.2	8.8	55	108
90-13-1	1-Chloronaphthalene	119	81.1	11.1	48	115
90-12-0	1-Methylnaphthalene	3004	79.2	13.2	40	119
58-90-2	2,3,4,6-Tetrachlorophenol	1724	84.7	13.6	44	125
935-95-5	2,3,5,6-Tetrachlorophenol	227	75.9	11.9	40	112

Table 25. Method 8270 Solid Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
608-27-5	2,3-Dichloroaniline	108	82.4	13	44	121
95-95-4	2,4,5-Trichlorophenol	4014	82.6	13.7	41	124
118-79-6	2,4,6-Tribromophenol	2930	85.7	15.4	39	132
88-06-2	2,4,6-Trichlorophenol	4183	82.1	14.5	39	126
120-83-2	2,4-Dichlorophenol	3794	80.9	13.7	40	122
105-67-9	2,4-Dimethylphenol	3886	78.4	16.2	30	127
121-14-2	2,4-Dinitrotoluene	4075	86.8	12.9	48	126
87-65-0	2,6-Dichlorophenol	1364	79.2	12.6	41	117
606-20-2	2,6-Dinitrotoluene	3706	85	13	46	124
53-96-3	2-Acetylaminofluorene	175	94	13.3	54	134
91-58-7	2-Chloronaphthalene	3569	77.5	12.1	41	114
95-57-8	2-Chlorophenol	3977	77.3	14.5	34	121
321-60-8	2-Fluorobiphenyl	3191	79.5	11.8	44	115
367-12-4	2-Fluorophenol	3008	75.2	13.3	35	115
91-57-6	2-Methylnaphthalene	5059	80.1	14	38	122
95-48-7	2-Methylphenol (o-Cresol)	4016	77	14.9	32	122
88-74-4	2-Nitroaniline	3639	85.4	13.8	44	127
119-75-5	2-Nitrodiphenylamine	279	88.1	11.6	53	123
88-75-5	2-Nitrophenol	3804	79.6	14.5	36	123
109-06-8	2-Picoline [2-Methylpyridine]	181	64.5	12.7	27	103
91-94-1	3,3'-Dichlorobenzidine	3521	71.3	16.5	22	121
56-49-5	3-Methylcholanthrene	188	95.1	13	56	134
99-09-2	3-Nitroaniline	3454	75.9	14.3	33	119
65794-96-9	3/4-Methylphenol [m/p-Cresol]	2900	76.5	14.1	34	119
534-52-1	4,6-Dinitro-2-methylphenol	3739	80.7	17.2	29	132
101-55-3	4-Bromophenyl phenyl ether	3708	85.1	13	46	124

Table 25. Method 8270 Solid Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
59-50-7	4-Chloro-3-methylphenol	3880	83.3	12.9	45	122
106-47-8	4-Chloroaniline [p-Chloroaniline]	3435	61.3	14.9	17	106
7005-72-3	4-Chlorophenyl phenyl ether	3673	83	12.7	45	121
106-44-5	4-Methylphenol [p-Cresol]	1555	84.1	14.1	42	126
100-02-7	4-Nitrophenol	3976	80.6	17	30	132
99-55-8	5-Nitro-o-toluidine [2-Amino-4-nitrotoluene]	187	69.8	15.8	23	117
57-97-6	7,12-Dimethylbenz(a)-anthracene	338	96.2	15.3	50	142
83-32-9	Acenaphthene	5300	81.3	13.7	40	123
208-96-8	Acenaphthylene	5194	81.8	16.8	32	132
98-86-2	Acetophenone	2101	73.9	13.6	33	115
120-12-7	Anthracene	5250	85.2	12.7	47	123
1912-24-9	Atrazine	1428	87.1	13.4	47	127
103-33-3	Azobenzene	378	82.1	14.2	39	125
56-55-3	Benz(a)anthracene	5385	87.4	12.9	49	126
50-32-8	Benzo(a)pyrene	5500	86.9	13.9	45	129
205-99-2	Benzo(b)fluoranthene	5323	88.3	14.5	45	132
191-24-2	Benzo(g,h,i)perylene	5263	88.5	15.1	43	134
207-08-9	Benzo(k)fluoranthene	5386	89.6	14.2	47	132
100-51-6	Benzyl alcohol	2895	75.7	15.6	29	122
111-91-1	bis(2-Chloroethoxy)methane	3705	78.4	14.2	36	121
111-44-4	Bis(2-chloroethyl) ether	3711	75.4	14.9	31	120
39638-32-9	bis(2-Chloroisopropyl) ether	769	82	16.3	33	131
117-81-7	Bis(2-ethylhexyl) phthalate	4018	91.9	13.7	51	133
103-23-1	bis(2-Ethylhexyl)adipate	156	90.8	10.1	61	121
85-68-7	Butyl benzyl phthalate	3956	90.3	14	48	132

Table 25. Method 8270 Solid Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
105-60-2	Caprolactam	1203	81.3	11.9	46	117
86-74-8	Carbazole	3095	86.3	12	50	123
510-15-6	Chlorobenzilate	172	99.7	16.9	49	150
218-01-9	Chrysene	5395	87.1	12.2	50	124
84-74-2	Di-n-butyl phthalate	4041	89.4	12.8	51	128
117-84-0	Di-n-octyl phthalate	3985	92.4	16	45	140
2303-16-4	Diallate [cis or trans]	173	93.7	12.7	56	132
53-70-3	Dibenzo(a,h)anthracene	5393	89.5	14.7	45	134
132-64-9	Dibenzofuran	3749	81.5	12.7	44	120
84-66-2	Diethyl phthalate	4012	87.2	12.3	50	124
60-51-5	Dimethoate	137	68	13.3	28	108
131-11-3	Dimethyl phthalate	4023	85.9	12.6	48	124
60-11-7	Dimethylaminoazobenzene	177	98.7	11.6	64	134
88-85-7	Dinoseb	123	67.3	17.1	16	119
101-84-8	Diphenyl ether	114	95.6	6	78	114
122-39-4	Diphenylamine	854	79.5	10.6	48	111
62-50-0	Ethyl methanesulfonate	174	85.1	16.9	34	136
206-44-0	Fluoranthene	5340	88.3	12.9	50	127
86-73-7	Fluorene	5150	84.2	13.8	43	125
118-74-1	Hexachlorobenzene	4138	83.5	13	45	122
87-68-3	Hexachlorobutadiene	4003	77.3	15.3	32	123
67-72-1	Hexachloroethane	4049	72.2	14.9	28	117
1888-71-7	Hexachloropropene	259	81.9	16.7	32	132
95-13-6	Indene	188	85.3	8.9	59	112
193-39-5	Indeno(1,2,3-cd)pyrene	5367	89.3	14.7	45	133
465-73-6	isodrin	167	93.8	12.8	56	132

Table 25. Method 8270 Solid Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
78-59-1	Isophorone	3787	75.9	15.2	30	122
120-58-1	Isosafrole	174	89.5	15.4	43	136
66-27-3	Methyl methanesulfonate	150	77.9	13.1	38	117
100-75-4	N-Nitrosopiperidine	232	89.4	9.8	60	119
924-16-3	N-Nitrosodi-n-butylamine	236	91.7	10.8	59	124
621-64-7	N-Nitrosodi-n-propylamine	3857	78.2	13.9	36	120
55-18-5	N-nitrosodiethylamine	421	82.1	13.8	41	124
62-75-9	N-Nitrosodimethylamine	3170	71.6	16.2	23	120
86-30-6	N-Nitrosodiphenylamine	2968	82.7	14.8	38	127
10595-95-6	n-Nitrosomethylethylamine	265	78.7	14.9	34	123
59-89-2	n-Nitrosomorpholine	172	91.3	13.8	50	133
930-55-2	n-Nitrosopyrrolidine	326	85.5	13.6	45	126
91-20-3	Naphthalene	5342	78.8	14.7	35	123
98-95-3	Nitrobenzene	4103	77.8	14.7	34	122
4165-60-0	Nitrobenzene-d5	3226	79.3	14.2	37	122
56-57-5	Nitroquinoline-1-oxide	177	91.3	24.5	18	165
126-68-1	O,O,O-Triethyl phosphorothioate	138	91.6	10.8	59	124
593-45-3	Octadecane	113	87.4	14.5	44	131
608-93-5	Pentachlorobenzene	346	89.7	11.8	54	125
76-01-7	Pentachloroethane	131	70.4	10.6	39	102
87-86-5	Pentachlorophenol	4161	78.7	18	25	133
82-68-8	Pentchloronitrobenzene	579	86.1	16	38	134
62-44-2	Phenacetin	185	95	12.5	57	133
85-01-8	Phenanthrene	5259	85.4	12	50	121
108-95-2	Phenol	4029	77.3	14.4	34	121
4165-62-2	Phenol-d5	1016	77.4	14.9	33	122

Table 25. Method 8270 Solid Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
23950-58-5	Pronamide	179	93	12.4	56	130
129-00-0	Pyrene	5518	87.2	13.3	47	127
91-22-5	Quinoline	219	90	11.9	54	126
94-59-7	Safrole	176	87.8	13.6	47	129
1718-51-0	Terphenyl-d14	3111	90.5	12.3	54	127
3689-24-5	Tetraethyl dithiopyrophosphate [Sulfotep]	136	94.4	14	52	137
297-97-2	Thionazine	139	94.6	10.7	62	127

Table 26. Method 8270 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
92-52-4	1,1-Biphenyl	2247	82.1	11.1	49	115
95-94-3	1,2,4,5-Tetrachlorobenzene	2326	77.9	14.5	35	121
120-82-1	1,2,4-Trichlorobenzene	4716	72.6	14.5	29	116
95-50-1	1,2-Dichlorobenzene	4442	71.4	13.3	32	111
528-29-0	1,2-Dinitrobenzene [1,2-DNB]	112	83.9	8.3	59	109
122-66-7	1,2-Diphenylhydrazine [Azobenzene]	2244	85.4	12.2	49	122
99-35-4	1,3,5-Trinitrobenzene [1,3,5-TNB]	241	89.1	16	41	137
541-73-1	1,3-Dichlorobenzene	4375	68.6	13.6	28	110
99-65-0	1,3-Dinitrobenzene [1,3-DNB]	601	88.2	13.1	49	128
106-46-7	1,4-Dichlorobenzene	5433	70.4	13.9	29	112
90-13-1	1-Chloronaphthalene	211	84.5	8.8	58	111
90-12-0	1-Methylnaphthalene	3742	80	13.1	41	119
134-32-7	1-Naphthylamine	258	73.7	16.6	24	124
58-90-2	2,3,4,6-Tetrachlorophenol	2293	89	13	50	128

Table 26. Method 8270 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
935-95-5	2,3,5,6-Tetrachlorophenol	266	85.6	11.7	50	121
608-27-5	2,3-Dichloroaniline	150	99.2	9.8	70	129
95-95-4	2,4,5-Trichlorophenol	5707	88.1	11.8	53	123
118-79-6	2,4,6-Tribromophenol	2059	91.5	16	43	140
88-06-2	2,4,6-Trichlorophenol	6136	87.2	12.4	50	125
120-83-2	2,4-Dichlorophenol	5330	84	12.2	47	121
105-67-9	2,4-Dimethylphenol	5298	77.5	15.6	31	124
51-28-5	2,4-Dinitrophenol	5127	82.9	20	23	143
121-14-2	2,4-Dinitrotoluene	6032	92.3	11.8	57	128
87-65-0	2,6-Dichlorophenol	1583	84	11.4	50	118
606-20-2	2,6-Dinitrotoluene	5107	90.7	11.2	57	124
53-96-3	2-Acetylaminofluorene	228	98.9	12.9	60	138
91-58-7	2-Chloronaphthalene	5084	78	12.8	40	116
95-57-8	2-Chlorophenol	5571	77.5	13.2	38	117
93951-73-6	2-Chlorophenol-d4	119	79.9	8.7	54	106
321-60-8	2-Fluorobiphenyl	2263	81.2	12.4	44	119
367-12-4	2-Fluorophenol	2022	68.8	16.6	19	119
91-57-6	2-Methylnaphthalene	6330	80.7	13.6	40	121
95-48-7	2-Methylphenol (o-Cresol)	5800	73	14.5	30	117
88-74-4	2-Nitroaniline	4855	90.8	12.1	55	127
119-75-5	2-Nitrodiphenylamine	272	97.3	11.3	64	131
88-75-5	2-Nitrophenol	5097	84.6	12.7	47	123
109-06-8	2-Picoline [2-Methylpyridine]	195	71.6	12.6	34	109
91-94-1	3,3'-Dichlorobenzidine	4815	77.9	16.9	27	129
56-49-5	3-Methylcholanthrene	237	94	12.8	56	133

Table 26. Method 8270 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
99-09-2	3-Nitroaniline	4808	84.4	14.5	41	128
65794-96-9	3/4-Methylphenol [m/p-Cresol]	3472	69.7	13.6	29	110
534-52-1	4,6-Dinitro-2-methylphenol	5097	90.1	15.5	44	137
101-55-3	4-Bromophenyl phenyl ether	5074	89.1	11.5	55	124
59-50-7	4-Chloro-3-methylphenol	5338	85.5	11.3	52	119
106-47-8	4-Chloroaniline [p-Chloroaniline]	4687	75.3	14	33	117
7005-72-3	4-Chlorophenyl phenyl ether	5071	86.7	11.3	53	121
106-44-5	4-Methylphenol [p-Cresol]	2798	72.5	15.8	25	120
99-55-8	5-Nitro-o-toluidine [2-amino-4-nitrotoluene]	260	82.1	14.6	38	126
57-97-6	7,12-Dimethylbenz(a)-anthracene	373	97.1	11.9	61	133
83-32-9	Acenaphthene	6952	84.5	12.3	47	122
208-96-8	Acenaphthylene	6662	85.3	14.7	41	130
98-86-2	Acetophenone	2877	82.1	12	46	118
120-12-7	Anthracene	6792	89.6	11	57	123
140-57-8	Aramite	100	82.8	16.3	34	132
1912-24-9	Atrazine	2328	92.8	16.4	44	142
103-33-3	Azobenzene	578	88.5	9.3	61	116
56-55-3	Benz(a)anthracene	6867	91.6	11.1	58	125
50-32-8	Benzo(a)pyrene	7045	90.8	12.4	54	128
205-99-2	Benzo(b)fluoranthene	6767	92	12.9	53	131
191-24-2	Benzo(g,h,i)perylene	6624	92	13.9	50	134
207-08-9	Benzo(k)fluoranthene	6803	93.2	12.1	57	129
100-51-6	Benzyl alcohol	3349	71.2	13.5	31	112
111-91-1	bis(2-Chloroethoxy)methane	5094	83.9	11.9	48	120
111-44-4	Bis(2-chloroethyl) ether	5139	80.8	12.6	43	118

Table 26. Method 8270 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
39638-32-9	bis(2-Chloroisopropyl) ether	1140	83.4	15.4	37	130
117-81-7	Bis(2-ethylhexyl) phthalate	5288	95.2	13.3	55	135
85-68-7	Butyl benzyl phthalate	5173	93.3	13.5	53	134
86-74-8	Carbazole	4187	91.1	10.4	60	122
510-15-6	Chlorobenzilate	226	104.3	15.4	58	150
218-01-9	Chrysene	6779	91.3	10.7	59	123
124-18-5	Decane	126	66.9	12.8	29	105
84-74-2	Di-n-butyl phthalate	5329	93	11.4	59	127
117-84-0	Di-n-octyl phthalate	5222	95.5	15	51	140
2303-16-4	Diallate [cis or trans]	249	95.3	9.6	67	124
226-36-8	Dibenz(a,h)acridine	136	104.4	9.7	75	134
53-70-3	Dibenzo(a,h)anthracene	6840	92.7	13.8	51	134
132-64-9	Dibenzofuran	4963	85.3	10.8	53	118
84-66-2	Diethyl phthalate	5207	90.1	11.5	56	125
131-11-3	Dimethyl phthalate	4977	86	13.7	45	127
60-11-7	Dimethylaminoazobenzene	238	97.1	11.6	62	132
88-85-7	Dinoseb	144	93.4	10.8	61	126
101-84-8	Diphenyl ether	142	91.7	7.8	68	115
122-39-4	Diphenylamine	754	83	9.2	55	111
298-04-4	Disulfoton	122	92.5	12.5	55	130
62-50-0	Ethyl methanesulfonate	215	90.1	9.4	62	118
206-44-0	Fluoranthene	6826	92.6	11.9	57	128
86-73-7	Fluorene	6786	88.1	12	52	124
118-74-1	Hexachlorobenzene	6263	88.7	12.1	53	125
87-68-3	Hexachlorobutadiene	5878	73.1	16.9	22	124

Table 26. Method 8270 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
67-72-1	Hexachloroethane	5904	68	15.7	21	115
95-13-6	Indene	253	93.8	13.7	53	135
193-39-5	Indeno(1,2,3-cd)pyrene	6880	92.6	13.6	52	134
465-73-6	isodrin	212	97.6	10	68	128
78-59-1	Isophorone	5190	83.3	13.7	42	124
120-58-1	Isosafrole	230	91.1	11.8	56	126
66-27-3	Methyl methanesulfonate	237	70.1	12.3	33	107
298-00-0	Methyl parathion	121	101.6	19	45	159
100-75-4	N-Nitrosopiperidine	299	88.6	10.8	56	121
924-16-3	N-Nitrosodi-n-butylamine	322	90.4	10.3	60	121
621-64-7	N-Nitrosodi-n-propylamine	5145	84	11.7	49	119
55-18-5	N-nitrosodiethylamine	488	81.8	12.9	43	121
86-30-6	N-Nitrosodiphenylamine	3743	86.8	11.9	51	123
10595-95-6	n-Nitrosomethylethylamine	311	78.7	12.7	41	117
59-89-2	n-Nitrosomorpholine	214	86.2	10.3	55	117
930-55-2	n-Nitrosopyrrolidine	716	80.8	10.8	48	113
91-20-3	Naphthalene	6953	80	13.5	40	121
98-95-3	Nitrobenzene	5955	83	12.8	45	121
4165-60-0	Nitrobenzene-d5	2223	82.1	12.6	44	120
126-68-1	O,O,O-Triethyl phosphorothioate	212	92.6	8.8	66	119
95-53-4	o-Toluidine	296	69.9	13.2	30	110
593-45-3	Octadecane	151	89	13.1	50	128
56-38-2	Parathion	152	102.6	12.3	66	140
608-93-5	Pentachlorobenzene	401	91.1	10.7	59	123
76-01-7	Pentachloroethane	139	60.9	10.4	30	92

Table 26. Method 8270 Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
87-86-5	Pentachlorophenol	6083	86.4	17.1	35	138
82-68-8	Pentachloronitrobenzene	618	94.5	13.4	54	135
62-44-2	Phenacetin	241	97.9	8.9	71	124
85-01-8	Phenanthrene	6822	89.6	10.2	59	120
298-02-2	Phorate	126	88.6	16.8	38	139
23950-58-5	Pronamide	249	97	10.5	65	129
129-00-0	Pyrene	7013	91.1	11.5	57	126
91-22-5	Quinoline	249	100.1	10.5	69	132
94-59-7	Safrole	233	90	9.7	61	119
1718-51-0	Terphenyl-d14	1893	91.7	13.9	50	134
3689-24-5	Tetraethyl dithiopyrophosphate [Sulfotep]	200	96.7	11.9	61	133
297-97-2	Thionazine	196	102	10.1	72	132

Table 27. Method 8270 SIM Solid Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
90-12-0	1-Methylnaphthalene	2267	76.6	11.3	43	111
95-95-4	2,4,5-Trichlorophenol	169	79.9	14.9	35	125
91-58-7	2-Chloronaphthalene	615	76.7	10.5	45	108
321-60-8	2-Fluorobiphenyl	1961	80.6	11.6	46	115
91-57-6	2-Methylnaphthalene	2535	76.8	12.5	39	114
83-32-9	Acenaphthene	2813	77.7	11.2	44	111
208-96-8	Acenaphthylene	2761	77.1	12.8	39	116
120-12-7	Anthracene	2812	82.1	10.7	50	114
56-55-3	Benz(a)anthracene	2827	88	11.4	54	122

Table 27. Method 8270 SIM Solid Matrix

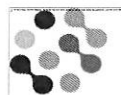
CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
50-32-8	Benzo(a)pyrene	2789	87.3	12.5	50	125
205-99-2	Benzo(b)fluoranthene	2790	90.3	12.6	53	128
191-24-2	Benzo(g,h,i)perylene	2739	87.8	13	49	127
207-08-9	Benzo(k)fluoranthene	2761	89.3	11.2	56	123
111-44-4	Bis(2-chloroethyl) ether	192	65.4	15.8	18	113
117-81-7	Bis(2-ethylhexyl) phthalate	181	108.9	13.9	67	150
85-68-7	Butyl benzyl phthalate	144	103.5	10.6	72	135
86-74-8	Carbazole	183	79.3	14.6	36	123
218-01-9	Chrysene	2812	87.5	10.2	57	118
84-74-2	Di-n-butyl phthalate	150	106.5	12.9	68	145
117-84-0	Di-n-octyl phthalate	144	105.5	16.8	55	156
53-70-3	Dibenzo(a,h)anthracene	2778	89.2	13.2	50	129
132-64-9	Dibenzofuran	282	71.9	12.2	35	108
84-66-2	Diethyl phthalate	147	99.3	10.9	67	132
131-11-3	Dimethyl phthalate	149	99.3	9.3	71	127
206-44-0	Fluoranthene	2782	87.3	10.7	55	119
86-73-7	Fluorene	2795	80.6	11.2	47	114
118-74-1	Hexachlorobenzene	201	81.9	14.2	39	125
193-39-5	Indeno(1,2,3-cd)pyrene	2812	89.6	13.5	49	130
62-75-9	N-Nitrosodimethylamine	117	90.7	10.9	58	124
91-20-3	Naphthalene	2823	74.7	12.2	38	111
4165-60-0	Nitrobenzene-d5	531	84.7	13.6	44	125
87-86-5	Pentachlorophenol	259	82.4	15.5	36	129
85-01-8	Phenanthrene	2792	80.8	10.6	49	113
129-00-0	Pyrene	2792	85.8	10.2	55	117
1718-51-0	Terphenyl-d14	1864	95.3	12.6	58	133

Table 28. Method 8270 SIM Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
92-52-4	1,1-Biphenyl	106	77.3	7.3	56	99
90-12-0	1-Methylnaphthalene	2566	77.9	12.5	41	115
95-95-4	2,4,5-Trichlorophenol	488	84.1	13.4	44	124
118-79-6	2,4,6-Tribromophenol	164	83.7	12.7	46	122
606-20-2	2,6-Dinitrotoluene	118	67.2	15.8	20	115
91-58-7	2-Chloronaphthalene	717	72.4	12.7	34	111
321-60-8	2-Fluorobiphenyl	747	79.2	8.8	53	106
91-57-6	2-Methylnaphthalene	2984	76.5	12.6	39	114
83-32-9	Acenaphthene	3241	80.9	11.1	48	114
208-96-8	Acenaphthylene	3234	77.8	14.4	35	121
120-12-7	Anthracene	3224	85.8	11	53	119
56-55-3	Benz(a)anthracene	3277	89.3	10.1	59	120
50-32-8	Benzo(a)pyrene	3284	86.4	11.2	53	120
205-99-2	Benzo(b)fluoranthene	3248	89.7	12.3	53	126
191-24-2	Benzo(g,h,i)perylene	3178	86	14.1	44	128
207-08-9	Benzo(k)fluoranthene	3167	89.3	11.9	54	125
111-44-4	Bis(2-chloroethyl) ether	775	77.8	12.6	40	116
117-81-7	Bis(2-ethylhexyl) phthalate	275	114.1	19.6	55	173
85-68-7	Butyl benzyl phthalate	159	90.7	17.3	39	143
86-74-8	Carbazole	631	84	13.1	45	123
218-01-9	Chrysene	3215	88.3	10.4	57	120
84-74-2	Di-n-butyl phthalate	153	102.5	14.2	60	145
117-84-0	Di-n-octyl phthalate	157	103.3	19	46	160
53-70-3	Dibenzo(a,h)anthracene	3233	87.2	14.5	44	131
132-64-9	Dibenzofuran	864	77.5	14.1	35	120

Table 28. Method 8270 SIM Water Matrix

CAS ID	Analyte	N Records	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
84-66-2	Diethyl phthalate	142	94.5	13.5	54	135
206-44-0	Fluoranthene	3242	89.1	10.4	58	120
86-73-7	Fluorene	3232	84.1	11.3	50	118
118-74-1	Hexachlorobenzene	947	84.8	13	46	124
87-68-3	Hexachlorobutadiene	187	84.5	14.7	40	129
193-39-5	Indeno(1,2,3-cd)pyrene	3244	88.7	13.7	48	130
62-75-9	N-Nitrosodimethylamine	162	62.5	10	33	92
91-20-3	Naphthalene	3277	78.8	11.9	43	114
4165-60-0	Nitrobenzene-d5	444	83.1	9.2	55	111
87-86-5	Pentachlorophenol	808	88.4	17.6	36	141
85-01-8	Phenanthrene	3240	83.6	10.3	53	115
129-00-0	Pyrene	3252	87.1	11.3	53	121
1718-51-0	Terphenyl-d14	642	95.1	12.4	58	132



eurofins

Lancaster Laboratories
Environmental

EDB by 8011 Water

<u>Compound</u>	<u>MS/MSD Windows</u>	<u>LCS/LCSD Windows</u>
Ethylene dibromide	60-140	60-140
Surrogate: 1,1,2,2-Tetrachloroethane		46 - 136

EDB by 8011 Soil

<u>Compound</u>	<u>MS/MSD Windows</u>	<u>LCS/LCSD Windows</u>
Ethylene dibromide	60-140	60-140
Surrogate: 1,1,2,2-Tetrachloroethane		60-140

QC Windows are evaluated periodically and subject to change.

Nitrate/Nitrite EPA 353.2

<u>Parameter</u>	<u>MS/MSD Windows</u>	<u>LCS/LCSD Windows</u>
Nitrate	90-110	90-110
Nitrite	90-110	90-110

Ammonia SM 4500 NH3 B/C

<u>Parameter</u>	<u>MS/MSD Windows</u>	<u>LCS/LCSD Windows</u>
Ammonia	85-105	85-105

Sulfide SM 4500 S2F

<u>Parameter</u>	<u>MS/MSD Windows</u>	<u>LCS/LCSD Windows</u>
Sulfide	80-120	80-120

Alkalinity, Carb and BiCarb SM 2320B

<u>Parameter</u>	<u>MS/MSD Windows</u>	<u>LCS/LCSD Windows</u>
Alkalinity	90-110	90-110
Bicarbonate	NA	NA
Carbonate	NA	NA
Caborate and Bicarbonate are calculations		

pH

<u>Parameter</u>	<u>MS/MSD Windows</u>	<u>LCS/LCSD Windows</u>
pH 9040C	75-125	75-125
pH 9045D	75-125	75-125

Flashpoint and Ignitability do not use MS/MSD and LCS/LCSD

Reactivity SW-846 Ch 7.3

<u>Parameter</u>	<u>MS/MSD Windows</u>	<u>LCS/LCSD Windows</u>
Total Reactivity	75-125	75-125
Sulfide Reactivity	68-102	68-102
Cyanide Reactivity	0-44	77-113

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ATTACHMENT 1 – EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL, LLC

Table 1-3: Analytical Method Quality Control

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Attachment 1, Table 1-3a
Analytical Method Quality Control and Corrective Action – Volatile Organics in Soil and Groundwater

Matrix	Soil/Groundwater					
Analytical Group	Volatiles					
Concentration Level	Low					
Sampling SOP						
Analytical Method/ SOP Reference	SW-846 8260 21-2					
Sampler's Name						
Field Sampling Organization						
Analytical Organization	ELLE					
No. of Sample Locations						
QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Surrogate Spike (organics)	Per sample (including MS/MSD, LCS, and Blanks)	2-21/QSM 5.0	Reanalyze if outside limits, if confirmed, report	ELLE Analyst	Precision	% recovery within acceptance limits
Method blanks	1 per 20 samples	Undetected for each constituent	Reanalyze to confirm detections	ELLE Analyst	Representativeness	Undetected results
MS/MSD	1 per 20 samples	2-21/QSM 5.0	Evaluation in conjunction with LCS results	ELLE Analyst	Accuracy/Bias	RPD <20
LCS	1 per 20 samples	2-21/QSM 5.0	Reanalyze LCS and associated samples. Analytes in the LCS that fail high and are ND in the samples can be reported	ELLE Analyst	Accuracy/Bias	RPD <20
Internal standards	Per sample (including MS/MSD, LCS, and blanks)	-50% to + 100% of internal standard area of 12 hour standard retention time change ≤30 seconds	Reanalyze, document if confirmed	ELLE Analyst	Precision	Results within acceptance limits

Attachment 1, Table 1-3a
Analytical Method Quality Control and Corrective Action – Volatile Organics in Soil and Groundwater

Matrix	Groundwater					
Analytical Group	Volatiles					
Concentration Level	Low					
Sampling SOP						
Analytical Method/ SOP Reference	SW-846 8260 21-1					
Sampler's Name						
Field Sampling Organization						
Analytical Organization	ELLE					
No. of Sample Locations						
QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Surrogate Spike (organics)	Per sample (including MS/MSD, LCS, and blanks)	1-21/QSM 5.0	Reanalyze, if confirmed, report	ELLE Analyst	Accuracy/Bias	Results within acceptance limits
MS/MSD	1 per 20 samples	1-21/QSM 5.0	Evaluation with LCS	ELLE Analyst	Accuracy/Bias	RPD \leq 20
LCS	1 per 20 samples	1-21/QSM 5.0	Reanalyze LCS and associated samples. Analytes in the LCS that fail high and are ND in the samples can be reported	ELLE Analyst	Accuracy/Bias	Results within acceptance limits
Blanks	1 per 20 samples or 1 per 12 hours	Undetected results	Reanalyze blanks and associated samples	ELLE Analyst	Representativeness	Undetected results

Attachment 1, Table 1-3a
Analytical Method Quality Control and Corrective Action – Volatile Organics in Soil and Groundwater

Matrix	Groundwater					
Analytical Group	Volatiles					
Concentration Level	Low					
Sampling SOP						
Analytical Method/ SOP Reference	SW-846 8260 21-1					
Sampler's Name						
Field Sampling Organization						
Analytical Organization	ELLE					
No. of Sample Locations						
QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Internal standards	Per sample (including MS/MSD, LCS, and blanks)	-50% to +100% of internal standard area of 12-hour standard retention time change ≤30 seconds	Reanalyze samples	ELLE Analyst	Precision	Results within acceptance limits

ELLE = Eurofins Lancaster Laboratories Environmental, LLC

LCS = laboratory control sample

MS = matrix spike

MSD = matrix spike duplicate

ND = non-detect

QC = quality control

QSM = Quality Systems Manual

RPD = relative percent difference

SOP = standard operating procedure

Attachment 1, Table 1-3b
Analytical Method Quality Control and Corrective Action – Semivolatile Organics in Soil and Groundwater

Matrix	Soil/Groundwater					
Analytical Group	GC/MS Semivolatiles					
Concentration Level						
Sampling SOP						
Analytical Method/ SOP Reference	SW-846 8270/26-3					
Sampler's Name						
Field Sampling Organization						
Analytical Organization	ELLE					
No. of Sample Locations						
QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Surrogate Spike (organics)	Per sample (including MS/MSD, LCS, and blanks)	Nitrobenzene-d5 37-122% 2-FBP 44-115% Terphenyl-d14 54-127% Phenol-d6 33-122% 2-FP 35-115% 2,4,6-TBP 39-132%	Reanalyze if outside limits; if confirmed, report.	ELLE Analyst	Precision	% recovery within acceptance limits
MS/MSD	1 per 20 samples	26-3	Evaluation in conjunction with LCS results	ELLE Analyst	Accuracy/Bias	RPD <20
LCS	1 per 20 samples	26-3; All % recoveries must fall within QSM 5.0 specified limits	Reanalyze LCS and associated samples. Analytes in the LCS that fail high and ND in the samples can be reported.	ELLE Analyst	Accuracy/Bias	RPD >20
Method blanks	1 per 20 samples	Undetected for each constituent	Reanalyze to confirm detections	ELLE Analyst	Representativeness	Undetected results
Internal Standards	Per sample (including MS/MSD, LCS, and blanks)	-50% to +100% of internal standard area of 12-hour standard retention time change ≤30 seconds.	Reanalyze, document if confirmed	ELLE Analyst	Precision	Results within acceptance limits

Attachment 1, Table 1-3b
Analytical Method Quality Control and Corrective Action – Semivolatile Organics in Soil

2-FBP = 2-fluorobiphenyl
2-FP = 2-fluorophenol
2,4,6-TBP = 2,4,6-tribromophenol
ELLE = Eurofins Lancaster Laboratories Environmental, LLC
GC/MS = gas chromatograph/mass spectrometer
LCS = laboratory control sample
MS = matrix spike
MSD = matrix spike duplicate
ND = non-detect
QC = quality control
QSM = Quality Systems Manual
RPD = relative percent difference
SOP = standard operating procedure

Attachment 1, Table 1-3c
Analytical Method Quality Control and Corrective Action – Ethylene Dibromide in Soil and Groundwater

Matrix	Soil/Groundwater					
Analytical Group	EDB 8011					
Concentration Level	low					
Sampling SOP						
Analytical Method/ SOP Reference	8011/24-27, 24-28					
Sampler's Name						
Field Sampling Organization						
Analytical Organization	ELLE					
No. of Sample Locations						
QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Surrogate Spike (organics)	Per sample (including MS/MSD, LCS, and Blanks)	1,1,2,2-Tetrachlorethane 60-140%	Reanalyze if outside limits, if confirmed, report	ELLE Analyst	Precision	% recovery within acceptance limits
Method blanks	1 per 20 samples	Undetected for each constituent	Reanalyze to confirm detections	ELLE Analyst	Representativeness	Undetected results
MS/MSD	1 per 20 samples	60-140%	Evaluation in conjunction with LCS results	ELLE Analyst	Accuracy/Bias	RPD <20

Attachment 1, Table 1-3c
Analytical Method Quality Control and Corrective Action – Ethylene Dibromide in Soil and Groundwater

Matrix	Soil					
Analytical Group	EDB 8011					
Concentration Level	low					
Sampling SOP						
Analytical Method/ SOP Reference	8011/24-27, 24-28					
Sampler's Name						
Field Sampling Organization						
Analytical Organization	ELLE					
No. of Sample Locations						
QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
LCS	1 per 20 samples	60-140%	Reanalyze LCS and associated samples. Analytes in the LCS that fail high and are ND in the samples can be reported.	ELLE Analyst	Accuracy/Bias	RPD <20

Attachment 1, Table 1-3c
Analytical Method Quality Control and Corrective Action – Ethylene Dibromide in Soil and Groundwater

Matrix	Groundwater					
Analytical Group	EDB 8011					
Concentration Level	Low					
Sampling SOP						
Analytical Method/ SOP Reference	8011/24-26, 24-29					
Sampler's Name						
Field Sampling Organization						
Analytical Organization	ELLE					
No. of Sample Locations						
QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Surrogate Spike (organics)	Per sample (including MS/MSD, LCS, and blanks)	1,1,2,2-Tetrachloroethane 46-136%	Reanalyze, if confirmed, report.	ELLE Analyst	Accuracy/Bias	Results within acceptance limits
MS/MSD	1 per 20 samples	60-140%	Evaluation with LCS	ELLE Analyst	Accuracy/Bias	RPD <20

Attachment 1, Table 1-3c
Analytical Method Quality Control and Corrective Action – Ethylene Dibromide in Soil and Groundwater

Matrix	Groundwater					
Analytical Group	EDB 8011					
Concentration Level	Low					
Sampling SOP						
Analytical Method/SOP Reference	8011/24-26, 24-29					
Sampler's Name						
Field Sampling Organization						
Analytical Organization	ELLE					
No. of Sample Locations						
QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
LCS	1 per 20 samples	60-140%	Reanalyze LCS and associated samples. Analytes in the LCS that fail high and are ND in the samples can be reported.	ELLE Analyst	Accuracy/Bias	RPD <20
Blanks	1 per 20 samples or 1 per 12 hours	Undetected results	Reanalyze blanks and associated samples	ELLE Analyst	Representativeness	Undetected results

EDB = ethylene dibromide

ELLE = Eurofins Lancaster Laboratories Environmental, LLC

LCS = laboratory control sample

MS = matrix spike

MSD = matrix spike duplicate

ND = non-detect

QC = quality control

RPD = relative percent difference

SOP = standard operating procedure

Attachment 1, Table 1-3d
Analytical Method Quality Control and Corrective Action – Total Petroleum Hydrocarbons in Soil and Groundwater

Matrix	Soil/Groundwater					
Analytical Group	Diesel Range Organics					
Concentration Level	low					
Sampling SOP						
Analytical Method/SOP Reference	SW-846 8015C/D 32-8					
Sampler's Name						
Field Sampling Organization						
Analytical Organization	ELLE					
No. of Sample Locations						
QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Surrogate Spike (organics)	Per Sample(including Blanks, LCS/LCSD, MS/MSD)	o-Terphenyl: 45-130%	Reanalyze if outside limits, if confirmed, report	ELLE Analyst	Precision	% recovery within acceptance limits
Method Blanks	1 per 20 samples	Undetected for each constituent	Reanalyze to confirm detections	ELLE Analyst	Representativeness	Undetected results
MS/MSD	1 per 20 samples	Per QSM 5.0	Evaluation in conjunction with LCS results	ELLE Analyst	Accuracy/Bias	RPD <20
LCS/LCSD	1 per 20 samples	Per QSM 5.0	Reanalyze LCS and associated samples. Analytes in the LCS that fail high and are ND in the samples can be reported.	ELLE Analyst	Accuracy/Bias	RPD <20

Attachment 1, Table 1-3d
Analytical Method Quality Control and Corrective Action – Total Petroleum Hydrocarbons in Soil

Matrix	Soil					
Analytical Group	Gasoline Range Organics					
Concentration Level	High					
Sampling SOP						
Analytical Method/SOP Reference	SW-846 8015B/C/D 32-11					
Sampler's Name						
Field Sampling Organization						
Analytical Organization	ELLE					
No. of Sample Locations						
QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Surrogate Spike (organics)	Per Sample(including Blanks, LCS/LCSD, MS/MSD)	Trifluorotoluene-F 50-142	Reanalyze if outside limits, if confirmed, report	ELLE Analyst	Precision	% recovery within acceptance limits
Method Blanks	1 per 20 samples	Undetected for each constituent	Reanalyze to confirm detections	ELLE Analyst	Representativeness	Undetected results
MS/MSD	1 per 20 samples	Per QSM 5.0	Evaluation in conjunction with LCS results	ELLE Analyst	Accuracy/Bias	RPD <30%
LCS/LCSD	1 per 20 samples	Per QSM 5.0	Reanalyze LCS and associated samples. Analytes in the LCS that fail high and are ND in the samples can be reported.	ELLE Analyst	Accuracy/Bias	RPD <30%

Attachment 1, Table 1-3d
Analytical Method Quality Control and Corrective Action – Total Petroleum Hydrocarbons in Soil

ELLE	Eurofins Lancaster Laboratories Environmental, LLC
LCS	Laboratory control sample
LCSD	laboratory control sample duplicate
MS	matrix spike
MSD	matrix spike duplicate
ND	non-detect
QC	quality control
QSM	Quality Systems Manual
RPD	relative percent difference
SOP	standard operating procedure

Attachment 1, Table 1-3e
Analytical Method Quality Control and Corrective Action – Organochlorine Pesticides and Chlorinated Herbicides in Soil and Groundwater

Matrix	Soil/Groundwater					
Analytical Group	Organochlorine Pesticides					
Concentration Level	low					
Sampling SOP						
Analytical Method/ SOP Reference	8081A, 8081B/ 24-3, 24-4					
Sampler's Name						
Field Sampling Organization						
Analytical Organization	ELLE					
No. of Sample Locations						
QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Surrogate Spike (organics)	Per sample (including MS/MSD, LCS, and Blanks)	Decachlorobiphenyl 54-143% Tetrachlorometaxylene 42-129%	Reanalyze if outside limits, if confirmed, report	ELLE Analyst	Precision	% recovery within acceptance limits
Method blanks	1 per 20 samples	Undetected for each constituent	Reanalyze to confirm detections	ELLE Analyst	Representativeness	Undetected results
MS/MSD	1 per 20 samples	Per QSM 5.0	Evaluation in conjunction with LCS results	ELLE Analyst	Accuracy/Bias	RPD <30

Attachment 1, Table 1-3e

Analytical Method Quality Control and Corrective Action – Organochlorine Pesticides and Chlorinated Herbicides in Soil

Matrix	Soil					
Analytical Group	Organochlorine Pesticides					
Concentration Level	low					
Sampling SOP						
Analytical Method/ SOP Reference	8081A, 8081B/ 24-3, 24-4					
Sampler's Name						
Field Sampling Organization						
Analytical Organization	ELLE					
No. of Sample Locations						
QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
LCS	1 per 20 samples	Per QSM 5.0	Reanalyze LCS and associated samples. Analytes in the LCS that fail high and are ND in the samples can be reported.	ELLE Analyst	Accuracy/Bias	RPD <30

Attachment 1, Table 1-3e
Analytical Method Quality Control and Corrective Action – Organochlorine Pesticides and Chlorinated Herbicides in Soil

Matrix	Soil					
Analytical Group	Herbicides					
Concentration Level	low					
Sampling SOP						
Analytical Method/ SOP Reference	8151A 24-18					
Sampler's Name						
Field Sampling Organization						
Analytical Organization	ELLE					
No. of Sample Locations						
QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Surrogate Spike (organics)	Per sample (including MS/MSD, LCS, and Blanks)	2,4-dichlorophenylacetic acid 27-122%	Reanalyze if outside limits, if confirmed, report	ELLE Analyst	Precision	% recovery within acceptance limits
Method blanks	1 per 20 samples	Undetected for each constituent	Reanalyze to confirm detections	ELLE Analyst	Representativeness	Undetected results
MS/MSD	1 per 20 samples	Per QSM 5.0	Evaluation in conjunction with LCS results	ELLE Analyst	Accuracy/Bias	RPD <30
LCS	1 per 20 samples	Per QSM 5.0	Reanalyze LCS and associated samples. Analytes in the LCS that fail high and are ND in the samples can be reported.	ELLE Analyst	Accuracy/Bias	RPD <30

Attachment 1, Table 1-3e

Analytical Method Quality Control and Corrective Action – Organochlorine Pesticides and Chlorinated Herbicides in Soil

ELLE = Eurofins Lancaster Laboratories Environmental, LLC
LCS = laboratory control sample
MS = matrix spike
MSD = matrix spike duplicate
ND = non-detect
QC = quality control
QSM = Quality Systems Manual
RPD = relative percent difference
SOP = standard operating procedure

Attachment 1, Table 1-3f
Analytical Method Quality Control and Corrective Action – Metals and Mercury in Soil and Groundwater

Matrix	Soil/Groundwater					
Analytical Group	Metals					
Concentration Level	Low					
Sampling SOP						
Analytical Method/ SOP Reference	SW-846 6010C/1-22 (7471B for Hg/2-22)					
Sampler's Name						
Field Sampling Organization						
Analytical Organization	ELLE					
No. of Sample Locations						
QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
MS	1 per 20	Recovery limits as specified in QSM 5.0	Analyze post digestion spike sample for SW-846 6010C	ELLE Analyst	Accuracy Bias	Results within acceptance limits
MSD (RPD)	1 per 20	Recovery limits as specified in QSM 5.0 RPD must be <20%	Flag data	ELLE Analyst	Accuracy Bias	Results within acceptance limits, RPD <20%
Duplicate (RPD)	1 per 20	RPD must be <20%	Flag data	ELLE Analyst	Precision	Results within acceptance limits
Initial Calibration Blank	Must be analyzed immediately following the ICV	Must be <3x the IDL, CVAA < LOQ	Correct problem, recalibrate, rerun	ELLE Analyst	Contamination	The result must be within \pm the RL
Continuing Calibration Blank	Must be analyzed immediately following the CCV, at a frequency of every 10 samples	Must be < 3x the IDL, CVAA < LOQ	Correct problem, recalibrate, rerun	ELLE Analyst	Contamination	The result must be within \pm the RL

Attachment 1, Table 1-3f
Analytical Method Quality Control and Corrective Action – Metals and Mercury in Soil and Groundwater

Matrix	Soil					
Analytical Group	Metals					
Concentration Level	Low					
Sampling SOP						
Analytical Method/ SOP Reference	SW-846 6010C/1-22 (7471B for Hg/2-22)					
Sampler's Name						
Field Sampling Organization						
Analytical Organization	ELLE					
No. of Sample Locations						
QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per 20	< ½ RL	Re-digest all associated samples	ELLE Analyst	Contamination	The result must be within ± the RL
Serial Dilutions (excluding mercury)	Must be prepared with each background sample, evaluated only when analyte concentrations are >50x the MDL	The percent difference must be <10%	Flag data	ELLE Analyst	Precision	The result must be within ± the RL
Interference Check Sample (excluding mercury)	At the beginning and end of each run immediately following the LLC	± 20% of the true value for each analyte	Recalibrate	ELLE Analyst	Representativeness	Results within acceptance criteria
Laboratory Control Sample	1 per 20	Recovery limits as specified in QSM 5.0 Elements in the LCS that fail high and are ND in the samples can be reported.	Re-digest and reanalyze LCS and associated samples	ELLE Analyst	Accuracy/Bias	Results within acceptance criteria
Post-Digestion Spike	Prepare with each background sample	± 25% of true value	Reported in data package	ELLE Analyst	Accuracy/Bias	Results within acceptance criteria

Attachment 1, Table 1-3f
Analytical Method Quality Control and Corrective Action – Metals and Mercury in Soil and Groundwater

Matrix	Water					
Analytical Group	Metals					
Concentration Level	Low					
Sampling SOP						
Analytical Method/ SOP Reference	SW-846 6010C/1-22 (7470B for Hg/2-22)					
Sampler's Name						
Field Sampling Organization						
Analytical Organization	ELLE					
No. of Sample Locations						
QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
MS	1 per 20	Recovery limits as specified in QSM 5.0	Analyze post digestion spike and Serial Dilution sample for SW-846 6010C	ELLE Analyst	Accuracy Bias	Results within acceptance limits
MSD (RPD)	1 per 20	Recovery limits as specified in QSM 5.0, RPD must be <20%	Analyze post digestion spike and Serial Dilution sample for SW-846 6010C	ELLE Analyst	Accuracy Bias	Results within acceptance limits, RPD <20%
Duplicate (RPD)	1 per 20	RPD must be <20%	Flag data	ELLE Analyst	Precision	Results within acceptance limits
Initial Calibration Blank	Must be analyzed immediately following the ICV	Must be <3x the IDL, CVAA <LOQ	Correct problem, recalibrate, rerun	ELLE Analyst	Contamination	The result must be within \pm the RL
Continuing Calibration Blank	Must be analyzed immediately following the CCV, at a frequency of every 10 samples	Must be <3x the IDL, CVAA <LOQ	Correct problem, recalibrate, rerun	ELLE Analyst	Contamination	The result must be within \pm the RL
Preparation Blank	1 per 20	< ½ RL	Re-digest all associated samples	ELLE Analyst	Contamination	The result must be within \pm the RL

Attachment 1, Table 1-3f
Analytical Method Quality Control and Corrective Action – Metals and Mercury in Soil and Groundwater

Matrix	Water					
Analytical Group	Metals					
Concentration Level	Low					
Sampling SOP						
Analytical Method/SOP Reference	SW-846 6010C/1-22 (7470A for Hg/2-22)					
Sampler's Name						
Field Sampling Organization						
Analytical Organization	ELLE					
No. of Sample Locations						
QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Serial Dilutions (excluding mercury)	Must be prepared with each background sample, evaluated only when analyte concentrations are >50x the MDL	The percent difference must be <10%	Flag data	ELLE Analyst	Precision	The result must be within \pm the RL
Interference Check Sample (excluding mercury)	At the beginning and end of each run immediately following the LLC	\pm 20% of the true value for each analyte	Recalibrate	ELLE Analyst	Representativeness	Results within acceptance criteria
Laboratory Control Sample	1 per 20	Recovery limits as specified in QSM 5.0 Elements in the LCS that fail high and are ND in the samples can be reported.	Re-digest and reanalyze LCS and associated samples	ELLE Analyst	Accuracy/Bias	Results within acceptance criteria
Post Digestion Spike	Prepare with each background sample	\pm 25% True Value	Reported in data package	ELLE Analyst	Accuracy/Bias	Results within acceptance criteria

Attachment 1, Table 1-3f
Analytical Method Quality Control and Corrective Action – Metals and Mercury in Soil and Groundwater

Matrix	Soil					
Analytical Group	Metals					
Concentration Level	Low					
Sampling SOP						
Analytical Method/ SOP Reference	SW-846 6020A/3-22					
Sampler's Name						
Field Sampling Organization						
Analytical Organization	ELLE					
No. of Sample Locations						
QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
MS	1 per 20	Recovery limits as specified in QSM 5.0	Analyze post digestion spike and Serial Dilution sample	ELLE Analyst	Accuracy Bias	Results within acceptance limits
MSD (RPD)	1 per 20	Recovery limits as specified in QSM 5.0 RPD must be <20%	Analyze post digestion spike and Serial Dilution sample	ELLE Analyst	Accuracy Bias	Results within acceptance limits, RPD <20%
Duplicate (RPD)	1 per 20	RPD must be <20%	Flag data	ELLE Analyst	Precision	Results within acceptance limits
Initial Calibration Blank	Must be analyzed immediately following the ICV	Must be <3x the IDL	Correct problem, recalibrate, rerun	ELLE Analyst	Contamination	The result must be within ± the RL
Continuing Calibration Blank	Must be analyzed immediately following the CCV, at a frequency of every 10 samples	Must be <3x the IDL	Correct problem, recalibrate, rerun	ELLE Analyst	Contamination	The result must be within ± the RL
Preparation Blank	1 per 20	< ½ RL	Re-digest all associated samples	ELLE Analyst	Contamination	The result must be within ± the RL

Attachment 1, Table 1-3f
Analytical Method Quality Control and Corrective Action – Metals and Mercury in Soil and Groundwater

Matrix	Soil					
Analytical Group	Metals					
Concentration Level	Low					
Sampling SOP						
Analytical Method/SOP Reference	SW-846 6020A/3-22					
Sampler's Name						
Field Sampling Organization						
Analytical Organization	ELLE					
No. of Sample Locations						
QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Serial Dilutions	Must be prepared with each background sample, evaluated only when analyte concentrations are >50x the MDL	The percent difference must be <10%	Flag data	ELLE Analyst	Precision	The result must be within \pm the RL
Interference Check Sample	At the beginning and end of each run immediately following the LLC	\pm 20% of the true value for each analyte	Recalibrate	ELLE Analyst	Representativeness	Results within acceptance criteria
Laboratory Control Sample	1 per 20	Recovery limits as specified in QSM 5.0 Elements in the LCS that fail high and are ND in the samples can be reported.	Re-digest and reanalyze LCS and associated samples	ELLE Analyst	Accuracy/Bias	Results within acceptance criteria
Post Digestion Spike	Prepare with each background sample	\pm 25% of real value	Reported in data package	ELLE Analyst	Accuracy/Bias	Results within acceptance criteria

Attachment 1, Table 1-3f
Analytical Method Quality Control and Corrective Action – Metals and Mercury in Soil and Groundwater

Matrix	Water					
Analytical Group	Metals					
Concentration Level	Low					
Sampling SOP						
Analytical Method/ SOP Reference	SW-846 6020A/3-22					
Sampler's Name						
Field Sampling Organization						
Analytical Organization	ELLE					
No. of Sample Locations						
QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
MS	1 per 20	Recovery limits as specified in QSM 5.0	Analyze post digestion spike and Serial Dilution sample	ELLE Analyst	Accuracy Bias	Results within acceptance limits
MSD (RPD)	1 per 20	Recovery limits as specified in QSM 5.0 RPD must be <20%	Analyze Post Digestion Spike and Serial Dilution sample	ELLE Analyst	Accuracy Bias	Results within acceptance limits, RPD <20%
Duplicate (RPD)	1 per 20	RPD must be <20%	Flag data	ELLE Analyst	Precision	Results within acceptance limits
Initial Calibration Blank	Must be analyzed immediately following the ICV	Must be <3x the IDL	Correct problem, recalibrate, rerun	ELLE Analyst	Contamination	The result must be within ± the RL
Continuing Calibration Blank	Must be analyzed immediately following the CCV, at a frequency of every 10 samples	Must be <3x the IDL	Correct problem, recalibrate, rerun	ELLE Analyst	Contamination	The result must be within ± the RL
Preparation Blank	1 per 20	< ½ RL	Re-digest all associated samples	ELLE Analyst	Contamination	The result must be within ± the RL

Attachment 1, Table 1-3f
Analytical Method Quality Control and Corrective Action – Metals and Mercury in Soil and Groundwater

Matrix	Water					
Analytical Group	Metals					
Concentration Level	Low					
Sampling SOP						
Analytical Method/ SOP Reference	SW-846 6020A/3-22					
Sampler's Name						
Field Sampling Organization						
Analytical Organization	ELLE					
No. of Sample Locations						
QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Serial Dilutions	Must be prepared with each background sample, evaluated only when analyte concentrations are >50x the MDL	The percent difference must be <10%	Flag data	ELLE Analyst	Precision	The result must be within \pm the RL
Interference Check Sample	At the beginning and end of each run immediately following the LLC	\pm 20% of the true value for each analyte	Recalibrate	ELLE Analyst	Representativeness	Results within acceptance criteria
Laboratory Control Sample	1 per 20	Recovery limits as specified in QSM 5.0. Elements in the LCS that fail high and are ND in the samples can be reported.	Re-digest and reanalyze LCS and associated samples	ELLE Analyst	Accuracy/Bias	Results within acceptance criteria
Post Digestion Spike	Prepare with each background sample	\pm 25% of real value	Reported in data package	ELLE Analyst	Accuracy/Bias	Results within acceptance criteria

Attachment 1, Table 1-3f
Analytical Method Quality Control and Corrective Action – Metals and Mercury in Soil and Groundwater

CCV = continuing calibration verification
CVAA = cold vapor atomic absorption
ELLE = Eurofins Lancaster Laboratories Environmental, LLC
ICV = initial calibration verification
IDL = instrument detection limit
LCS = laboratory control sample
LLC = low-level check
LOQ = limit of quantitation
MDL = method detection limit
MS = matrix spike
MSD = matrix spike duplicate
ND = non-detect
QC = quality control
QSM = Quality Systems Manual
RL = reporting limit
RPD = relative percent difference
SOP = standard operating procedure

Attachment 1, Table 1-3g
Analytical Method Quality Control and Corrective Action – Wet Chemistry Parameters in Soil and Groundwater

Matrix	Soil/Groundwater					
Analytical Group	Total Nitrite/Nitrate Nitrogen					
Concentration Level						
Sampling SOP						
Analytical Method/ SOP Reference	353.2/29-4					
Sampler's Name						
Field Sampling Organization						
Analytical Organization	ELLE					
No. of Sample Locations						
QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per batch	<LOQ	Correct problem, re-prepare and reanalyze the method blank and all sample associated	ELLE Analyst	Contamination	<LOQ
LCS	1 per batch	90-110%	Correct problem, re-prepare and reanalyze the LCS and all sample associated	ELLE Analyst	Analytical Accuracy	See attached list
Duplicate	1 per 10 samples	2%	No corrective action, matrix related	ELLE Analyst	Analytical Precision	See attached list
MS	1 per 10 samples	90-110%	No corrective action, matrix related	ELLE Analyst	Analytical Precision/Bias	See attached list
CCB	Every 10 samples	<LOQ	Correct problem, and reanalyze samples bracketing the CCB	ELLE Analyst	Instrument contamination	<LOQ
CCV	Every 10 samples	90-110%	Correct problem, and reanalyze samples bracketing the CCV	ELLE Analyst	Instrument calibration	90-110%

Attachment 1, Table 1-3g
Analytical Method Quality Control and Corrective Action – Wet Chemistry Parameters in Groundwater and Soil

Matrix	Water					
Analytical Group	Chloride/Sulfate/ Nitrate/Bromide by Ion Chromatograph					
Concentration Level						
Sampling SOP						
Analytical Method/ SOP Reference	300.0/29-8					
Sampler's Name						
Field Sampling Organization						
Analytical Organization	ELLE					
No. of Sample Locations						
QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per batch	<LOQ	Correct problem, re-prepare and reanalyze the method blank and all sample associated	ELLE Analyst	Contamination	<LOQ
LCS	1 per batch	90-110%	Correct problem, re-prepare and reanalyze the LCS and all sample associated	ELLE Analyst	Analytical Accuracy	Results within acceptance limits
Duplicate	1 per 10 samples	15%	No corrective action, matrix related	ELLE Analyst	Analytical Precision	Results within acceptance limits
MS	1 per 10 samples	90-110%	No corrective action, matrix related	ELLE Analyst	Analytical Bias	Results within acceptance limits
CCB	Every 10 samples	<LOQ	Correct problem, and reanalyze samples bracketing the CCB	ELLE Analyst	Instrument contamination	<LOQ
CCV	Every 10 samples	90-110%	Correct problem, and reanalyze samples bracketing the CCV	ELLE Analyst	Instrument calibration	90-110%

Attachment 1, Table 1-3g
Analytical Method Quality Control and Corrective Action – Wet Chemistry Parameters in Groundwater and Soil

Matrix	Water					
Analytical Group	Alkalinity					
Concentration Level						
Sampling SOP						
Analytical Method/ SOP Reference	SM2320B/29-26					
Sampler's Name						
Field Sampling Organization						
Analytical Organization	ELLE					
No. of Sample Locations						
QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
MS	1 per 20	Use statistical limit or method limit whichever is tighter	Flag data	ELLE Personnel	Accuracy Bias	Results within acceptance limits
MSD (RPD)	1 per 20	Use statistical limit or method limit whichever is tighter	Flag data	ELLE Personnel	Accuracy Bias/Precision	Results within acceptance limits
Duplicate (RPD)	1 per 10	Use statistical limit or method limit whichever is tighter	Flag data	ELLE Personnel	Precision	Results within acceptance limits
CCV (pH standard)	Every 10 samples	± 10%	Re-analyze all associated samples	ELLE Personnel	Instrument calibration	Results within acceptance limits
CCB (Alkalinity blank)	Must be analyzed immediately following the CCV, at a frequency of every 10 samples	Must be <reporting limit	Re-analyze all associated samples	ELLE Personnel	Contamination	The result must be < reporting limit
Preparation Blank	1 per 20	Must be <reporting limit	Re-analyze all associated samples	ELLE Personnel	Contamination	The result must be < reporting limit
LCS	1 per 20	Use statistical limit or method limit whichever is tighter	Re-analyze all associated samples	ELLE Personnel	Accuracy/Bias	Results within acceptance criteria

Attachment 1, Table 1-3g
Analytical Method Quality Control and Corrective Action – Wet Chemistry Parameters in Groundwater and Soil

Matrix	Water					
Analytical Group	Ammonia Nitrogen					
Concentration Level						
Sampling SOP						
Analytical Method/ SOP Reference	SM4500 NH3 B/C- 1997/29-18					
Sampler's Name						
Field Sampling Organization						
Analytical Organization	ELLE					
No. of Sample Locations						
QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per batch	<LOQ	Correct problem, re-prepare and reanalyze the method blank and all sample associated	ELLE Analyst	Contamination	<LOQ
LCS	1 per batch	85-105%	Correct problem, re-prepare and reanalyze the LCS and all sample associated	ELLE Analyst	Analytical Accuracy	Results within acceptance limits
Duplicate	1 per batch	6%	No corrective action, matrix related	ELLE Analyst	Analytical Precision	Results within acceptance limits
MS/MSD	1 per batch	85-105%	No corrective action, matrix related	ELLE Analyst	Analytical Precision/Bias	Results within acceptance limits

Attachment 1, Table 1-3g
Analytical Method Quality Control and Corrective Action – Wet Chemistry Parameters in Groundwater and Soil

Matrix	Soil					
Analytical Group	Ignitability					
Concentration Level						
Sampling SOP						
Analytical Method/ SOP Reference	40 CFR 261.21/29-19					
Sampler's Name						
Field Sampling Organization						
Analytical Organization	ELLE					
No. of Sample Locations						
QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
NA	NA	NA	NA	NA	NA	NA

Attachment 1, Table 1-3g
Analytical Method Quality Control and Corrective Action – Wet Chemistry Parameters in Groundwater and Soil

Matrix	Soil					
Analytical Group	pH					
Concentration Level						
Sampling SOP						
Analytical Method/ SOP Reference	SW-846 9045D mod/29-22					
Sampler's Name						
Field Sampling Organization						
Analytical Organization	ELLE					
No. of Sample Locations						
QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
LCS	1 per batch	95-105%	Correct problem, re-prepare and reanalyze the LCS and all sample associated	ELLE Analyst	Analytical Accuracy	Results within acceptance limits
Duplicate	1 per 10 samples	3%	No corrective action, matrix related	ELLE Analyst	Analytical Precision	Results within acceptance limits
CCV	Every 10 samples	90-110%	Correct problem, and reanalyze samples bracketing the CCV	ELLE Analyst	Instrument calibration	90-110%

Attachment 1, Table 1-3g
Analytical Method Quality Control and Corrective Action – Wet Chemistry Parameters in Groundwater and Soil

Matrix	Soil					
Analytical Group	Reactive Sulfide					
Concentration Level						
Sampling SOP						
Analytical Method/ SOP Reference	40 CFR Part 261/SW- 846 9034/29-2					
Sampler's Name						
Field Sampling Organization						
Analytical Organization	ELLE					
No. of Sample Locations						
QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per batch	<LOQ	Correct problem, re- prepare and reanalyze the method blank and all sample associated	ELLE Analyst	Contamination	<LOQ
LCS	1 per batch	68-94%	Correct problem, re- prepare and reanalyze the LCS and all sample associated	ELLE Analyst	Analytical Accuracy	Results within acceptance limits
MS/MSD	1 per batch	68-94%	No corrective action, matrix related	ELLE Analyst	Analytical Precision/Bias	Results within acceptance limits

Attachment 1, Table 1-3g
Analytical Method Quality Control and Corrective Action – Wet Chemistry Parameters in Groundwater and Soil

Matrix	Soil					
Analytical Group	Reactive Cyanide					
Concentration Level						
Sampling SOP						
Analytical Method/ SOP Reference	40 CFR Part 261/SW-846 9012A mod/29-3					
Sampler's Name						
Field Sampling Organization						
Analytical Organization	ELLE					
No. of Sample Locations						
QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per batch	<LOQ	Correct problem, re-prepare and reanalyze the method blank and all sample associated	ELLE Analyst	Contamination	<LOQ
LCS	1 per batch	77-113%	Correct problem, re-prepare and reanalyze the LCS and all sample associated	ELLE Analyst	Analytical Accuracy	Results within acceptance limits
Duplicate	1 per batch	20%	No corrective action, matrix related	ELLE Analyst	Analytical Precision	Results within acceptance limits
MS/MSD	1 per batch	0-44%	No corrective action, matrix related	ELLE Analyst	Analytical Precision/Bias	Results within acceptance limits
CCB	Every 10 samples	<LOQ	Correct problem, and reanalyze samples bracketing the CCB	ELLE Analyst	Instrument contamination	<LOQ
CCV	Every 10 samples	90-110%	Correct problem, and reanalyze samples bracketing the CCV	ELLE Analyst	Instrument calibration	90-110%

Attachment 1, Table 1-3g
Analytical Method Quality Control and Corrective Action – Wet Chemistry Parameters in Groundwater and Soil

Matrix	Solid					
Analytical Group	%Moisture					
Concentration Level						
Sampling SOP						
Analytical Method/ SOP Reference	SM20 2540G/29-27					
Sampler's Name						
Field Sampling Organization						
Analytical Organization	ELLE					
No. of Sample Locations						
QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Duplicate	1 per 10 samples	29-27	No corrective action, matrix related	ELLE Verifier	Results within acceptance limits	

Attachment 1, Table 1-3g
Analytical Method Quality Control and Corrective Action – Wet Chemistry Parameters in Groundwater and Soil

Matrix	Water					
Analytical Group	Sulfide (titrimetric)					
Concentration Level						
Sampling SOP						
Analytical Method/ SOP Reference	SM4500-S2 F					
Sampler's Name						
Field Sampling Organization						
Analytical Organization	ELLE					
No. of Sample Locations						
QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per batch	<LOQ	Correct problem, re-prepare and reanalyze the method blank and all sample associated	ELLE Analyst	Contamination	<LOQ
Laboratory Control Standard	1 per batch	80-120%	Correct problem, re-prepare and reanalyze the LCS and all sample associated	ELLE Analyst	Analytical Accuracy	Results within acceptance limits
Duplicate	1 per batch	20%	No corrective action, matrix related	ELLE Analyst	Analytical Precision	Results within acceptance limits
MS/MSD	1 per batch	80-120%	No corrective action, matrix related	ELLE Analyst	Analytical Precision/Bias	Results within acceptance limits

Attachment 1, Table 1-3g
Analytical Method Quality Control and Corrective Action – Wet Chemistry Parameters in Groundwater and Soil

CCB = Continuing calibration blank
CCV = Continuing calibration verification
ELLE = Eurofins Lancaster Laboratories Environmental, LLC
LCS = Laboratory control sample
LOQ = Limit of quantitation
MS = Matrix spike
MSD = Matrix spike duplicate
NA = Not applicable
QC = Quality control
RPD = Relative percent difference
SOP = Standard operating procedure

ATTACHMENT 1 – EUROFINs LANCASTER LABORATORIES ENVIRONMENTAL, LLC

**Table 1-4: Analytical Instrument and Equipment Maintenance, Testing, and
Inspection**

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Attachment 1, Table 1-4a
Analytical Instrument and Equipment Maintenance, Testing, and Inspection – Volatile Organics

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	Standard Operating Procedure Reference
Analytical Balance	Annual calibration/ verification	Daily check with Class 1 weights	Visual inspection	Annual calibration/daily check	See standard operating procedure	See standard operating procedure	Outside vendor for calibration/Analyst for daily checks	21-5
Agilent 6890 GC/5973 Matrix Spike Duplicate	As needed, replacement of components	Continuing calibration verification per 12-hour tune period	Visual inspection of components	As needed	Initial calibration or continuing calibration verification passes method criteria	Perform additional maintenance prior to instrument calibration or continuing calibration verification	Analysts or group leaders	21-6

Attachment 1, Table 1-4b
Analytical Instrument and Equipment Maintenance, Testing, and Inspection – Semivolatile Organics

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	Standard Operating Procedure Reference
Semivolatiles Agilent GC/MS; Thermo Trace DSQII	Injection port; column, ion source; other components as needed	Calibration check	Visual	Daily routine maintenance (injection port); as needed for other components	Varies with method being performed	Perform maintenance again; re- calibration if necessary	ELLE Analyst	26-5

ELLE = Eurofins Lancaster Laboratories Environmental, LLC

GC = gas chromatograph

MS = mass spectrometer

Attachment 1, Table 1-4c
Analytical Instrument and Equipment Maintenance, Testing, and Inspection – Ethylene Dibromide

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	Standard Operating Procedure Reference
GC, HP5890, HP 6890, and HP7890 with Electron Conductivity Detector	Injection port maintenance; electron conductivity detector maintenance	Calibration Check	Visual Inspection	As needed	Initial calibration after maintenance is within specifications	Perform maintenance again	GC analyst	24-20

GC = gas chromatograph

Attachment 1, Table 1-4d
Analytical Instrument and Equipment Maintenance, Testing, and Inspection – Total Petroleum Hydrocarbons

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	Standard Operating Procedure Reference
HP5890, HP6890, or Agilent 7890 Gas Chromatograph with Flame Ionization Detector	Injection port maintenance; column; flame ionization detector maintenance	Calibration Check	Visual Inspection	As needed	Initial Calibration within Specifications	Perform Maintenance again; re- calibrate if necessary	ELLE analyst	SOP 32-6 and 32-16
Analytical Balance	Annual Calibration/ Verification	Daily Check with Class 1 weights	Visual inspection	Annual calibration/daily check	See SOP	See SOP	Outside vendor for calibration/ Analyst for daily checks	32-15

ELLE = Eurofins Lancaster Laboratories Environmental, LLC

SOP = standard operating procedure

Attachment 1, Table 1-4e
Analytical Instrument and Equipment Maintenance, Testing, and Inspection – Organochlorine Pesticides and Chlorinated Herbicides

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	Standard Operating Procedure Reference
GC, HP5890, HP 6890, and HP7890 with Electron Conductivity Detector	Injection port maintenance; electron conductivity detector maintenance	Calibration Check	Visual Inspection	As needed	Initial calibration after maintenance is within specifications	Perform maintenance again	GC analyst	24-20
GC, HP7890 with Nitrogen-phosphorous detector	Injection port maintenance; Nitrogen-phosphorous detector maintenance	Calibration Check	Visual Inspection	As needed	Initial calibration after maintenance is within specifications	Perform maintenance again	GC analyst	24-20
Top Loading balance	Not applicable	Calibration Check	Visual Inspection	As needed	Within calibration ranges	Perform maintenance again	Technician	24-25

GC = gas chromatograph

Attachment 1, Table 1-4f
Analytical Instrument and Equipment Maintenance, Testing, and Inspection – Metals and Mercury

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	Standard Operating Procedure Reference
Thermo 6000 Series Inductively Coupled Plasma- Atomic Emission Spectrometry	As needed replacement of components	Calibration checks	Visual inspection of components	As needed maintenance/ calibration checks every 10 injections	90-110% for the calibration checks	Recalibration	ELLE Analyst	1-22
Leeman Labs Hydra II Mercury Analyzer	As needed replacement of components	Calibration checks	Visual inspection of components	As needed maintenance/ calibration checks every 10 injections	80-120% for the calibration checks	Recalibration	ELLE Analyst	2-22
Perkin Elmer ELAN 9000	As needed replacement of components	Calibration checks	Visual inspection of components	As needed maintenance/ calibration checks every 10 injections	90-110% for the calibration checks	Recalibration	ELLE Analyst	3-22
Agilent 7500 CE	As needed replacement of components	Calibration checks	Visual inspection of components	As needed maintenance/ calibration checks every 10 injections	90-110% for the calibration checks	Recalibration	ELLE Analyst	3-22
Agilent 7700X	As needed replacement of components	Calibration checks	Visual inspection of components	As needed maintenance/ calibration checks every 10 injections	90-110% for the calibration checks	Recalibration	ELLE Analyst	3-22

ELLE = Eurofins Lancaster Laboratories Environmental, LLC

Attachment 1, Table 1-4g
Analytical Instrument and Equipment Maintenance, Testing, and Inspection – Wet Chemistry Parameters

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	Standard Operating Procedure Reference
Mantech Autotitrator	As needed replacement of components	Calibration checks	Visual inspection of components	As needed maintenance/ calibration checks every 10 injections	90-110% for the calibration checks	Recalibration	ELLE Analyst	29-26
pH/ Ion-Specific Electrode Meter	As needed replacement of components, electrodes	Calibration checks	Visual inspection of components	As needed maintenance/ calibration checks every 10 injections	90-110% for the calibration checks	Recalibration	ELLE Analyst	29-22
Ion Chromatograph	As needed replacement of components, columns	Calibration checks	Visual inspection of components	As needed maintenance/ calibration checks every 10 injections	90-110% for the calibration checks	Recalibration	ELLE Analyst	29-28
Flow Analyzer	As needed replacement of components, tubing	Calibration checks	Visual inspection of components	As needed maintenance/ calibration checks every 10 injections	90-110% for the calibration checks	Recalibration	ELLE Analyst	29-2, 29-3, 29-4
Analytical balance	Not applicable	Calibration check	Visual Inspection	As needed	Within Calibration Ranges	Perform maintenance again	Technician	29-27

ELLE = Eurofins Lancaster Laboratories Environmental, LLC

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**ATTACHMENT 1 – EUROFINS LANCASTER LABORATORIES
ENVIRONMENTAL, LLC**

Table 1-5: Analytical Instrument Calibration

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Attachment 1, Table 1-5a
Analytical Instrument Calibration – Volatile Organics

Instrument	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	Standard Operating Procedure Reference
GC/MS (volatiles)	SW-846 8260C/see SOPs	See SOPs	After continuing calibration fails; continuing calibration checks occur every 12 hours	Continuing calibration checks ≤20%; minimum response factor for select compounds (see SOP)	Recalibrate, perform instrument maintenance if calibration cannot confirm to criteria, recalibrate	ELLE analyst	21-1 and 21-2

ELLE = Eurofins Lancaster Laboratories Environmental, LLC

GC = gas chromatograph

MS = mass spectrometer

SOP = standard operating procedure

Attachment 1, Table 1-5b
Analytical Instrument Calibration – Semivolatile Organics

Instrument	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	Standard Operating Procedure Reference
GC/MS Semivolatiles	See 26-1, 26-3	See SOP	After continuing calibration fails; continuing calibration checks occur every 12 hours	Response factor for standard performance calibration check ≥ 0.05 ; % relative standard deviation for continuing check standard $\leq 20\%$	Recalibrate, perform instrument maintenance; if calibration cannot confirm to criteria, recalibrate	ELLE Analyst	26-1, 26-3

ELLE = Eurofins Lancaster Laboratories Environmental, LLC

GC = gas chromatograph

MS = mass spectrometer

SOP = standard operating procedure

Attachment 1, Table 1-5c
Analytical Instrument Calibration – Ethylene Dibromide

Instrument	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	Standard Operating Procedure Reference
EDB 8011 GC	See SOP 24-26, 24-27	Calibration scheme begins at or near the reporting limit through a 20-fold of the initial calibration level	After continuing calibration fails. Continuing calibration checks occur every 12 hours or after 10 injections	% Relative standard deviation for initial calibration $\leq 10\%$ % relative standard deviation for continuing calibration verification $\leq 15\%$	Recalibrate, perform instrument maintenance; if calibration can't confirm to criteria, recalibrate	ELLE Analyst	24-26, 24-27

EDB = ethylene dibromide

ELLE = Eurofins Lancaster Laboratories Environmental, LLC

GC = gas chromatograph

SOP = standard operating procedure

Attachment 1, Table 1-5d
Analytical Instrument Calibration – Total Petroleum Hydrocarbons

Instrument	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	Standard Operating Procedure Reference
Diesel Range Organics/ Residual Range Organics	SW 8015C/D See 32-8 and 32-9	Soil: 12-583 milligrams per kilogram Water: 50-10,000 micrograms per liter	After continuing calibration fails. Continuing calibration checks occur every 12 hours	% RSD for ICAL $\leq 20\%$ % RSD for CCV $\leq 20\%$	Recalibrate, perform instrument maintenance; if calibration cannot confirm to criteria, recalibrate	ELLE Analyst	32-1 and 32-4
GC Gasoline Range Organics Solid	SW 8015B/C/D	See SOP	See 32-11	% RSD for ICAL $\leq 20\%$ % RSD for CCV $\pm 15\%$	Recalibrate, perform instrument maintenance; if calibration cannot confirm to criteria, recalibrate	ELLE Analyst	32-11
GC Gasoline Range Organics Water	SW 8015B/C/D	See SOP	See 32-10	% RSD for ICAL $\leq 20\%$ % RSD for CCV $\leq 15\%$	Recalibrate, perform instrument maintenance; if calibration cannot confirm to criteria, recalibrate	ELLE Analyst	32-10

CCV = continuing calibration verification

ELLE = Eurofins Lancaster Laboratories Environmental, LLC

GC = gas chromatograph

ICAL = initial calibration

RSD = relative standard deviation

SOP = standard operating procedure

Attachment 1, Table 1-5e
Analytical Instrument Calibration – Organochlorine Pesticides and Chlorinated Herbicides

Instrument	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	Standard Operating Procedure Reference
Organochlorine Pesticides	See SOP 24-1, 24-3	Calibration scheme begins at or near the reporting limit through a 20-fold of the initial calibration level	After continuing calibration fails. Continuing calibration checks occur every 12 hours	% RSD for ICAL \leq 20% % RSD for CCV \leq 15%	Recalibrate, perform instrument maintenance; if calibration can't confirm to criteria, recalibrate	ELLE Analyst	24-1, 24-3
Herbicides	See SOP 24-16, 24-18	Calibration scheme begins at or near the reporting limit through a 40-fold of the initial calibration level	After continuing calibration fails. Continuing calibration checks occur every 12 hours	% RSD for ICAL \leq 20% % RSD for CCV \leq 15%	Recalibrate, perform instrument maintenance; if calibration can't confirm to criteria, recalibrate	ELLE Analyst	24-16, 24-18
Organochlorine Pesticides	See SOP 24-4, 24-5	Calibration scheme begins at or near the reporting limit through a 20 fold of the initial calibration level	After continuing calibration fails. Continuing calibration checks occur every 12 hours	% RSD for ICAL \leq 20% % RSD for CCV \leq 20%	Recalibrate, perform instrument maintenance; if calibration can't confirm to criteria, recalibrate	ELLE Analyst	24-4, 24-5

CCV = continuing calibration verification

ELLE = Eurofins Lancaster Laboratories Environmental, LLC

ICAL = initial calibration

RSD = relative standard deviation

SOP = standard operating procedure

Attachment 1, Table 1-5f
Analytical Instrument Calibration – Metals and Mercury

Instrument	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	Standard Operating Procedure Reference
Inductively Coupled Plasma	See SOP	See SOP	Each new run and continuing calibration per 10 samples	Independent calibration verification within $\pm 10\%$, standards $< 5\%$ relative standard deviation	Recalibrate, perform instrument maintenance if calibration cannot conform to criteria, recalibrate	ELLE Analyst	1-22
Cold Vapor Atomic Absorption	See SOP	See SOP	Each new run and continuing calibration per 10 samples	Independent calibration verification within $\pm 10\%$, standards Correlation coefficient > 0.995	Recalibrate, perform instrument maintenance if calibration cannot conform to criteria, recalibrate	ELLE Analyst	2-22
Inductively Coupled Plasma/Mass Spectrometer	See SOP	See SOP	Each new run and continuing calibration per 10 samples	Independent calibration verification within $\pm 10\%$	Recalibrate, perform instrument maintenance if calibration cannot conform to criteria, recalibrate	ELLE Analyst	3-22

ELLE = Eurofins Lancaster Laboratories Environmental, LLC

SOP = standard operating procedure

Attachment 1, Table 1-5g
Analytical Instrument Calibration – Wet Chemistry Parameters

Instrument	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	Standard Operating Procedure Reference
pH Meter	29-22		Each new run and continuing calibration per 10 samples	Independent calibration verification within $\pm 10\%$	Recalibrate, perform instrument maintenance if calibration cannot conform to criteria, recalibrate	ELLE Analyst	29-22
Flow Analyzer	29-2, 29-3, 29-4		Each new run and continuing calibration per 10 samples	Independent calibration verification within $\pm 10\%$	Recalibrate, perform instrument maintenance if calibration cannot conform to criteria, recalibrate	ELLE Analyst	29-3, 29-4
Ion Chromatograph	29-8		Monthly, and continuing calibration per 10 samples	Independent calibration verification within $\pm 10\%$	Recalibrate, perform instrument maintenance if calibration cannot conform to criteria, recalibrate	ELLE Analyst	29-8
Total Nitrate/Nitrite	29-4	See SOP	Each new run and continuing calibration per 10 samples	Independent calibration verification within $\pm 10\%$, standards correlation coefficient. >0.995	Recalibrate, perform instrument maintenance if calibration cannot conform to criteria, recalibrate	ELLE Analyst	29-4
Anions Water	29-8	See SOP	Monthly, and continuing calibration per 10 samples	Independent calibration verification within $\pm 10\%$	Recalibrate, perform instrument maintenance if calibration cannot conform to criteria, recalibrate	ELLE Analyst	29-8
Ammonia Water	29-28	See SOP	Quarterly, and continuing calibration per 10 samples	Independent calibration verification within $\pm 10\%$	Recalibrate, perform instrument maintenance if calibration cannot conform to criteria, recalibrate	ELLE Analyst	29-11
Reactive Cyanide Solid	29-3	See SOP	Each new run and continuing calibration per 10 samples	Independent calibration verification within $\pm 10\%$, standards correlation coefficient. >0.995	Recalibrate, perform instrument maintenance if calibration cannot conform to criteria, recalibrate	ELLE Analyst	29-3
Reactive Sulfide Solid	29-2	NA	NA	NA	NA	ELLE Analyst	29-2
Ignitability Solid	29-19	NA	NA	NA	NA	ELLE Analyst	29-19

Attachment 1, Table 1-5g
Analytical Instrument Calibration – Wet Chemistry Parameters

Instrument	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	Standard Operating Procedure Reference
pH Solid	29-22	See SOP	Each new run and continuing calibration per 10 samples	Independent calibration verification within $\pm 10\%$	Recalibrate, perform instrument maintenance if calibration cannot conform to criteria, recalibrate	ELLE Analyst	29-22
Moisture Solid	29-27	0.01-50.0 grams	Daily	± 0.5 grams	Perform balance internal calibration, tag out of operation and contact outside support	ELLE Analyst	29-27
Mantech Autotitrator	29-26	See SOP	As needed maintenance/ calibration checks every 10 injections	90-110% for the calibration checks	Recalibration	ELLE Analyst	29-26

ELLE = Eurofins Lancaster Laboratories Environmental, LLC

NA = not applicable

SOP = standard operating procedure

ATTACHMENT 1 – EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL, LLC

Table 1-6: Laboratory Accreditation, Quality Manual, and Standard Operating Procedures

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SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL LLC

2425 New Holland Pike

Lancaster, PA 17601

Dorothy M. Love Phone: 717-556-7327

ENVIRONMENTAL

Valid To: November 30, 2018

Certificate Number: 0001.01

In recognition of the successful completion of the A2LA evaluation process (including an assessment of the laboratory's compliance with ISO IEC 17025:2005, the 2009 TNI Environmental Testing Laboratory Standard, and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in version 5.0 of the DoD Quality Systems Manual for Environmental Laboratories, accreditation is granted to this laboratory to perform recognized EPA methods using the following testing technologies and in the analyte categories identified below:

Testing Technologies

Atomic Absorption/ICP-AES Spectrometry, ICP-MS Spectrometry, Gas Chromatography, Gas Chromatography/Mass Spectrometry, Gravimetry, High Performance Liquid Chromatography, Ion Chromatography, Misc.-Electronic Probes (pH, F⁻, O₂), Oxygen Demand, Spectrophotometry (Visible), Spectrophotometry (Automated), Titrimetry, TCLP, Total Organic Carbon, Turbidity, Liquid Chromatography/Mass Spectrometry/Mass Spectrometry, High Resolution Gas Chromatography/Mass Spectrometry

<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
Demands					
BOD	-----	-----	SM 5210B-2001	-----	-----
CBOD	-----	-----	SM 5210B-2001	-----	-----
COD	-----	-----	EPA 410.4	-----	-----
Total Carbon	-----	-----	-----	SM 5310C-2000	SM 5310B-2000 MOD
Total Inorganic Carbon	-----	-----	-----	SM 5310C-2000	SM 5310B-2000 MOD
Total Organic Carbon	-----	-----	EPA 415.1 EPA 9060 EPA 9060A SM 5310C-2000	EPA 9060 EPA 9060A SM 5310C-2000	EPA 9060 EPA 9060A SM 5310B MOD

(A2LA Cert No. 0001.01) 02/27/2017

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<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
Nutrients					
Ammonia	-----	-----	EPA 350.1 SM 4500 NH3 B & D-1997	-----	EPA 350.1
Fluoride	-----	-----	SM 4500 FC-1997 EPA 300.0 EPA 340.2 EPA 9056 EPA 9056A	EPA 9056 EPA 9056A	EPA 300.0
Nitrate (as N)	-----	-----	EPA 300.0 EPA 9056 EPA 9056A	EPA 9056 EPA 9056A	EPA 300.0
Nitrite (as N)	-----	-----	EPA 300.0 EPA 9056 EPA 9056A	EPA 9056 EPA 9056A	EPA 300.0
Nitrate/Nitrite	-----	-----	EPA 353.2	-----	-----
Orthophosphate (as P)	-----	-----	EPA 365.3	-----	-----
Total Kjeldahl Nitrogen	-----	-----	EPA 351.2	-----	EPA 351.2
Total Phosphorus	-----	-----	EPA 365.1	-----	EPA 365.1
Wet Chemistry					
Acid Volatile Sulfide	-----	-----	-----	-----	EPA-821-R- 91-100
Acidity	-----	-----	SM 2310B-1997	-----	-----
Alkalinity	-----	-----	SM 2320B-1997	-----	-----
Bromide	-----	-----	EPA 300.0 EPA 9056 EPA 9056A	EPA 9056 EPA 9056A	-----
Bulk Density	-----	-----	-----	ASTM E868- 82	ASTM E868- 82
Chloride	-----	-----	EPA 300.0 EPA 325.3 EPA 9056 EPA 9056A	EPA 9056 EPA 9056A	EPA 300.0
Color	-----	-----	SM 2120B-2001	-----	-----
Corrosivity	-----	-----	-----	SW-846 Chapter 7	SW-846 Chapter 7
Cyanide	EPA 9012A EPA 9012B	-----	EPA 335.2 EPA 335.4 MOD EPA 9012A EPA 9012B ASTM D7511 OIA-1677-09	EPA 9012A EPA 9012B ASTM D7511 OIA-1677-09	EPA 9012A EPA 9012B
Dissolved Oxygen	-----	-----	SM 4500 OG- 2001	-----	-----
Dissolved Silica	-----	-----	EPA 370.1 SM 4500 SiC- 1997	-----	-----



<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
Ferrous Iron	-----	-----	SM 3500Fe B- MOD 1997	-----	-----
Filterable Residue	-----	-----	SM 2540C-1997	-----	-----
Flashpoint	-----	-----	-----	EPA1010A	EPA 1010A
Grain Size	-----	-----	-----	-----	ASTM D422
Hardness	-----	-----	SM 2340C-1997	-----	-----
HEM-SGT	-----	-----	EPA 1664A EPA 1664B	-----	EPA 9071B
Hexavalent Chromium Digestion	EPA 3060A	-----	-----	-----	EPA 3060A
Hexavalent Chromium	EPA 7196A	-----	SM 3500 CrB- 2009 EPA 218.6 EPA 7196A EPA 7199	EPA 218.6 EPA 7196A EPA 7199	EPA 7196A EPA 7199
Ignitability	-----	-----	-----	40 CFR 261.21	40 CFR 261.21
Non-Filterable Residue	-----	-----	EPA 160.2 SM 2540D-1997	-----	-----
Oxidation Reduction Potential	-----	-----	ASTM D1498	ASTM D1498	ASTM D1498
Paint Filter Test	-----	-----	EPA 9095A	EPA 9095A	EPA 9095A
pH	-----	-----	SM 4500 H+B- 2000 EPA 150.1 EPA 9040B EPA 9040C	EPA 9040B EPA 9040C EPA 9045C EPA 9045D	EPA 9040B EPA 9040C EPA 9045C EPA 9045D
Phenol	-----	-----	EPA 420.4 EPA 9066	EPA 9066	-----
Reactivity	-----	-----	-----	SW-846 Chapter 7.3	SW-846 Chapter 7.3
Settleable Residue	-----	-----	SM 2540F-1997	-----	-----
Specific Conductance	-----	-----	EPA 120.1 SM 2510B-1997 EPA 9050A	EPA 9050A	
Sulfate	-----	-----	EPA 300.0 EPA 375.4 EPA 9056 EPA 9056A	EPA 9056 EPA 9056A	EPA 300.0
Sulfide	-----	-----	EPA 376.1 EPA 376.2 SM 4500 S2D- 2000 SM 4500 S2F- 2000	-----	-----
Surfactants	-----	-----	SM 5540C-2000	-----	-----
Total Filterable Residue	-----	-----	SM 2540C-1997	-----	-----
Total Residue	-----	-----	EPA 160.3 SM 2540B-1997	-----	-----



<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
Total Fixed and Total Volatile Solids, Dissolved Fixed and Dissolved Volatile Solids, Suspended Fixed and Suspended Volatile Solids	-----		SM 2540 E-1997	-----	-----
Turbidity	-----	-----	EPA 180.1 SM 2130 B-2001	-----	-----
Volatile Residue	-----	-----	EPA 160.4	-----	-----
Metals					
Metals Digestion	EPA 3050B	EPA 3050B	EPA 200.2 EPA 3050B EPA 3005A EPA 3010A EPA 3010A MOD EPA 3020	EPA 3050B EPA 3010A EPA 3010A MOD EPA 3020	EPA 3050B
Aluminum	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	-----	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Antimony	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 200.8 MOD EPA 6020 EPA 6020A	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Arsenic	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 200.8 MOD EPA 6020 EPA 6020A	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Barium	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	-----	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A

<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
Beryllium	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 200.8 MOD EPA 6020 EPA 6020A	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Boron	EPA 6010B EPA 6010C	-----	EPA 200.7 EPA 6010B EPA 6010C	EPA 6010B EPA 6010C	EPA 6010B EPA 6010C
Cadmium	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 200.8 MOD EPA 6020 EPA 6020A	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Calcium	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	-----	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Chromium	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 200.8 MOD EPA 6020 EPA 6020A	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Cobalt	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	-----	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Copper	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	-----	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Iron	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	-----	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A



<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
Lead	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 200.8 MOD EPA 6020 EPA 6020A	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Molybdenum	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	-----	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Magnesium	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	-----	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Manganese	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 200.8 MOD EPA 6020 EPA 6020A	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Mercury	EPA 7471A EPA 7471B	-----	EPA 245.1 EPA 7470A	EPA 7470A	EPA 7471A EPA 7471B
Nickel	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 200.8 MOD EPA 6020 EPA 6020A	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Potassium	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	-----	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Selenium	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	-----	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Silicon	-----	-----	EPA 6010C	EPA 6010C	EPA 6010C

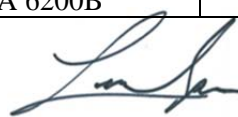


<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
Silver	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	-----	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Sodium	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	-----	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Strontium	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	-----	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Thallium	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	-----	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Tin	EPA 6010B EPA 6010C	-----	EPA 200.7 EPA 6010B EPA 6010C	EPA 6010B EPA 6010C	EPA 6010B EPA 6010C
Titanium	-----	-----	EPA 200.7 EPA 6010B EPA 6010C	EPA 200.7 EPA 6010B EPA 6010C	EPA 200.7 EPA 6010B EPA 6010C
Vanadium	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 200.8 MOD EPA 6020 EPA 6020A	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Zinc	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 200.8 MOD EPA 6020 EPA 6020A	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Zirconium	-----	-----	EPA 200.7 EPA 6010B EPA 6010C	EPA 200.7 EPA 6010B EPA 6010C	EPA 200.7 EPA 6010B EPA 6010C



<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
Purgeable Organics (Volatiles)					
Volatile Preparation	-----	-----	EPA 5030A EPA 5030B	EPA 5030A EPA 5030B	EPA 5035 EPA 5035A
Acetone	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Acetonitrile	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Acrolein	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Acrylonitrile	-----	EPA TO-15 EPA TO- 15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Alpha Methyl Styrene	-----	EPA TO-15	-----	-----	-----
Allyl Chloride	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
tert-Amyl Alcohol	-----	-----	-----	-----	EPA 8260B EPA 8260C
tert-Amyl methyl ether	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
tert-Butyl Alcohol	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
tert-Butyl Formate	-----	-----	-----	-----	EPA 8260B EPA 8260C

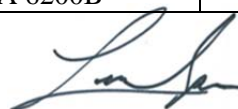
<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
Benzene	-----	EPA TO-15 EPA TO- 15 SIM EPA 18 mod EPA 25 mod	EPA 602 EPA 624 EPA 8021B EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1
Benzyl Chloride	-----	EPA TO-15	-----	-----	-----
Bromobenzene	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Bromochloromethane	-----	-----	EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Bromodichloromethane	-----	EPA TO-15 EPA TO- 15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Bromoethene	-----	EPA TO-15	-----	-----	-----
Bromoform	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Bromomethane	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Butane	-----	EPA 18 mod EPA 25 mod	-----	-----	-----
1,3-Butadiene	-----	EPA TO-15 EPA TO- 15 SIM	-----	-----	-----
2-Butanone	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C



<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
n-Butylbenzene	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
sec-Butylbenzene	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
tert-Butylbenzene	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Carbon Disulfide	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Carbon Tetrachloride	-----	EPA TO-15 EPA TO- 15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
2-chloro-1,3-butadiene	-----	-----	EPA 624 EPA 8260B EPA 8260C	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Chloroacetonitrile	-----	-----	EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Chlorobenzene	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1-Chlorobutane	-----	-----	EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Chlorodifluoromethane	-----	EPA TO-15	-----	-----	
Chloroethane	-----	EPA TO-15 EPA TO- 15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
2-chloroethyl vinyl ether	-----	-----	EPA 624 EPA 8260B EPA 8260C	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C

<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
Carbon Range Organics C1-C10 (including subsets of this range i.e. hydrocarbons as propane, hydrocarbons as methane, hydrocarbons as hexane)	-----	EPA 18 mod EPA 25 mod	-----	-----	-----
Chloroform	-----	EPA TO-15 EPA TO- 15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Chloromethane	-----	EPA TO-15 EPA TO- 15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
3-Chloroprene	-----	EPA TO-15	-----	-----	-----
2-Chlorotoluene	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
4-Chlorotoluene	-----	-----	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Cyclohexane	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Di-Isopropyl Ether	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Dibromochloromethane	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,2-Dibromo-3- chloropropane	-----	EPA TO-15 EPA TO- 15 SIM	EPA 624 EPA 8011 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8011 EPA 8260B EPA 8260C	EPA 8260B EPA 8260C

<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
Dibromomethane	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,2-Dibromoethane (EDB)	-----	EPA TO-15 EPA TO- 15 SIM	EPA 624 EPA 8011 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8011 EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,2-Dichlorobenzene	-----	EPA TO-15 EPA TO- 15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,3-Dichlorobenzene	-----	EPA TO-15 EPA TO- 15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,4-Dichlorobenzene	-----	EPA TO-15 EPA TO- 15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
trans-1,4-dichloro-2- butene	-----	-----	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Dichlorodi- fluoromethane	-----	EPA TO-15 EPA TO- 15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,1-Dichloroethane	-----	EPA TO-15 EPA TO- 15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,2-Dichloroethane	-----	EPA TO-15 EPA TO- 15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,1-Dichloroethene	-----	EPA TO-15 EPA TO- 15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C

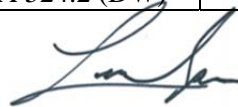


<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
cis-1,2-Dichloroethene	-----	EPA TO-15 EPA TO- 15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
trans-1,2-Dichloroethene	-----	EPA TO-15 EPA TO- 15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Dichlorofluoromethane	-----	EPA TO-15	EPA 524.2 (DW)	-----	-----
1,2-Dichloropropane	-----	EPA TO-15 EPA TO- 15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,3-Dichloropropane	-----	-----	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
2,2-Dichloropropane	-----	-----	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,1-Dichloropropanone	-----	-----	EPA 524.2 (DW)	-----	-----
1,1-Dichloropropene	-----	-----	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
cis-1,3-Dichloropropene	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
trans-1,3-Dichloropropene	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,4-Dioxane	-----	EPA TO-15	EPA 8260B EPA 8260C EPA 8260 SIM	EPA 8260B EPA 8260C EPA 8260 SIM	EPA 8260B EPA 8260C EPA 8260 SIM

<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
Ethanol	-----	EPA TO-15	EPA 8260B EPA 8260C EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Ethane	-----	EPA 18 mod EPA 25 mod	-----	-----	-----
Ethyl Acetate	-----	EPA TO-15	-----	-----	-----
Ethyl Acrylate	-----	EPA TO-15	-----	-----	-----
Ethylbenzene	-----	EPA TO-15 EPA TO- 15 SIM EPA 18 mod EPA 25 mod	EPA 602 EPA 624 EPA 8021B EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1
Ethyl Ether	-----	-----	EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Ethyl Methacrylate	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
4-Ethyltoluene	-----	EPA TO-15	-----	-----	-----
Ethyl tert-butyl Ether	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Freon-113	-----	EPA TO-15 EPA TO- 15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Freon-114	-----	EPA TO-15	-----	-----	-----
Gasoline Range Organics (GRO) [Volatile Petroleum Hydrocarbons (VPH)]	-----	-----	EPA 8015B EPA 8015C EPA 8015D EPA 8260B EPA 8260C NW TPH-Gx MA VPH WA DOE VPH OA-1	EPA 8015B EPA 8015C EPA 8015D EPA 8260B EPA 8260C NW TPH-Gx MA VPH WA DOE VPH OA-1	EPA 8015B EPA 8015C EPA 8015D EPA 8260B EPA 8260C NW TPH-Gx MA VPH WA DOE VPH OA-1



<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
Heptane	-----	EPA TO-15	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Hexane	-----	EPA TO-15 EPA 18 mod EPA 25 mod	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
2-Hexanone	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Hexachlorobutadiene	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Hexachloroethane	-----	EPA TO-15	EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Isooctane	-----	EPA TO-15	-----	-----	-----
Isopropyl Alcohol	-----	EPA TO-15	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Isopropylbenzene	-----	EPA TO-15	EPA 624 EPA 8021B EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1	EPA 8021B EPA 8260B EPA 8260COA-1
1,4-Isopropyltoluene	-----	-----	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Methane	-----	EPA 18 mod EPA 25 mod	-----	-----	-----
Methylacrylonitrile	-----	-----	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Methyl Acetate	-----	-----	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Methyl Acrylate	-----	EPA TO-15	EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C



<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
Methyl Iodide	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Methyl Ethyl Ketone	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Methylene Chloride	-----	EPA TO-15 EPA TO- 15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Methyl Isobutyl Ketone	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Methyl Methacrylate	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Methyl tert-Butyl Ether	-----	EPA TO-15 EPA TO- 15 SIM EPA 18 mod EPA 25 mod	EPA 602 EPA 624 EPA 8021B EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1
4-Methyl-2-pentanone	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Methylcyclohexane	-----	-----	EPA 624 EPA 8260B EPA 8260C	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
2-Nitropropane	-----	-----	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Naphthalene	-----	EPA TO-15 EPA TO- 15 SIM	EPA 602 EPA 624 EPA 8021B EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1
Nitrobenzene	-----	-----	EPA 524.2 (DW)	-----	-----

<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
Octane	-----	EPA TO-15	-----	-----	-----
Pentachloroethane	-----	-----	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Pentane	-----	EPA TO-15 EPA 18 mod EPA 25 mod	-----	-----	-----
Propionitrile	-----	-----	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Propane	-----	EPA 18 mod EPA 25 mod	-----	-----	-----
Propene	-----	EPA TO-15	-----	-----	-----
n-Propylbenzene	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Styrene	-----	EPA TO-15 EPA TO- 15 SIM	EPA 602 EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
tert-Amyl Ethyl Ether	-----	-----	EPA 8260B EPA 8260C EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,1,1,2- Tetrachloroethane	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,1,2,2- Tetrachloroethane	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C

<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
Tetrachloroethene	-----	EPA TO-15 EPA TO- 15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Tetrahydrofuran	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Toluene	-----	EPA TO-15 EPA TO- 15 SIM EPA 18 mod EPA 25 mod	EPA 602 EPA 624 EPA 8021B EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1
1,2,3-Trichlorobenzene	-----	-----	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,2,4-Trichlorobenzene	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,1,1-Trichloroethane	-----	EPA TO-15 EPA TO- 15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,1,2-Trichloroethane	-----	EPA TO-15 EPA TO- 15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Trichloroethene	-----	EPA TO-15 EPA TO- 15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Trichlorofluoromethane	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C

<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
1,2,3-Trichloropropane	-----	EPA TO-15 EPA TO- 15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,2,4-Trimethylbenzene	-----	EPA TO-15 EPA TO- 15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,3,5-Trimethylbenzene	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Vinyl Acetate	-----	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Vinyl Chloride	-----	EPA TO-15 EPA TO- 15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Xylenes, total	-----	EPA TO-15 EPA TO- 15 SIM EPA 18 mod EPA 25 mod	EPA 602 EPA 624 EPA 8021B EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1
1,2-Xylene	-----	EPA TO-15 EPA TO- 15 SIM	EPA 602 EPA 624 EPA 8021B EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1
1,3-Xylene	-----	EPA TO-15 EPA TO- 15 SIM	EPA 602 EPA 624 EPA 8021B EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1

<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
1,4-Xylene	-----	EPA TO-15 EPA TO- 15 SIM	EPA 602 EPA 624 EPA 8021B EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1
Extractable Organics (Semivolatiles)					
Organic Extraction	EPA 3540C EPA 3546 EPA 3550B EPA 3550C	-----	EPA 3510C EPA 3511	EPA 3510C EPA 3511	EPA 3540C EPA 3546 EPA 3550B EPA 3550C
Acenaphthene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	-----	EPA 625 EPA 8270C EPA 8270C SIM EPA 8270D EPA 8270D SIM	EPA 8270C EPA 8270C SIM EPA 8270D EPA 8270D SIM	EPA 8270C EPA 8270C SIM EPA 8270D EPA 8270D SIM
Acenaphthylene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	-----	EPA 625 EPA 8270C EPA 8270C SIM EPA 8270D EPA 8270D SIM	EPA 8270C EPA 8270C SIM EPA 8270D EPA 8270D SIM	EPA 8270C EPA 8270C SIM EPA 8270D EPA 8270D SIM
Acetic Acid	-----	-----	EPA 8015B EPA 8015D	EPA 8015B EPA 8015D	-----
Acetophenone	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
2-Acetylaminofluorene	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Alkylated PAHs	EPA 8270C SIM EPA 8270D SIM	-----	EPA 8270C SIM EPA 8270D SIM	EPA 8270C SIM EPA 8270D SIM	EPA 8270C SIM EPA 8270D SIM
4-Aminobiphenyl	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
2-Amino-4,6- dinitrotoluene	-----	-----	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B
4-Amino-2,6- dinitrotoluene	-----	-----	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B
Aniline	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D



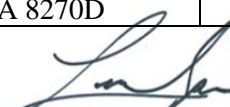
<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
Anthracene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	-----	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
Atrazine	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Benzaldehyde	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Benzidine	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Benzoic Acid	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Benzo (a) Anthracene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	-----	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
Benzo (b) Fluoranthene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	-----	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
Benzo (k) Fluoranthene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	-----	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
Benzo (ghi) Perylene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	-----	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
Benzo (a) Pyrene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	-----	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM

<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
Benzo (e) Pyrene	EPA 8270C SIM EPA 8270D SIM	-----	EPA 8270C SIM EPA 8270D SIM	EPA 8270C SIM EPA 8270D SIM	EPA 8270C SIM EPA 8270D SIM
Benzyl Alcohol	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Biphenyl	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
bis (2-chloroethoxy) Methane	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
bis (2-chloroethoxy) Ether	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
bis (2-chloroethyl) Ether	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM	EPA 8270C EPA 8270D EPA 8270 C SIM	EPA 8270C EPA 8270D
bis (2-chloroisopropyl) Ether	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
bis (2-ethylhexyl) Phthalate	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	-----	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
4-Bromophenylphenyl Ether	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Butyl Benzyl Phthalate	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM	EPA 8270C EPA 8270D EPA 8270C SIM	EPA 8270C EPA 8270D
Butyric Acid	-----	-----	EPA 8015B EPA 8015D	EPA 8015B EPA 8015D	-----
Caprolactam	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Carbazole	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Carbon Range Organics C8-C44 (including subsets of this range i.e. HRO, MRO, ORO, RRO)	-----	-----	EPA 8015B EPA 8015C EPA 8015D EPA 8270C TN EPH	EPA 8015B EPA 8015C EPA 8015D EPA 8270C TN EPH	EPA 8015B EPA 8015C EPA 8015D EPA 8270C TN EPH



<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
4-Chloroaniline	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
4-Chloro-3-methylphenol	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Chlorobenzilate	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
1-Chloronaphthalene	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
2-Chloronaphthalene	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
2-Chlorophenol	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
4-Chlorophenyl Phenyl Ether	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Chrysene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	-----	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
Citric Acid	-----	-----	EPA 8015B EPA 8015D	EPA 8015B EPA 8015D	-----
Cresols (Methyl Phenols)	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
cis-/trans-Diallate	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
2,4-Diamino-6-nitrotoluene	-----	-----	EPA 8330B	EPA 8330B	EPA 8330B
2,6-Diamino-4-nitrotoluene	-----	-----	EPA 8330B	EPA 8330B	EPA 8330B
Dibenzo (a,h) Acridine	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Dibenzo (a,h) Anthracene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	-----	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
Dibenzofuran	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270D SIM

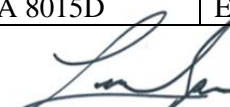
<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
Dibenzothiophene	EPA 8270C SIM EPA 8270D SIM	-----	EPA 8270C SIM EPA 8270D SIM	EPA 8270C SIM EPA 8270D SIM	EPA 8270C SIM EPA 8270D SIM
1,2-Dichlorobenzene	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
1,3-Dichlorobenzene	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
1,4-Dichlorobenzene	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
3,3'-Dichlorobenzidine	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Diesel Range Organics (DRO) [Extractable Petroleum Hydrocarbons (EPH)]	-----	-----	EPA 8015B EPA 8015C EPA 8015D EPA 8270C CT ETPH MA EPH NWTPH DX NJ EPH TX1005/ TX1006 WADOE EPH OA-2	EPA 8015B EPA 8015C EPA 8015D EPA 8270C CT ETPH MA EPH NWTPH DX NJ EPH TX1005/ TX1006 WADOE EPH OA-2	EPA 8015B EPA 8015C EPA 8015D EPA 8270C CT ETPH MA EPH NWTPH DX NJ EPH TX1005/ TX1006 WADOE EPH OA-2
2,4-Dichlorophenol	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
2,6-Dichlorophenol	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Diethyl Phthalate	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Dimethoate	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
p- Dimethylaminoazobenze	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
7,12-Dimethylbenz (a) Anthracene	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
alpha-,alpha- Dimethyphenethylamine	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
2,4-Dimethylphenol	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D



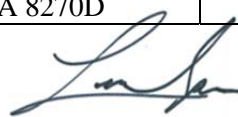
<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
Dimethyl Phthalate	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
3,3'-Dimethylbenzidine	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Di-n-butyl Phthalate	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM	EPA 8270C EPA 8270D EPA 8270C SIM	EPA 8270C EPA 8270D
Di-n-octyl Phthalate	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
3,5-Dinitroaniline	-----	-----	EPA 8330B	EPA 8330B	EPA 8330B
1,3-Dinitrobenzene	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D EPA 8330 EPA 8330A EPA 8330B	EPA 8270C EPA 8270D EPA 8330 EPA 8330A EPA 8330B	EPA 8270C EPA 8270D EPA 8330 EPA 8330A EPA 8330B
2,4-Dinitrophenol	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
2,4-Dinitrotoluene	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D EPA 8330 EPA 8330A EPA 8330B	EPA 8270C EPA 8270D EPA 8330 EPA 8330A EPA 8330B	EPA 8270C EPA 8270D EPA 8330 EPA 8330A EPA 8330B
2,6-Dinitrotoluene	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D EPA 8330 EPA 8330A EPA 8330B	EPA 8270C EPA 8270D EPA 8330 EPA 8330A EPA 8330B	EPA 8270C EPA 8270D EPA 8330 EPA 8330A EPA 8330B
1,4-Dioxane	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	-----	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
Diphenylamine	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Diphenyl Ether	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
1,2-Diphenylhydrazine	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D



<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
Ethyl Methane Sulfonate	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Fluoroanthene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	-----	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
Fluorene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	-----	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
Formic Acid	-----	-----	EPA 8015B EPA 8015D	EPA 8015B EPA 8015D	-----
Hexachlorobenzene	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM	EPA 8270C EPA 8270D EPA 8270C SIM	EPA 8270C EPA 8270D
Hexachlorobutadiene	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Hexachlorocyclo- Pentadiene	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Hexachloroethane	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Hexachloropropene	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Hexahydro-1,3,5- trinitro-1,3,5-triazine (RDX)	-----	-----	EPA 8330 EPA 8330A <u>EPA 8330B</u>	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B
Indeno (1,2,3-cd) Pyrene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	-----	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
Isodrin	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Isophorone	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Isosafrole	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Isobutyric Acid	-----	-----	EPA 8015B EPA 8015D	EPA 8015B EPA 8015D	-----



<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
Lactic Acid	-----	-----	EPA 8015B EPA 8015D	EPA 8015B EPA 8015D	-----
Methapyriline	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
3-Methycholanthrene	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
2-Methyl-4,6-dinitrophenol	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Methyl Methane Sulfonate	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
1-Methylnaphthalene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	-----	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
2-Methylnaphthalene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	-----	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270C SIM EPA 8270D SIMEPA 8270D	EPA 8270C EPA 8270C SIM EPA 8270D SIM EPA 8270D
2-Methylphenol	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
4-Methylphenol	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Naphthalene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	-----	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
1,4-Naphthoquinone	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
1-Naphthylamine	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
2-Naphthylamine	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
4-Nitroquinoline-1-oxide	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
2-Nitroaniline	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
3-Nitroaniline	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D



<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
4-Nitroaniline	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Nitrobenzene	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D EPA 8330 EPA 8330A EPA 8330B	EPA 8270C EPA 8270D EPA 8330 EPA 8330A EPA 8330B	EPA 8270C EPA 8270D EPA 8330 EPA 8330A EPA 8330B
Nitroglycerin	-----	-----	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B
2-Nitrophenol	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
4-Nitrophenol	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
2-Nitrotoluene	-----	-----	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B
3-Nitrotoluene	-----	-----	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B
4-Nitrotoluene	-----	-----	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B
5-Nitro-o-toluidine	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
n-Nitroso-di-n-butylamine	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
n-Nitrosodiethylamine	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
n-Nitrosodimethylamine	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
n-Nitrosodimethylethylamine	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
n-Nitrosomorpholine	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
n-Nitrosodi-n-propylamine	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D



<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
n-Nitrosodiphenylamine	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
n-Nitrosopiperidine	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
n-Nitrosopyrrolidine	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	-----	-----	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B
Oxalic Acid	-----	-----	EPA 8015B EPA 8015D	EPA 8015B EPA 8015D	-----
2,2-Oxybis (1-chloropropane)	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Pentachlorobenzene	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Pentachloronitrobenzene	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Pentachlorophenol	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Pentaerythritol Tetranitrate (PETN)	-----	-----	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B
Perylene	EPA 8270C SIM EPA 8270D SIM	-----	EPA 8270C SIM EPA 8270D SIM	EPA 8270C SIM EPA 8270D SIM	EPA 8270C SIM EPA 8270D SIM
Petroleum Range Organics	-----	-----	FLPRO	FLPRO	FLPRO
Phenacetin	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Phenanthrene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	-----	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
Phenol	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
1,4-Phenylenediamine	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
2-Picoline	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Pronamide	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D



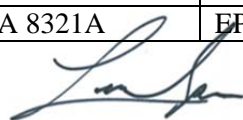
<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
Propionic Acid	-----	-----	EPA 8015B EPA 8015D	EPA 8015B EPA 8015D	-----
Pyrene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	-----	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
Pyridine	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Pyruvic Acid	-----	-----	EPA 8015B EPA 8015D	EPA 8015B EPA 8015D	-----
Quinic Acid	-----	-----	EPA 8015B EPA 8015D	EPA 8015B EPA 8015D	-----
Succinic Acid	-----	-----	EPA 8015B EPA 8015D	EPA 8015B EPA 8015D	-----
Tartaric Acid	-----	-----	EPA 8015B EPA 8015D	EPA 8015B EPA 8015D	-----
Safrole	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
1,2,4,5- Tetrachlorobenzene	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
2,3,4,6- Tetrachlorophenol	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Tetraethyl Dithiopyrophosphate	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Tetraethyl Lead	-----	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Tetramethyl Lead	-----	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	-----
Tetryl	-----	-----	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B
Thionazin	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
o-Toluidine	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
1,2,4-Trichlorobenzene	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
1,3,5-Trinitrobenzene	-----	-----	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B



<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
2,4,5-Trichlorophenol	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
2,4,6-Trichlorophenol	EPA 8270C EPA 8270D	-----	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
O,O,O-Tri-ethylphosphorothioate	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
1,3,5-Trinitrobenzene	EPA 8270C EPA 8270D	-----	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
2,4,6-Trinitrotoluene	-----	-----	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B
Pesticides/Herbicides/ PCBs					
Organic Extraction	EPA 3540C EPA 3546 EPA 3550B EPA 3550C	-----	EPA 3510C EPA 3511	EPA 3510C EPA 3511	EPA 3540C EPA 3546 EPA 3550B EPA 3550C
Acifluorfen	-----	-----	EPA 8151A	EPA 8151A	EPA 8151A
Aldrin	EPA 8081A EPA 8081B	-----	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Azinphos Methyl (Guthion)	-----	-----	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
alpha-BHC	EPA 8081A EPA 8081B	-----	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
beta-BHC	EPA 8081A EPA 8081B	-----	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
delta-BHC	EPA 8081A EPA 8081B	-----	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
gamma-BHC (Lindane)	EPA 8081A EPA 8081B	-----	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Bentazon	-----	-----	EPA 8151A	EPA 8151A	EPA 8151A
Bolstar	-----	-----	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
alpha-Chlordane	EPA 8081A EPA 8081B	-----	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Chloramben	-----	-----	EPA 8151A	EPA 8151A	EPA 8151A
Chlordane (technical)	EPA 8081A EPA 8081B	-----	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B



<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
Chlorobenzilate	-----	-----	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Chlorpyrifos	-----	-----	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
Coumaphos	-----	-----	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
2,4-D	EPA 8151A	-----	EPA 8151A	EPA 8151A	EPA 8151A
2,4'-DDD	EPA 8081A EPA 8081B	-----	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
2,4'-DDE	EPA 8081A EPA 8081B	-----	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
2,4'-DDT	EPA 8081A EPA 8081B	-----	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Dalapon	EPA 8151A	-----	EPA 8151A	EPA 8151A	EPA 8151A
2,4-DB	EPA 8151A	-----	EPA 8151A	EPA 8151A	EPA 8151A
4,4'-DDD	EPA 8081A EPA 8081B	-----	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
4,4'-DDE	EPA 8081A EPA 8081B	-----	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
4,4'-DDT	EPA 8081A EPA 8081B	-----	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Demeton-O	-----	-----	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
Demeton-S	-----	-----	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
Diallate	-----	-----	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Diazinon	-----	-----	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
1,2-Dibromo-3-chloropropane (DBCP)	-----	-----	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Dicamba	EPA 8151A	-----	EPA 8151A	EPA 8151A	EPA 8151A
3,5-Dichlorobenzoic acid	-----	-----	EPA 8151A	EPA 8151A	EPA 8151A
Dichlorvos	-----	-----	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
Dichloroprop	EPA 8151A	-----	EPA 8151A	EPA 8151A	EPA 8151A
Dieldrin	EPA 8081A EPA 8081B	-----	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Dinoseb	EPA 8151A	-----	EPA 8151A EPA 8270C EPA 8270D	EPA 8151A EPA 8270C EPA 8270D	EPA 8151A EPA 8270C EPA 8270D
Disulfoton	-----	-----	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
Diuron	-----	-----	EPA 8321A	EPA 8321A	EPA 8321A



<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
Endosulfan I (alpha)	EPA 8081A EPA 8081B	-----	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Endosulfan II (beta)	EPA 8081A EPA 8081B	-----	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Endosulfan Sulfate	EPA 8081A EPA 8081B	-----	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Endrin	EPA 8081A EPA 8081B	-----	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Endrin Aldehyde	EPA 8081A EPA 8081B	-----	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Endrin Ketone	EPA 8081A EPA 8081B	-----	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Ethion	-----	-----	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
Ethoprop	-----	-----	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
Fensulfothion	-----	-----	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
Fenthion	-----	-----	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
Fenuron	-----	-----	EPA 8321A	EPA 8321A	EPA 8321A
Gamma-Chlordane	EPA 8081A EPA 8081B	-----	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Heptachlor	EPA 8081A EPA 8081B	-----	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Heptachlor Epoxide	EPA 8081A EPA 8081B	-----	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Hexachlorobenzene	EPA 8081A EPA 8081B	-----	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Hexachlorocyclopentadiene	-----	-----	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Isodrin	-----	-----	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Malathion	-----	-----	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
MCPA	EPA 8151A	-----	EPA 8151A	EPA 8151A	EPA 8151A
MCPP	EPA 8151A	-----	EPA 8151A	EPA 8151A	EPA 8151A
Merphos	-----	-----	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B

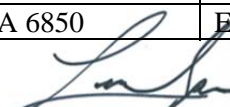
<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
Methoxychlor	EPA 8081A EPA 8081B	-----	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Mevinphos	-----	-----	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
Mirex	EPA 8081A EPA 8081B	-----	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Parathion Ethyl	-----	-----	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
Parathion Methyl	-----	-----	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
PCB-1016 (Arochlor)	EPA 8082 EPA 8082A	-----	EPA 608 EPA 8082 EPA 8082A	EPA 8082 EPA 8082A	EPA 8082 EPA 8082A
PCB-1221	EPA 8082 EPA 8082A	-----	EPA 608 EPA 8082 EPA 8082A	EPA 8082 EPA 8082A	EPA 8082 EPA 8082A
PCB-1232	EPA 8082 EPA 8082A	-----	EPA 608 EPA 8082 EPA 8082A	EPA 8082 EPA 8082A	EPA 8082 EPA 8082A
PCB-1242	EPA 8082 EPA 8082A	-----	EPA 608 EPA 8082 EPA 8082A	EPA 8082 EPA 8082A	EPA 8082 EPA 8082A
PCB-1248	EPA 8082 EPA 8082A	-----	EPA 608 EPA 8082 EPA 8082A	EPA 8082 EPA 8082A	EPA 8082 EPA 8082A
PCB-1254	EPA 8082 EPA 8082A	-----	EPA 608 EPA 8082 EPA 8082A	EPA 8082 EPA 8082A	EPA 8082 EPA 8082A
PCB-1260	EPA 8082 EPA 8082A	-----	EPA 608 EPA 8082 EPA 8082A	EPA 8082 EPA 8082A	EPA 8082 EPA 8082A
PCB-1262	EPA 8082 EPA 8082A	-----	EPA 608 EPA 8082 EPA 8082A	EPA 8082 EPA 8082A	EPA 8082 EPA 8082A
PCB-1268	EPA 8082 EPA 8082A	-----	EPA 608 EPA 8082 EPA 8082A	EPA 8082 EPA 8082A	EPA 8082 EPA 8082A
Aroclor 5432	-----	-----	EPA 8082 EPA 8082A	EPA 8082 EPA 8082A	EPA 8082 EPA 8082A
Aroclor 5442	-----	-----	EPA 8082 EPA 8082A	EPA 8082 EPA 8082A	EPA 8082 EPA 8082A
Aroclor 5460	-----	-----	EPA 8082 EPA 8082A	EPA 8082 EPA 8082A	EPA 8082 EPA 8082A
PCB Congeners (209)	EPA 1668	-----	EPA 1668A EPA 1668C	EPA 1668A EPA 1668C	EPA 1668A EPA 1668C
Pentachlorophenol (PCP)	EPA 8151A	-----	EPA 8151A	EPA 8151A	EPA 8151A



<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
Phorate	-----	-----	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
Picloram	-----	-----	EPA 8151A	EPA 8151A	EPA 8151A
Simazine	-----	-----	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
Stirophos (Tetrachlorvinphos)	-----	-----	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
2,4,5-T	EPA 8151A	-----	EPA 8151A	EPA 8151A	EPA 8151A
Tokuthion (Prothiofos)	-----	-----	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
2,4,5-TP (Silvex)	EPA 8151A	-----	EPA 8151A	EPA 8151A	EPA 8151A
Toxaphene	EPA 8081A EPA 8081B	-----	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Trichloronate	-----	-----	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
PCB Homologues					
Monochlorobiphenyls	-----	-----	EPA 680	EPA 680	EPA 680
Dichlorobiphenyls	-----	-----	EPA 680	EPA 680	EPA 680
Trichlorobiphenyls	-----	-----	EPA 680	EPA 680	EPA 680
Tetrachlorobiphenyls	-----	-----	EPA 680	EPA 680	EPA 680
Pentachlorobiphenyls	-----	-----	EPA 680	EPA 680	EPA 680
Hexachlorobiphenyls	-----	-----	EPA 680	EPA 680	EPA 680
Heptachlorobiphenyls	-----	-----	EPA 680	EPA 680	EPA 680
Octachlorobiphenyls	-----	-----	EPA 680	EPA 680	EPA 680
Nonachlorobiphenyls	-----	-----	EPA 680	EPA 680	EPA 680
Decachlorobiphenyls	-----	-----	EPA 680	EPA 680	EPA 680
Dioxins/Furans					
2,3,7,8-TCDD	EPA 1613B EPA 8290A	-----	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
2,3,7,8-TCDF	EPA 1613B EPA 8290A	-----	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
1,2,3,7,8-PeCDF	EPA 1613B EPA 8290A	-----	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
2,3,4,7,8-PeCDF	EPA 1613B EPA 8290A	-----	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
1,2,3,7,8-PeCDD	EPA 1613B EPA 8290A	-----	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
1,2,3,4,7,8-HxCDF	EPA 1613B EPA 8290A	-----	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
1,2,3,6,7,8-HxCDF	EPA 1613B EPA 8290A	-----	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
2,3,4,6,7,8-HxCDF	EPA 1613B EPA 8290A	-----	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
1,2,3,7,8,9-HxCDF	EPA 1613B EPA 8290A	-----	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A



<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
1,2,3,4,7,8,-HxCDD	EPA 1613B EPA 8290A	-----	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
1,2,3,6,7,8-HxCDD	EPA 1613B EPA 8290A	-----	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
1,2,3,7,8,9-HxCDD	EPA 1613B EPA 8290A	-----	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
1,2,3,4,6,7,8-HpCDF	EPA 1613B EPA 8290A	-----	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
1,2,3,4,7,8,9-HpCDF	EPA 1613B EPA 8290A	-----	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
1,2,3,4,6,7,8-HpCDD	EPA 1613B EPA 8290A	-----	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
OCDF	EPA 1613B EPA 8290A	-----	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
OCDD	EPA 1613B EPA 8290A	-----	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
Total HpCDD	EPA 1613B EPA 8290A	-----	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
Total HpCDF	EPA 1613B EPA 8290A	-----	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
Total HxCDD	EPA 1613B EPA 8290A	-----	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
Total HxCDF	EPA 1613B EPA 8290A	-----	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
Total PeCDD	EPA 1613B EPA 8290A	-----	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
Total PeCDF	EPA 1613B EPA 8290A	-----	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
Total TCDD	EPA 1613B EPA 8290A	-----	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
Total TCDF	EPA 1613B EPA 8290A	-----	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
Misc. Headspace Analysis					
Carbon Dioxide	-----	-----	RSK-175	RSK-175	-----
Ethane	-----	-----	RSK-175	RSK-175	-----
Ethene	-----	-----	RSK-175	RSK-175	-----
Methane	-----	-----	RSK-175	RSK-175	-----
Hazardous Waste Characteristics					
Toxicity Characteristic Leaching Procedure	-----	-----	-----	EPA 1311	EPA 1311
Synthetic Precipitation Leaching Procedure	-----	-----	-----	EPA 1312	EPA 1312
Other					
Perchlorate	-----	-----	EPA 6850	EPA 6850	EPA 6850

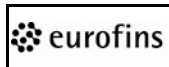


<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
Hydrazine	-----	-----	EPA 8315A MOD	EPA 8315A MOD	EPA 8315A MOD
Formaldehyde	-----	-----	-----	EPA 8315A	EPA 8315A
Methylhydrazine	-----	-----	EPA 8315A MOD	EPA 8315A MOD	EPA 8315A MOD
1,1-Dimethylhydrazine	-----	-----	EPA 8315A MOD	EPA 8315A MOD	EPA 8315A MOD
Volatile Preparation	-----	-----	EPA 5030A EPA 5030B	EPA 5030A EPA 5030B	EPA 5035 EPA 5035A
Organic Extraction	EPA 3540C EPA 3546 EPA 3550B EPA 3550C	-----	EPA 3510C EPA 3511	EPA 3510C EPA 3511	EPA 3540C EPA 3546 EPA 3550B EPA 3550C
Perfluorinated Alkyl Acids (PFAAs)					
<u>N-ethyl perfluorooctane- sulfonamidoacetic Acid (NEtFOSAA)</u>	-----	-----	EPA 537 / 537 MOD (DW and NPW)	EPA537 MOD	-----
<u>N-methyl perfluorooctane- sulfonamidoacetic Acid (NMeFOSAA)</u>	-----	-----	EPA 537 / 537 MOD (DW and NPW)	EPA537 MOD	-----
<u>Perfluorobutanesulfonate</u>	-----	-----	EPA 537 / 537 MOD (DW and NPW)	EPA 537 MOD	EPA 537 MOD
<u>Perfluorodecanoic Acid</u>	-----	-----	EPA 537 / 537 MOD (DW and NPW)	EPA 537 MOD	EPA 537 MOD
<u>Perfluorododecanoic Acid</u>	-----	-----	EPA 537 / 537 MOD (DW and NPW)	EPA 537 MOD	EPA 537 MOD
<u>Perfluoroheptanoic Acid</u>	-----	-----	EPA 537 / 537 MOD (DW and NPW)	EPA 537 MOD	EPA 537 MOD
<u>Perfluorohexanesulfonate</u>	-----	-----	EPA 537 / 537 MOD (DW and NPW)	EPA 537 MOD	EPA 537 MOD
<u>Perfluorohexanoic Acid</u>	-----	-----	EPA 537 / 537 MOD (DW and NPW)	EPA 537 MOD	EPA 537 MOD
<u>Perfluorononanoic Acid</u>	-----	-----	EPA 537 / 537 MOD (DW and NPW)	EPA 537 MOD	EPA 537 MOD
<u>Perfluoro- Octanesulfonate</u>	-----	-----	EPA 537 / 537 MOD (DW and NPW)	EPA 537 MOD	EPA 537 MOD

<u>Parameter/Analyte</u>	<u>Tissue</u>	<u>Air</u>	<u>Nonpotable Water (*DW)</u>	<u>Solid Hazardous Waste</u>	
				<u>Aqueous</u>	<u>Solid</u>
<u>Perfluorooctanoic Acid</u>	-----	-----	EPA 537 / 537 MOD (DW and NPW)	EPA 537 MOD	EPA 537 MOD
<u>Perfluorotetradecanoic Acid</u>	-----	-----	EPA 537 / 537 MOD (DW and NPW)	EPA 537 MOD	EPA 537 MOD
<u>Perfluorotridecanoic Acid</u>	-----	-----	EPA 537 / 537 MOD (DW and NPW)	EPA 537 MOD	EPA 537 MOD
<u>Perfluoroundecanoic Acid</u>	-----	-----	EPA 537 / 537 MOD (DW and NPW)	EPA 537 MOD	EPA 537 MOD
<u>8:2 Fluorotelomersulfonate</u>	-----	-----	EPA 537 / 537 MOD	EPA 537 MOD	-----

* DW noted in parenthesis for drinking water method

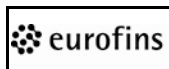


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Environmental Quality Policy Manual

Eurofins Lancaster Laboratories Environmental, LLC

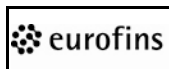
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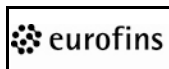
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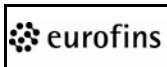
Revision Log:

Revision: 13		Effective Date:	This version
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Throughout Document	Reflect re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers	
Title Page	Regulatory compliance	Added text for address, phone, reviewer/approver titles (previously listed on hardcopy covers and pre-EtQ versions)	
Section 1	Updated training requirements	Removed requirement for all employees to read the appendices, they are available as resources; required for dept 4052 only.	
Section 1.2	Regulatory compliance	Inserted additional ISO17025 text at opening and closing of Quality Policy Statement	
Section 2.1.1	New Section	Summarize processes to ensure business continuity and contingency plans	
Section 2.2	Reflect current structure	Moved summation of technical director and QA manager to this section; changed employee responsible for daily operation from COB to VP. Throughout document, clarified management structure to include VP.	
Section 2.6	Added process	Added ability for management and/or QA to issue a stop work notice.	
Section 2.16	Regulatory compliance	Inserted additional ISO17025 text regarding ensuring impartiality, operation integrity, etc.	
Section 3	Added building	Added building D	
Section 4.2	Clarification	Noted that interim amendments to controlled procedures are not allowed.	
Section 5.5	Added information	Noted that minimum sample retention period is 2 weeks form reporting	
Section 6.4	Clarification	Standardized use or the terminology for equipment (supporting units) vs instruments (data producing units)	
Section 6.5.1.9	New section	Added to address passwords and audit trails for systems used to process electronic data	
Section 6.5.2	Clarification	Clarified SDLC processes	
Section 8.1	Added information	Added reference to laboratory website for all current accreditation records	
Section 10.2	Added information	Added information regarding electronic data, signatures, and audit trails	
Section 10.4	Regulatory compliance	Added DoD reporting requirements for DL, LOD, LOQ	
Section 10.5	Clarification	Clarified process and intent of data review	
Section 10.7	Updated process	Added process for identification of accreditation status Noted use of LlabWeb for secure data transfer	
Section 12.1	Added process	Added ability for management and/or QA to issue a stop work notice.	
Section 12.4	Clarification, new process	Clarified processes that address preventive action; changed "PPI" to "Lean"	
Section 13.2	Clarification	Added detail on project evaluations	
13.4	Added detail	Added information regarding the subcontractor warranty and the need to ensure subcontractor can meet accreditation requirements	
Appendices A-J	Updated for current information	Updated to reflect current SOPs, personnel, methods, etc.	

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Revision: 12		Effective Date: Jul 29, 2013
Section	Justification	Changes
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version
Throughout Document	Reflect re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers
Section 1.1	Not required	Deleted "Our Unique Promise of Value" statement
Section 2.1	Reflect current organization	Added new company name and incorporation state
Section 2.3.1	Detail	Added section to describe the responsibilities of the technical director.
Section 2.5	Document Consolidation	Added language consistent with SOP-QC-024 so that procedure can be inactivated.
Section 4.2	Document Consolidation	Added language from SOP-QC-024 regarding QA's signature so that procedure can be inactivated.
Sections 5.3 and 5.6	Document Consolidation	Added information from LOM-SOP-ES-212 so that procedure can be inactivated.
	Clarification	Added information to clarify the difference between and LSAR and a legal chain of custody.
Section 9	Document Consolidation	Added information from LOM-SOP-ES-213 so that procedure can be inactivated.
Section 10.4	Enhancement	Added definition and detail for LOD (Limit of Detection)

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INTRODUCTION

This *Quality Policy Manual* is based upon Eurofins Lancaster Laboratories Environmental LLC's (herein referred to as the laboratory) overall business and management philosophies, mission, and goals. This manual is written to present the policies employed by the laboratory as well as the support departments that serve the environmental laboratories and to comply with the requirements of the National Environmental Laboratory Accreditation Program, ISO 17025, and the Department of Defense (DoD). These policies define the "what" we do with emphasis on management's responsibilities and commitment to quality. Governing SOPs are in place within the organization, to ensure the proper execution of this policy document (refer to Appendix A). This manual is required reading for laboratory personnel. The appendices are available resources to all personnel but are not required reading for all employees. The most recent and up-to-date *Quality Policy Manual* and all referenced documents are available to all laboratory personnel who work in or support the laboratory. The laboratory actively strives for continuous improvement of its quality systems to better serve our clients.

1.1. Mission Statement

The laboratory offers analytical and consulting services in the chemical and biological sciences with comprehensive expertise in environmental laboratory applications. The company mission statement describes the corporate philosophy:

At Eurofins Lancaster Laboratories, Environmental LLC we are people working together to serve the health and environmental needs of society through science and technology. We strive to be the recognized leader in all that we do.

Our mission is to provide independent laboratory services in the chemical and biological sciences with excellent quality and service. As a corporate community, we:

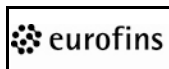
- Deliver quality by fully understanding and always meeting the requirements of those we serve.
- Live our values by relating to our clients, coworkers, shareholders, suppliers, and community in a fair and ethical manner.
- Manage our growth and financial resources so we can serve our clients well, provide a satisfactory return to shareholders, and maintain our meaningful and enriching workplace.

1.2. Quality Policy

The Executive Management Group recognizes quality as a key element of the laboratory's standard of service. The group supports the laboratory's commitment to quality as defined by NELAP, ISO 17025, DoD, and other regulatory agencies (i.e. states) through the strict adherence to the Quality Policy Statement. The Quality Assurance Manager wrote the Quality Policy Statement, with final approval from the laboratory Vice-President. The policy can not be revised without their approval.

The Quality Policy Statement gives employees clear requirements for the production of analytical data. Employees are trained on the components of the Quality Policy Statement during their first day of orientation. Each employee signs the statement upon hire as agreement to implement the policy in all aspects of their work. Employee agreement to any subsequent revisions of the statement are obtained by documented reading and understanding of and agreement to follow the Quality Manual, which contains the current version of the statement. The statement is as follows:

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As an organization, all personnel are committed to high quality professional practice, testing and data, and service to our clients.

We strive to provide the highest quality data achievable by:

- Following all documentation requirements; describing clearly and accurately all activities performed; documenting “real time” as the task is carried out; understanding that it is never acceptable to “back date” entries and should additional information be required at a later date, the actual date and by whom the notation is made must be documented.
- Providing accountability and traceability for each sample analyzed through proper sample handling, labeling, preparation, instrument calibration/qualification, analysis, and reporting; establishing an audit trail that identifies date, time, analyst, instrument used, instrument conditions, quality control samples (where appropriate and/or required by the method), and associated standard material.
- Emphasizing a total quality management process and commitment to continuous improvement which provides accuracy, and strict compliance with agency regulations and client requirements, giving the highest degree of confidence; understanding that meeting the requirements of the next employee in the work flow process is just as important as meeting the needs of the external client.
- Providing thorough documentation and explanation to qualify reported data that may not meet all requirements and specifications, but is still of use to the client; understanding this occurs only after discussion with the client on the data limitations and acceptability of this approach.
- Responding immediately to indications of questionable data, out-of-specification occurrences, equipment malfunctions, and other types of laboratory problems, with investigation and applicable corrective action; documenting these activities completely, including the reasons for the decisions made.
- Providing a work environment that ensures accessibility to all levels of management and encourages questions and expression of concern on quality issues to management.

We each take personal responsibility to provide this quality product while meeting the company's high standards of integrity and ethics, understanding that improprieties, such as failure to conduct the required test, manipulation of test procedures or data, or inaccurate documentation will not be tolerated. Intentional misrepresentation of the activities performed is considered fraud and is grounds for termination.

I understand the expectations and commit to implementation of all applicable policies and procedures and to providing quality data.

1.3. Statement of Values

As a corporate community, we embrace our heritage of integrity and strive to live by the following principles:

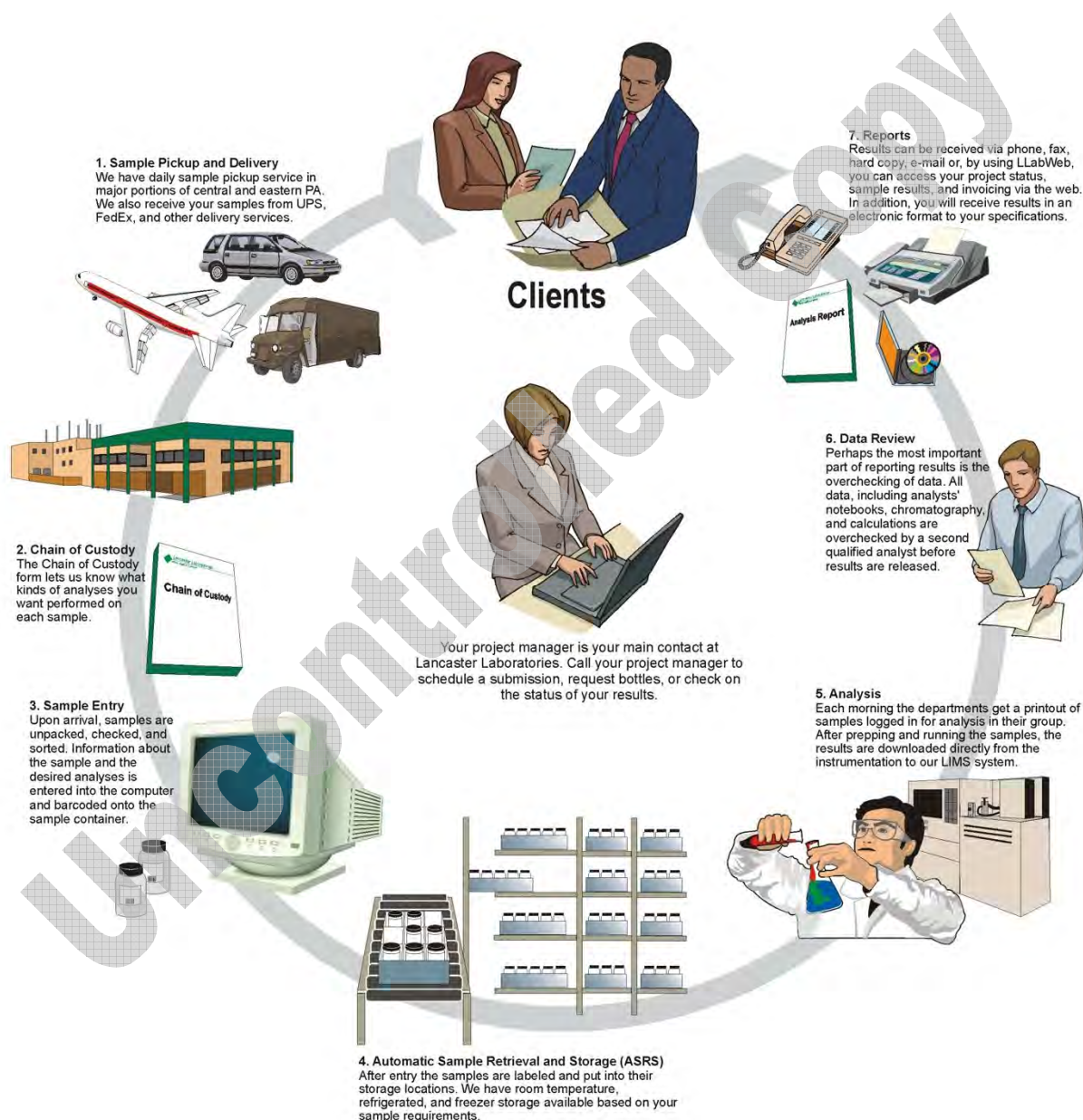
- Fairness and honesty in all our relationships
- Mutual trust
- A respect for ourselves and others
- A sense of caring that leads us to act responsibly toward each other and society, now and in the future
- Loyalty to our clients and one another
- A spirit of open-mindedness as we deal with all

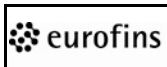
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- Dedication to service
- Good stewardship of our resources
- A commitment to flexibility and continuous improvement

We each take personal responsibility to live these values in all of our dealings, knowing full well our pledge may involve difficult choices, hard work, and courage.

1.4. Sample Flow-Through Diagram



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1.5. Certifications, Accreditations, and Registrations

Accreditation/Certification is the process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications and/or standards. It is the one generally accepted method by which a laboratory such as ours can demonstrate its capability of generating acceptable, professional, quality test results in those areas in which it claims competence. To this end, we have actively sought accreditation by organizations offering it in those areas relevant to our technical expertise. We strive to ensure that the facilities, equipment, procedures, records, and methods used by the laboratory in the testing of environmental samples are in compliance with the requirements of these standards.

Although organizations offering accreditation differ somewhat in the details of their programs, they generally evaluate laboratories in four basic areas: personnel (adequate staffing, education, training, and experience), physical facilities, instrumentation/equipment, and quality assurance program. This evaluation is performed by one or more of the following procedures: periodic on-site inspections of the laboratory by assessors experienced in technical operations, quality systems, and management; periodic analysis of proficiency test samples; and periodic updating of the laboratory's file to reflect changes in personnel, equipment, or services offered. Some states offer reciprocity with other state programs.

Appendix B lists accreditations and registrations held by the laboratory in support of environmental work. Current copies of all scopes of accreditation are kept on file in the Quality Assurance Department.

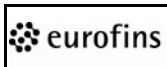
2. ORGANIZATION AND PERSONNEL

2.1. Company Overview and History

The laboratory was founded in 1961 by Dr. Earl Hess in response to a need for high quality technical services by the agricultural and industrial communities in southeastern Pennsylvania. Nourished in a culture of quality and caring about all those associated with the business, the corporation became an industry leader known for innovative business practices and people-friendly policies. The company was independently owned until the retirement of Dr. Hess in 1995. At that time, the laboratory was acquired by a publicly held company, Thermo TerraTech, Inc., a Thermo Electron company. Ownership changed in September 2000, when the laboratory was acquired by Goldner, Hawn, Johnson, and Morrison, Inc. (GHJ&M), a private equity investment firm. In August 2005, the laboratory was acquired by Fisher Scientific under their BioPharma Division. On November 9, 2006, Thermo Electron and Fisher Scientific merged to form Thermo Fisher Scientific. In April 2011, Thermo Fisher Scientific sold the laboratory to Eurofins Scientific. Effective July 1, 2013, the Pharmaceutical and Environmental Divisions were split into separate business entities and the company name became Eurofins Lancaster Laboratories Environmental, LLC. The laboratory continues to operate as an independent laboratory and is incorporated by the State of Delaware.

The laboratory provides a wide array of laboratory services to clients working in environmental industries. We strive to offer high quality technical services in the chemical and biological sciences with personal attention to client needs. These services include chemical analyses, microbiological testing, and analytical method development. We are, therefore, a technical service company and do not manufacture or distribute goods. Our "product" is accurate and timely technical information and our continued existence depends on the quality of the services we offer and efficiency with which we deliver them.

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2.1.1 Business Continuity and Contingency Plans

Various policies and practices are in place to address continuity of business and contingency plans to ensure continued operations or minimal disruption in operations should unplanned events (natural disasters, unexpected management changes, etc.) occur.

Section 2.2 of this document explains the identification of deputies for key management positions. Section 3.3 discusses the disaster recovery plan. Section 6.5 addresses the security and backup of our computer systems. Section 10.8 addresses handling of client records should the company have a change in ownership or go out of business.

2.2. Organizational Structure

The laboratory Vice-President/Technical Director, Duane Luckenbill, is responsible for the daily operations of the laboratory.

The Executive Management Group is defined as the Eurofins Environment Testing US Chairman of the Board and President and Eurofins Lancaster Laboratories Environmental, LLC Vice-President.

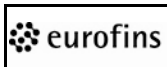
The management staff includes directors, managers and group leaders. Organizational charts are presented in Appendix C. A list of key personnel is also provided. The Vice-President and Quality Assurance (QA) Manager have identified deputies for all key management personnel.

2.2.1 Technical Director

The Technical Director ensures that the laboratory's policies and objectives for quality of testing services are documented in this quality manual. The Technical Director must assure that the manual is communicated to, understood, and implemented by all personnel concerned.

2.2.2. Quality Assurance Manager

The Quality Assurance Manager ensures that the quality system is followed at all times. The QA Manager reports directly to the Vice-President thus ensuring corrective actions to quality issues are taken promptly and are separate from business decisions. The QA Manager has no direct supervisory responsibility for the generation of technical data to avoid any conflict of interest in administering the QA program. The QA Manager has the final authority to stop work that compromises our integrity or data quality. The situation must be investigated and appropriate corrective action must be put in place before the QA Manager will authorize the resumption of work. The specific duties of the QA Manager are communicated in job plan format.

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2.3. Management Responsibilities

Laboratory management duties are outlined for supervisory personnel using a job plan format, which details each individual's responsibilities along with expected results. Typically, management duties include, but are not limited to:

- Personnel hiring and training
- Supervision of personnel
- Providing resources to ensure a work environment free from commercial, financial, and other undue pressures that may adversely affect the quality of their work
- Providing resources to ensure a safe work environment
- Directing daily work operations, including scheduling of work
- Ensuring compliance with the TNI Standards, ISO 17025, Department of Defense quality Systems Manual, state agency programs, analytical methods, and client requirements.
- Assessing laboratory capacity and workload
- Resource allocation
- Ensuring quality of data produced
- Contributing to the continuous improvement of the laboratory operation
- Ensuring that corrective actions are carried out in an appropriate and agreed time-frame.
- Communicating problems and concerns to Senior and Executive Management to enlist a higher level of support for corrections and continuous improvements.
- Maintaining awareness of technical developments and regulatory requirements

2.4. Overview of the Quality Assurance Program

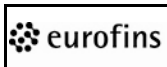
Quality Assurance (QA) is responsible for developing planned activities whose purpose is to provide assurance to all levels of management that a quality program is in place within the laboratory, and that it is functioning in an effective manner that is consistent with the requirements of NELAP, ISO 17025, DoD, and any other regulatory agencies (i.e. states) in which we hold accreditation. Although the laboratory is a wholly owned subsidiary of Eurofins Scientific, the Quality Assurance and Quality Systems operations described in this manual are specific to the Lancaster site.

The administration of the QA program is the responsibility of the QA Manager in cooperation with all levels of management.

The QA program, as directed by executive management, was established to:

- Ensure accountability, accuracy, and traceability of all analytical data generated.
- Ensure that current regulatory, agency, and client requirements are being met.
- Ensure that operating procedures are in place to minimize the possible loss, damage, and tampering with data, in addition to ensuring that raw data is stored in a secured area and is maintained by designated archivists and/or system administrators.
- Ensure that curriculum vitae (CVs) and training records are maintained to document that staff members have the necessary education, training, and experience to perform their job responsibilities and functions.
- Ensure that regulatory training is provided to applicable employees on a routine and ongoing basis.
- Ensure that all procedures are available, controlled, and current.

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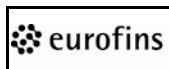
- Ensure that documentation demonstrates that procedures are carried out in a compliant and effective manner.
- Ensure that all equipment and instrumentation is qualified, maintained, and calibrated, as appropriate, in accordance with written standard operating procedures.
- Ensure that all significant laboratory problems are investigated, evaluated for root cause and corrective action is put in place as documented
- Ensure that an internal audit program is in place to provide on-going monitoring and confirm that laboratory personnel are adhering to standard operating procedures and applicable regulations.
- Ensure that quality issues are brought to the attention of management in a timely manner.

2.5 Quality Assurance Responsibilities

The QA Manager assigns tasks with input from the company Vice President. The primary responsibilities of QA include, but are not limited to the following:

- Oversee the laboratories' internal audit program which consists of various audit types and applies to all laboratory activities (technical and administrative).
- Review and approve standard operating procedures and analytical methods.
- Review and approve validation documentation.
- Review non-conforming quality control data
- Perform tracking and trending of quality measurements and report the status and effectiveness of the quality system to management.
- Approve investigation and corrective action reports (ICARs) and audit responses to ensure that they are completed in a timely manner, evaluated for root cause, and corrective actions are implemented as needed. To monitor corrective action for effectiveness.
- Host client and regulatory agencies during facility audits and follow-up to any cited deficiencies.
- Provide regulatory guidance to the laboratory and support areas.
- Monitor Good Laboratory Practice (GLP) regulatory activities.
- Communicate quality issues to management in a timely manner
- Provide and/or coordinate on-going regulatory training (e.g., GLP).
- Participate in the vendor and supplier approval process, including subcontractors.
- Review analytical data for compliance with our procedures.
- Prepare and review QA project plans (QAPPs) as required by EPA and client projects.
- Maintain and update this *Quality Policy Manual*.
- Maintenance of the Laboratory's accreditations, including but not limited to, administration of the proficiency test sample programs, both single and double blinds.
- Communicate (within 30 days) to the relevant state authorities when there are management or facility changes that impact the laboratory. Changes in the technical director must be made within 20 days.

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2.6. Communication of Quality Issues to Management

The QA Department is responsible for preparing reports to Management to keep them apprised of outstanding quality issues. Reports to management foster communication, review, and refinement of QA activities to ensure that the QA program is adequate to meet regulatory and the laboratory's quality objectives. The following reports are used to communicate quality issues and include, but are not limited to:

- Internal, client, and agency audit reports and corrective action plans
- Proficiency test reports
- Investigation and corrective action reports
- Monthly and quarterly quality status reports
- Plans for corrective action

Upon review of quality issues, management and/or QA may issue a stop work notice if an issue indicates the potential for a problem on a broader scale with an analysis. The investigation would need to be completed and the issue resolved before work could continue. The information is tracked through our Investigation and Corrective Action Report (ICAR) process.

2.7. Personnel Qualifications and Responsibilities

Full resumes and responsibilities of key personnel are provided in Appendix D.

Due to the number of analysts on staff, entry level chemists, technicians, and support personnel are not included in the resume section. However, all employees have job plans that define their responsibilities. Duties for these personnel typically include:

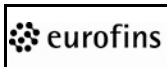
- Sample storage
- Sample preparations
- Performance of tests
- Calibration, operation, and maintenance of instruments
- Data entry
- Standard and reagent preparation
- Glassware preparation
- Data deliverables preparation

2.8. Relationship of Functional Groups and the Quality Assurance Program

In addition to this *Quality Policy Manual*, aspects of the QA program are documented in a series of standard operating procedures that support the proper execution of this document. Technical operation procedures with required quality components are also in place. A list of the titles of relevant SOPs is provided in Appendix E. There are a variety of mechanisms used to communicate requirements and verify compliance with the QA program, including:

- Management requires that all employees read and be trained in the policies and SOPs that are pertinent to their jobs.
- Employee job plans define individual responsibilities. All job plans (PMDs) include QA aspects, and performance is reviewed annually.
- Laboratory audit findings are circulated to management and require a response and follow-up to items needing corrective action.

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- Cross-functional meetings, including representatives from QA, Client Services, Marketing, management, and technical operations are held regularly to review specific projects and quality issues.

2.9. Balancing Laboratory Capacity and Workload

Evaluating laboratory capacity to perform specific projects is the responsibility of the Vice-President, laboratory directors and managers, and the Client Services director and manager. These responsibilities are documented in the individual job plans for these positions.

The laboratory facilities and staff size are very large compared to other laboratories serving the environmental industry. Many analysts are cross-trained to perform a variety of tests, and there is redundant equipment available in case of malfunctions. This minimizes the need to evaluate small and medium size projects against capacity available to complete them. Large projects are reviewed against capacity estimates before bids are submitted to ensure that the client's analysis schedule is met.

Regularly scheduled meetings are held with upper management, laboratory middle management, Client Services and QA personnel to review progress with current projects, as well as special requirements of new work scheduled for the laboratory.

Laboratory capacity and backlog is tracked on a continuous basis using information from the Laboratory Sample Information System (LIMS) including turnaround time, and work in-house.

2.10. Identification of Approved Signatories

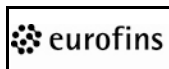
All data is reviewed and verified prior to release to the client. Based on complexity or regulatory needs, some projects are designated for secondary (technical and/or QA) review of the Analysis Reports and/or data deliverables. Approved signatories for these secondary reviews are defined in the SOP on Data Entry, Verification, and Reporting. Directors, managers, group leaders, and other designated employees (such as QA, project managers, and senior technical staff) are designated to approve/release Analysis Reports. Request for approval of an employee to approve/release reports must be made through the QA Department. These authorized personnel are designated with an asterisk in the personnel list provided in Appendix C.

2.11. Personnel Training

The experience and training received by personnel is of great importance to our clients and regulatory agencies. Curricula Vitae (CVs) and on-going training documentation are available to demonstrate how personnel have been prepared for the tasks they routinely perform. To ensure the highest quality of services at the laboratory, training programs and plans are developed to match skills with job functions. Accurate training documentation is the responsibility of both the employee and their supervisor. On a routine basis, the supervisor reviews and approves training documentation to verify that it is complete and current.

Training requirements can be met through education, prior job experience, internal and external training classes, on-the-job training, TRN training modules, procedure reading, or any combination thereof, to enable the person to perform assigned job functions and meet regulatory compliance.

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Each analyst training to perform a new analysis is required to perform an initial demonstration of capability and meet the requirements for accuracy and precision before working independently on the test method. Typically, this is accomplished by the successful analysis of four known samples. However, there are certain tests performed that are not required by the mandated test method or regulation to perform the above procedure (i.e., EPA 1010, 9095). In this case, the analyst's documentation of proficiency is satisfied by the sign-off of having read, understood, and agreed to follow the SOP as written and observation by a senior analyst.

Management personnel are responsible for planning ongoing professional growth and development activities for an employee through on-the-job training and/or internal and external training courses so an employee can maintain a current skill set to match job responsibilities.

An annual performance review based on job accountabilities, objective measures, and pre-defined standards is completed by management personnel for each employee. This assessment is documented and maintained. Input is obtained from other managerial personnel as needed.

2.11.1. New Hire Training

New employees are oriented as part of a year-long process that is designed to make the employee feel welcome and comfortable by defining our culture, traditions, philosophies, and work practices. During the orientation process an employee learns about personnel and safety policies and business strategies in addition to quality, ethics, and customer satisfaction expectations through a formal process administered by our Human Resources Department.

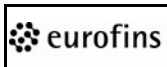
New employees are required to attend "core" technical orientation, as applicable, which can entail the participation in training module exercises, short session attendance, and/or other skill training specific to their assigned department or job function. Additional job-specific training required for an employee is based upon their assigned duties and is identified by their supervisor. Technical orientation occurs during the first few weeks of employment.

The orientation process is designed to enable employees to initiate and take responsibility for their personal and professional career growth at the laboratory. The orientation process is conducted without regard to employee race, color, creed, national origin, sex, age, or disability in accordance with the laboratory's Employee Equal Opportunity (EEO) policy.

2.11.2. Ongoing Training

Refresher and ongoing training occurs through various means, which include but are not limited to, training in or independently review new/updated standard operating procedures and TRN training procedures; on-going regulatory training; in-house or off-site classes or seminars. The goal of this training is to ensure that employees remain current with changes to laboratory systems and practices, as applicable to their job function. Retraining and re-qualification activities occur as directed by procedures or regulations. Employees are retrained if an issue or investigation warrants that retraining is a necessary corrective action. Management directs when employee re-training is required, and the extent of the re-training.

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2.12. Regulatory Training

The QA Department is responsible for coordinating and conducting initial and ongoing regulatory training (i.e., GLP) for all applicable laboratory and support personnel. It is the responsibility of management within each department to ensure that personnel attend the required training sessions.

The choice of training format and topics covered for ongoing regulatory training is left to the discretion of QA and the trainer. All training sessions reinforce the concepts in the regulations as they are relevant to the laboratory.

Whenever possible, after training is completed, a demonstration of proficiency of the training topic is given. The demonstration of proficiency is generally in the form of a quiz although other demonstrations of proficiency are acceptable depending on the scope and content of the training. If necessary, training is presented and/or repeated one-on-one with individuals who do not demonstrate proficiency in the training topic. This is performed by QA in conjunction with applicable laboratory management personnel.

2.13. Employee Safety

The laboratory, being mindful of its responsibilities as an employer and active corporate citizen, has established the following objectives of its safety program:

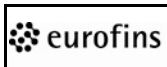
- Provide a safe environment for its employees, visitors, and the community surrounding its place of business.
- Provide ongoing safety training for employees.
- Provide all necessary facilities and equipment to ensure the safety of its employees and to minimize all chemical exposure during the normal performance of their required tasks, and to take all necessary precautions to safeguard the surrounding environment.
- Provide periodic health physicals for employees.
- Foster and encourage safe operations and a proper safety attitude on the part of our employees through general operations and systems, training, and the *Chemical Hygiene Plan* (CHP).

The CHP addresses various aspects of our safety program in greater detail.

A Safety Committee works to enhance our overall safety program. The committee meets on a routine and ongoing basis and its specific responsibilities are detailed below:

- Review accident and incident reports. Make recommendations for methods of prevention to eliminate further accidents.
- Promote safety awareness and distribute safety information by various means (e.g., posters, videotapes, pamphlets, and books). Use internal communication channels to promote safety awareness.
- Enhance and recommend safety-training programs for all employees, as necessary.
- Maintain up-to-date information on employee concerns that are safety related. Offer input and information to the Chemical Hygiene Officer and/or Safety Officer, as needed.

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2.14. Client Services/Project Management Responsibilities

Members of the laboratory Client Services/Project Management Group are responsible for organizing and managing client projects. Clients are assigned a project manager (a.k.a. “CSR”) who serves as their primary contact at the laboratory. It is the project manager’s responsibility to act as the client advocate by communicating client requirements to laboratory personnel and ensuring that clients provide complete information needed by the laboratory to meet those requirements. All client verbal communications are documented by the project manager in a controlled notebook. In addition to information management, Project Management responsibilities include:

- Coordinating and preparing proposals in conjunction with technical staff.
- Confirming certification status.
- Hosting client visits and audits.
- Coordinating and communicating turnaround time (TAT) requirements for high priority samples/projects.
- Answering common technical questions, facilitating problem resolution.
- Providing clients with sample status report or results (partial reports) prior to receipt of the final Analysis Reports (e.g., fax, e-mail, phone).
- Scheduling sample submissions, sample containers, and sample pick-up via the laboratory courier service.
- Informing the client of deviation from their contract.

2.15. Confidentiality

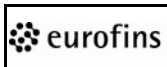
Strict confidentiality is maintained in all of our dealings with clients. Confidentiality agreements, therefore, are willingly provided.

All employees are required to protect company technical data, including client names and test results from disclosure to any third party. This policy, as described in the *Eurofins Lancaster Laboratories Employee Handbook*, is provided and presented to employees during their orientation period.

Intellectual property associated with the testing that we perform under contract for a client is the property of the client.

In an attempt to ensure the confidentiality of our systems and procedures within our laboratory, it is our policy to restrict the distribution of our internal procedures to clients. Clients are permitted to review our procedures while on-site as part of an audit or visit. Based on this policy, we would request that any documents viewed would not be shared or made available to any third parties without the permission of the laboratory.

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2.16. Business Conduct

Our business conduct policy applies to all operations of the company. All employees must avoid involvement in any activities that would diminish confidence in their competence, impartiality, judgment, or operational integrity. All employees must further avoid any relationship with other individuals or organizations (including Eurofins Scientific sister companies) that might impair, or even appear to impair, the proper performance of their company-related responsibilities. Employees must avoid any situation that might affect their independence of judgment with respect to any business dealings between the company and any other organization or individual. Any employee who believes that they have such a conflict, whether actual or potential, or who is aware of any conflict involving any other employee must report all pertinent details to the Vice-President or President of the company. The company's management vigorously enforces this policy and takes prompt and appropriate action, including termination, against any employee found to be in violation.

2.17. Operational Integrity

All employees sign an Employee Ethics Statement on their first day of employment. Employees responsible for generating, handling, or reviewing laboratory data understand that the laboratory mission is to perform all work with the highest level of integrity. Under no circumstances are shortcuts or generating results to suit a client's purpose rather than good scientific practice considered acceptable. Any violation of the laboratory ethics policy results in a detailed investigation that could lead to termination.

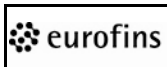
All levels of management consider the following activities unacceptable:

- Knowingly recording inaccurate data.
- Fabrication of data without performing the work needed to generate the information. This includes creating any type of fictitious data or documentation.
- Time travel or adjusting clocks on computerized systems to make it appear that data was acquired at some time other than the actual time.
- Manipulation of data for the express purpose of passing system suitability or quality control criteria.
- Selective use of data generated, or not using data that was legitimately generated and has an impact on the outcome of the test.
- Executing significant deviations from approved test methods and procedures without prior approval from the laboratory management and/or the client.

If an issue does arise which could compromise data integrity, personnel are instructed to perform the following activities:

- Clearly document the situation and maintain all data generated. There is a big difference between poor judgment and fraud. Fraud usually involves intent to conceal an action taken. Therefore, the more documentation that is maintained, the less likely an action is considered fraudulent if further scrutinized.
- When out-of-specification results or quality type issues are detected, all supporting data and relative background information must be documented and presented for management review. Problem resolution and client contact, as applicable, must also be documented.
- Review any questionable situations and decisions with a supervisor.

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- Bring a questionable or uncomfortable issue directly to the QA Manager or a member of the QA Department as part of our QA open door policy.
- Utilize the company's Ethics Committee. See Section 12.4 of this manual.

3. BUILDINGS AND FACILITIES

3.1. Facility

The laboratory is located at 2425 New Holland Pike, Lancaster PA. The facility consists of two campuses located on the North and South sides of Route 23. The two campuses are connected by a pedestrian bridge that spans route 23.

The North campus sits on a commercial plot measuring 5.2 acres. Several structures occupy this plot. The primary structure, Building A, is a 3-story building of concrete, brick, and wood construction. It is approximately 116,000 square feet and consists of approximately 62,000 square feet of laboratory space; 25,000 square feet of office space; and 29,000 square feet of storage, mechanical, and service space. Ancillary structures include a 1000 square foot chemical storage building (organic solvent, acid, and gas cylinder storage), a 10,000 square foot Butler building which houses stability chambers, and a 3,000 square foot storage warehouse which also houses a bottle packing area.

Property adjacent to Building A also includes two buildings that are leased. This space includes an 1800 square foot garage for recycling and for auto maintenance, and a 3500 square foot barn for shop and maintenance areas.

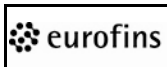
The South Campus sits on a plot measuring 14.48 acres on the south side of Route 23. Three primary laboratory and three ancillary storage buildings occupy this plot. Buildings B and C are 3-story buildings of steel and concrete construction. Building D is a 4-story building of steel and concrete construction. Each building is equipped with sprinkler protection. Building B is approximately 50,000 square feet and consists of approximately 20,000 square feet of laboratory space; 18,000 square feet of office space; and 12,000 square feet of storage, mechanical, and service space. Building C is approximately 45,000 square feet and consists of approximately 24,000 square feet of laboratory space, 9,000 square feet of office space, and 6,000 square feet of storage, service, and mechanical space. Building D is approximately 84,000 square feet and consists of approximately 35,000 square feet of laboratory space, 19,000 square feet of office space, and 24,000 square feet of storage, service, and mechanical space. Ancillary structures include a 400 square foot chemical storage building (organic solvent) and a 200 square foot medical waste storage building.

Property adjacent to Buildings B, C, and D also includes one building that is leased. This space includes approximately 8,000 square feet of warehouse space and 2000 square feet of Training laboratories, offices, and conference rooms.

There is an automatic fire alarm and security system hooked up at the facility. This system is monitored offsite by Choice Security. The entire campus and all exterior doors are monitored by video surveillance.

This facility is serviced by public sewer. Drinking water comes from a private well while the facility sprinkler system is fed by the public water supply. The closest surface water is the Conestoga Creek.

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3.2. Security

The laboratory is considered a secure facility. All outside doors except the main lobby entrance are locked during normal business hours to prevent unauthorized entry. An attendant monitors this entrance at all times.

During evenings, weekends, and holidays, all doors are locked and Security personnel are on site to prevent unauthorized entry into the building. Video cameras are utilized by Security personnel to monitor the facility grounds.

Every employee is issued a photo ID badge which also serves as a building access card. This badge must be worn at all times while on laboratory property so that employees are easily identified. Access to secured/designated areas within the building is limited to only applicable employees through the building security system. This system is administered by Security staff.

All visitors must register with the lobby attendant and are issued a visitor badge. A staff person must accompany visitors while in the facility. Additional visitor rules are outlined in the *Visitor Security and Safety Rules* pamphlet which is provided to all guests.

Building access cards are issued on a temporary basis to contractors or service technicians (e.g., electricians and plumbers) who need access to the building to work on a project. These cards provide the contractor with limited access during the normal workday and must be returned when the work is complete.

3.3. Disaster Recovery

A disaster recovery plan is in place to provide direction for situations where normal operations of the laboratory are not possible. In the event that the building would be severely challenged, a designated disaster recovery team, which includes Physical Services, Maintenance, Safety, Corporate Management, Public Relations, and other applicable personnel depending on the scope of the disaster, would assemble at a designated area to assess the situation and formulate a plan.

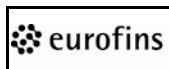
The plan addresses, in general terms, how to approach the following issues: electrical failures, heating/air conditioning failures, fire/building evacuation, computer failures, hazardous material spills, injury to employees, pandemic flu, disruption of phone service, and stability chamber failures.

3.4. Environmental Monitoring

The air handling system for the main laboratory is specially designed to protect sensitive instruments from harmful vapors to ensure that samples are not contaminated. The Physical Services/Maintenance Group is responsible for maintaining the HVAC and exhaust hood systems. This is particularly important in our instrumentation rooms and computer center where a controlled environment, positive pressure system is maintained.

Most refrigerators, freezers, incubators, and ovens used for analysis are monitored by a computerized system equipped with stationary thermometer temperature probes linked to a master panel that is accessed through a computer. If a unit is outside of a predefined temperature range for a specified period of time, the system alarms. Units not on the computerized system must be monitored manually by recording thermometer temperature readings twice daily.

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The laboratory is set up so that there is effective separation between neighboring areas in which there is potential for contamination. Laboratory storage blanks are also used to evaluate conditions under which samples for volatile analysis are stored to monitor for cross-contamination potential. QA provides oversight of the environmental monitoring system.

3.5. Water Systems

Well water and the public sewer system service the facility. The water system is monitored to meet the permit requirements of the Pennsylvania Department of Environmental Protection.

Reagent water is available to analysts for sample preparation (including dilution) and glassware cleaning. Two reverse-osmosis deionized water systems deliver highly purified water to a sealed fiberglass storage tank. From the storage tank the water is delivered to an ion-exchange-carbon filter system for further polishing. The water is also exposed to an in-line ultraviolet sterilization lamp before being circulated to taps throughout the laboratory.

Daily monitoring and preventive maintenance for the system is the responsibility of the Maintenance Department. Monthly and annual testing is performed as required by regulatory guidance. QA provides oversight of the water system monitoring. In addition, method blanks are tested with each batch (≤ 20) of samples.

3.6. Housekeeping/Cleaning

The laboratory is dedicated to providing a clean workplace. A third party professional cleaning service provides routine cleaning of "common areas" that include lavatories, drinking fountains, floors, and windows. Technical staff are responsible for the cleaning (or the contract of cleaning) of specific laboratory work areas.

Detergents used for cleaning contain no to very low levels of metals, pesticides/herbicides/fungicides, or volatile solvents.

3.7. Insect & Rodent Control

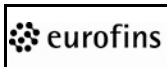
Steps are taken to prevent, monitor, and control insect and rodent infestation. The coordination of this program is the responsibility of the Physical Services Department under the direction of QA. An outside service firm is contracted to perform routine and ongoing monitoring of the facility to ensure that preventive measures which are in place are effective and are working as intended.

No insect or rodent control chemical agents in a liquid or vapor form are applied or sprayed in any laboratory building, unless there is no other option, in which case department management must be contacted for approval.

3.8. Emergency Power Supply

The laboratory is located at the junction of two power grids that supply electrical service to the facility. If one of the power grids fails, we have the ability to work with the power company to have service switched to the other grid. Various types of diesel and natural gas generators are also available on a standby basis to supply power to selected areas of the laboratory in case of a power outage.

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To reduce spikes and spurious line voltage changes to laboratory instruments that can affect results or damage electronic equipment, “conditional power” is fed to these sensitive instruments. All essential computer systems are on uninterrupted power supply (UPS) which is a battery system that provides continuous conditional power for a limited time period in the event of a short power outage.

3.9. Facility Changes

Procedures are in place to manage change, ensure communication, and to minimize negative consequences through active participation of personnel involved in a facility change. The goal is to ensure that physical and environmental condition changes are adequately evaluated for impact and reduction of risk to quality, safety, health, employee, environment, property, analytical services, and business operations before and after the change is implemented.

4. DOCUMENT CONTROL

The administration of the document control system including tracking, filing, updating, and archiving of historical copies is the responsibility of the Office Services (OS) Department.

It is our policy to restrict the distribution of our internal procedures to clients and we discourage the distribution of company confidential documents outside of the facility. Clients are permitted to review our procedures while on-site as part of an audit or visit. Any documents that are distributed are only sent with the approval of QA.

The goals of the document control process are:

- Format documents according to consistent and defined standards
- Review and approve new documents
- Schedule review of existing documents
- Control of document versions and effective dates
- Review and approval of document changes
- Control document distribution and removal of obsolete documents
- Archive and protect obsolete documents

4.1. Hierarchy of Internal Operating Procedures

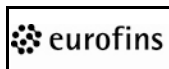
The hierarchy of controlled procedures at the laboratory is defined. These procedures and documentation are made available to promote consistency throughout the organization and to meet regulatory requirements. A list of relevant methods and procedures is located in Appendix E. The development of new procedures and the updating and reclassification of current procedures is an ongoing project.

4.1.1. Level 1 – *Quality Policy Manual* and Company Policies

The intent of these documents is to define “what” we do with emphasis on Executive and Management’s responsibility for quality.

The purpose of the *Quality Policy Manual* is to provide a framework to outline the quality systems at the laboratory. Organizational charts, list of SOPs, a list of equipment, instrumentation, and personnel resumes are included as attachments to this manual.

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- Executive Management is responsible for ensuring that adequate personnel, resources, and support are available to carry out the requirements of this *Quality Policy Manual*.
- Management is responsible for ensuring that SOPs or other appropriate documents are written and available to personnel to define the practices and systems which support these policies.
- All employees are responsible for conducting business in a manner which is compliant with quality and company policies and associated SOPs or other appropriate documents. Review of these policies and procedures must be documented.

Additional company policies are written to support and expand upon this *Quality Policy Manual*. These policies contain more detailed information about a subject with approval signatures executed at the Executive and/or Management level.

4.1.2. Level 2 – Standard Operating Procedures

The intent of these standard operating procedures is to define “who, what, where, and when.” These procedures provide specific information for a process or topic so that the requirements outlined in this *Quality Policy Manual* and company policies can be achieved. The review and approval of these SOPs is performed at the director/manager/group leader level, including QA review and signoff, and the responsibility of these SOPs lies with the area or person directing the operation.

SOPs can apply to site-wide operations, the entire company, across multiple departments, or a specific operating area.

4.1.3. Level 3 – Work Instructions (at a departmental level)

The intent of these procedures or documents is to define in greater detail the specific “how to”. The level of detail in these documents must be sufficient so any appropriately trained person can perform the task accurately. Examples include, but are not limited to standard operating procedures (SOPs); maintenance and calibration procedures; and the laboratory analytical methods. Departmental level procedures/documents are reviewed and approved at the manager or group leader level including QA review and signoff.

4.1.4. Level 4 – Quality Records

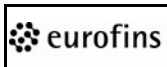
The intent of these documents is to provide documented evidence to support our quality systems and operations. Examples include but are not limited to, data notebooks/logbooks, and preformatted data recording forms.

4.2. Document Approval, Issue, Control, and Maintenance

The document control process ensures that documents are approved and adequate for use. It ensures that documents are readily available to personnel and at locations where essential operations are performed.

Procedures are available in electronic form on the company's intranet site through our document management system. The Document Control Group maintains this system in a current and accurate state. These procedures can be printed from this system for reference by employees as the corresponding task is being performed. Prior to using a printed document, the employee must ensure that it is the current version.

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Each procedure is uniquely identified and includes effective date, revision identification, and page numbering (total number of pages). All documents are searchable and uniquely identified in the document management system.

Controlled policies, procedures, and work instructions are reviewed and approved by appropriate individuals and are formally issued and administered through the Office Services Group.

Word versions of each procedure can be accessed within the document management system by designated personnel within the Document Control group. A PDF copy is maintained on a separate limited access server as a back up to the system.

Procedures are reviewed to ensure that they are accurate, current, and compliant. The frequency of review is either annual or biennial, depending on the procedure. QA is the final signature on procedures which gives QA the authority to implement the procedure; the exception is the Quality Assurance procedures for which the Vice President or his designee is the final signature. Upon the effective date of new or updated documents, all copies of obsolete documents are removed from service. The original historical copy of each outdated/obsolete procedure is clearly identified as a historical version and maintained in a permanent archive file separate from any current versions. (Note: OH EPA is required to review all revised documents applicable to its certification prior to the document being made effective).

Interim amendments to procedures are not allowed. Any needed changes require a revision to the document.

4.3. Client-Supplied Methods and Documentation

Client documentation to support environmental testing at the laboratory is maintained in a centralized area. This information is organized by client/project in the Client Services/Project Management Group. Client documentation includes the following information depending on project size and scope:

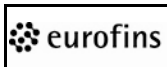
- Client supplied analyte lists
- Client supplied project plans
- Client contract quality manuals with specified limits, QC criteria, etc.
- Communication/correspondence records which relate to testing requirements, interpretation of results, or reporting formats

4.4. Laboratory Notebooks, Logbooks, and Forms

Procedures are in place to ensure that all data is traceable, authentic, complete, and retrievable. The following general requirements outline our system for the issuing, control, and archival of laboratory notebook and logbooks.

- The administration of notebooks and logbooks is controlled by the Office Services Group. They maintain a master index to uniquely number and identify each book distributed.
- Notebooks and logbooks can contain blank or preformatted pages.
- Notebooks and logbooks are bound, uniquely identified and have sequentially pre-numbered pages.

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- If notebooks or logbooks contain preprinted laboratory form pages:
 - A unique identification number is assigned to each form
 - Forms are approved by appropriate management personnel before they are put into use
 - Forms are reviewed on a routine basis to ensure they are still accurate and current
- Completed notebooks are returned to an archivist. Incomplete books are returned to Document Control:
 - Two years from the issue date
 - for employee specific notebooks – when the employee leaves the company
 - for project specific notebooks – when the project for which it was used is complete
- In specific situations, records are bound to create books at the time of archival (e.g., temperature charts).
- At the time of archival any page(s) in the notebook or logbook that does not contain data documentation is crossed-out or a statement is written on the last page used to note that the book is complete to prevent data from being entered at a later date.
- Notebooks and logbooks identified as requiring permanent archival are assigned a designated qualifier.

4.5. Control of External Documents

Hard copy versions of external documents are controlled through the form system.

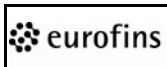
External documents such as copies of the 40 CFR and ASTM methods are stored exclusively in the QA Department. QA also keeps applicable agency documents on file, these include, but are not limited to, the TNI (The NELAC Institute) and ISO 17025 standards.

Environmental methods from the EPA or Standard Methods are available in the QA Department, but the technical areas also have copies that pertain to the tests that they perform. Any external document that is maintained in these areas must be inventoried and listed on a controlled form. Some methods are available on-line and are accessed through the Internet.

It is the laboratory's understanding that the need to control external documents is to ensure that the most current version of a method is referenced or appropriate manual is being used. Regulatory methods are used as references by the laboratory and testing is performed as per written SOPs that fall under our existing document control system and have scheduled reviews. The scheduled review of SOPs is used to ensure that the proper version of a method is referenced. While using the most current version of an analytical method is our typical practice, there are specific client needs and accreditation rules that require previous versions of a method to be used.

The technical areas are responsible for ensuring that all manufacturers' manuals are current and available to analysts. The vendor provides instrument manuals when new equipment is purchased or existing instruments are updated. These manuals are kept with the instruments to which they are associated.

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5. SAMPLE HANDLING

5.1. Sample Collection

It is the responsibility of the client to send us representative and/or homogeneous and properly preserved samples of the system from which they are drawn. The laboratory assumes that all multiple sample containers with the same designator/description and bottle type contain a homogeneous, representative sample. We also assume that it is acceptable to deplete one container and move to the next, without implications unless otherwise indicated by the client.

The laboratory provides the appropriate sample containers, required preservative, chain-of-custody (COC) forms, shipping containers, labels, and custody seals. The laboratory also provides trip blanks and analyte-free water for field blanks. Preparation of methanol containers for field preservation of volatile soil samples is available.

Sample containers are purchased pre-cleaned by the supplier. For pre-preserved bottles, each lot of preservative is checked for contaminants before use and this testing is documented.

The laboratory provides instructions with all bottle orders that define how to sample, preserve, store, and ship the samples prior to their delivery at the laboratory. These instructions inform the client of the importance of proper sampling and advise them that non-compliant samples are rejected or reported with a qualifier.

If samples are collected by the laboratory personnel, applicable sampling methods are in place to perform the sampling operation.

As samples are analyzed at the laboratory, there are times when additional sample volume is necessary to complete testing or perform retesting. If this situation arises, "additional sample" is requested by the laboratory and/or submitted by a client to supplement current work being performed within our facility. Additional sample received is either assigned a new laboratory sample ID number and/or a comment noted on the final report to state that additional sample was received, depending on the situation. It is our goal to provide accurate traceability between sample submission and when testing is performed.

5.2. Sample Receipt and Entry

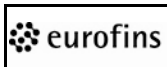
5.2.1. Sample Receipt

Samples can be received at the laboratory 24 hours a day, 7 days a week, 365 days of the year. Receipt can occur in one of three ways:

- The laboratory courier services (i.e., Transportation Department)
- Personal delivery
- Commercial courier

All samples received for testing are delivered to the Sample Administration Department immediately upon arrival. This group is responsible for the unpacking and organizing of the samples. This process includes checking custody seals if present, paperwork agreement, signing the chain of custody, recording cooler temperatures, documenting the condition of containers, accounting for all sample bottles, and observing any safety hazards, and reporting any problems to Client Services for communication to the client. This receipt process is documented in the LIMS.

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5.2.2. Sample Entry

As soon as practical after sample receipt, all samples are entered into our laboratory information management system (LIMS). Samples awaiting log-in are stored in temporary holding areas, at appropriate storage conditions to maintain sample integrity. Samples scheduled for Volatile analysis are stored separately. If there is doubt about the suitability of items received or if items do not conform to the description provided or the testing required is not clear or specified, the client is contacted and the conversation documented.

At the time of entry, the LIMS assigns a unique the laboratory' sample number to each sample. This number is sequentially assigned and a label is generated and is attached to the sample container.

Samples are tracked to the minute upon arrival. This allows the client to see exactly how long it took the samples to pass through receipt, unpacking, and entry.

A sample acknowledgement is generated from the LIMS per sample entry group. Upon request, a copy of the Acknowledgement may be sent to the client to confirm sample receipt and entry on the day following sample log-in. Internally, appropriate personnel audit all applicable sample entry and client paperwork.

5.2.3. Sample Preservation Check

Support personnel check and document preservation of non-volatile liquid samples after the samples have been entered into the LIMS and before they are placed into storage. Any checks of volatile samples are performed and documented at the time of analysis.

5.2.4. Sample Rejection Policy

Any time a sample is received in a condition that does not meet the method, regulatory, or client requirements, the condition of the sample is clearly documented on a sample administration documentation log or sample problem form. This information is forwarded to the CSR and the client is contacted to discuss the best course of action. The client is given the option to resample or have the sample analyzed and reported with a comment.

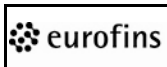
5.3. Sample Identification and Tracking

A sample label is generated for each sample and, in addition to the assigned unique sample number, the following information is displayed on the label: client name, sample identification assigned by the client, sample collection information, bottle code ID, analyses requested, and any applicable notes to laboratory personnel. The label includes a barcode that is used to trace the sample storage location.

To ensure accountability of results, the unique sample number assigned is used to identify the sample in all laboratory data documentation, including notebooks, instrument printouts, and final reports. The sample number is also used to identify additional containers of the sample that are created during sample preparation and analysis (e.g., subsamples, extracts, digests).

Routine sample tracking is documented using the Laboratory Sample Analysis Record (LSAR) which captures the date, time and analyst for each sample preparation and analysis. The information is compiled in the LIMS using electronic record tracking from the data upload and entry functions. This displays, per sample, on each Analysis Report.

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5.4. Sample Storage

After sample entry, samples are placed in an assigned and identified storage location until needed for analysis. Room temperature, refrigerated, and frozen storage are available and samples are stored in accordance with regulatory, method, or client direction. The LIMS is used to assign storage locations, which assists in the orderly storage of samples. Sample storage locations are secured and monitored for accurate temperature control.

The central locked storage facility contains 3430 square feet of refrigerated space, including 2740 square feet equipped for automated sample retrieval. Samples are stored in the laboratory's automated storage and retrieval system (ASRS) or other assigned storage locations (separate volatiles areas) within the laboratory until completion of all analytical work.

When a sample is scheduled for analysis, the analyst retrieves it from the storage area. To maintain the integrity and security of the sample(s), the amount needed for analysis is removed and the sample(s) returned to storage as soon as possible.

5.5. Sample Return/Disposal

Samples remain in the storage area following analysis until the testing results have been verified and the analysis report has been generated. On a regular basis, a list is generated from the LIMS that summarizes samples that can be removed from the storage area. At a minimum, samples are held for 2 weeks after reporting before they would be eligible for disposal. Samples are either returned to the client or disposed of in accordance with local, state, and federal regulations.

Due to the variety of waste generated at the laboratory, several general categories of wastes and waste streams have been identified. Identification of waste occurs through information provided by the client, historical information, and/or analytical testing. The laboratory uses a sophisticated, computerized LIMS, which includes programming to assist in the identification of hazardous wastes at time of discard.

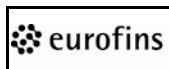
For reasons of environmental liability, client confidentiality, proprietary product formulation protection, etc., wastes generated by the laboratory are disposed of via incineration at EPA licensed facilities. The three exceptions include bulk neutralized acid waste, COD analysis waste, and lab pack waste containing mercury. None of these exceptions involve containers with client information.

5.6. Legal Chain of Custody

Samples being tested for litigation require locked storage and documentation of the time and personnel responsible when the sample was not in storage. This level of documentation is available upon client request and procedures to define these activities are in place and include the following:

- A chain-of-custody document is initiated for each bottle type submitted by the client.
- The chain of custody is signed each time the sample is stored, removed from storage, or changes hands.
- Clients requesting internal chain-of-custody documentation receive the completed forms after the analysis is complete.

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5.7. Representativeness of Samples

Each analytical method provides specific procedures for ensuring that a representative aliquot of the sample is used for testing. These procedures include shaking water samples and mixing solid samples. Analysts are instructed in sampling techniques that prevent contamination of samples.

6. TECHNICAL REQUIREMENTS – TRACEABILITY OF MEASUREMENTS

6.1. Reagents and Solvents

The reliability of our analytical results can be directly affected by the quality of reagents used in the laboratory. Procedures are in place to address labeling, storage, and evaluation of these materials. Reagents and solvents include acids, bases, indicators, buffer solutions, colorimetric solutions (CS), test solutions (TS), and volumetric solutions (VS). The *Chemical Hygiene Plan* provides safety information in regard to the storage and handling of laboratory chemicals.

Each analytical method includes a list of reagents needed to perform the test. Reagents are fully described, including chemical name, purity, and description of preparation. Where applicable, shelf life and storage conditions are also listed. The laboratory is responsible for checking that new supplies meet the method requirements. These checks are documented and maintained.

Departmental management ensures that an adequate inventory of reagents needed to perform testing is maintained. Reagents received at the laboratory funnel through the Shipping and Receiving Department and deliveries are verified and labeled with the date of receipt. Large volume reagents (e.g., solvents, acids) are stored in a building outside of the laboratory until needed for use.

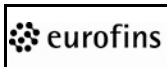
In addition to the name and concentration of the reagent, all reagents are labeled with the manufacturer/vendor, storage conditions, the date opened, and an expiration or re-evaluation date. Before using any reagent, the analyst must ensure that the material was properly stored and labeled. If a reagent has passed its expiration date or shows signs of deterioration, the material is not to be used in the laboratory and must be discarded or segregated as expired. In some method development or research work, expired reagents may be used. These must be labeled as such or stored in a designated location.

If a re-evaluation date is reached before a reagent is completely consumed, the reagent will be inspected by physical observation for signs of degradation. Physical signs include, but are not limited to, color changes, clumping or other texture changes for solids and formation of precipitate in solutions. This evaluation is performed by an experienced chemist or microbiologist.

Subsequent reagent solutions or mixtures prepared at the laboratory are fully documented in a logbook and labeled to include: unique name, concentration, date prepared, name of analyst who prepared the reagent, storage conditions or reference to the logbook containing these details, and expiration/re-evaluation date. The information recorded allows these solutions to be traced to the original stock solution. The reference to the logbook is intended for use on containers that are too small to clearly document all of the information.

All reagent certificates and MSDSs are retained by the laboratory.

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6.2. Media

Within the microbiology laboratory, procedures are in place to address preparation, labeling, storage, expiration, documentation, and quality/sterility evaluation requirements for these materials. These procedures are described in Appendix K.

6.3. Calibration Standards

Written calibration procedures are required, where applicable, for all instruments and equipment used in the laboratory. The source and accuracy of standards used for calibration purposes are integral to obtaining quality data. Requirements for calibration are provided in each analytical method including specifications for the standards used. Where available and practicable, calibration measurements made by the laboratory must be traceable to national standards of measurement (e.g., NIST). C of As are maintained for each material, as applicable.

Standards are usually purchased from commercial supply houses either as neat compounds or as solutions with certified concentrations. The accuracy and quality of these purchased standards is documented on a C of A and these certificates are maintained on file in the laboratory. Upon receipt at the laboratory, material must be labeled with a date of receipt and stored appropriately.

Most solutions and all neat materials require subsequent dilution to an appropriate working range. Records of all standard preparations include the dilution(s) made and a reference to the original and any intermediate mixtures. Solutions are labeled according to laboratory procedures and assigned unique names or code numbers that provide traceability to the original components and stored appropriately. Each new preparation of standard is tested for integrity by comparison to standards from another source or previously prepared solutions. Standards are not used for sample analyses in the laboratory past their expiration date. In some method development or research work, expired standards may be used. These must be labeled as such or stored in a designated location.

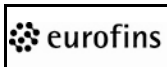
6.4. Equipment and Instrumentation

The laboratory is equipped with all equipment and instrumentation required for testing the scope of work which it supports. All equipment and instrumentation is maintained in proper working order. A master list of our equipment and instruments is maintained by our accounting department and includes the date received and the condition at receipt (new v. used). Our major equipment and instrumentation capabilities are summarized in Appendix F. In addition, we have numerous other instruments including pH meters along with support equipment such as ovens, incubators, centrifuges, balances, etc.

6.4.1. General Requirements

- Equipment/instrumentation is assigned a unique designation. This unique number or system identification is used to track the equipment or instrument within data documentation.
- A maintenance logbook is established in conjunction with installation and is readily available to document all incidents that pertain to the equipment or instrument as they occur.
- All test, measuring, and inspection of laboratory systems, equipment, and instrumentation used at the laboratory is routinely calibrated and maintained in accordance with applicable standard operating procedures.

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- A member of the technical group, or designated individual, performs routinely scheduled maintenance and calibration of laboratory equipment and instruments as required by laboratory procedures. These activities are documented.
- If appropriate standards or expertise for calibration or maintenance are not available in-house, the operation is conducted by an outside service firm, with appropriate accreditation. Certificates or other data generated by the service firm are reviewed by applicable the laboratory personnel to verify acceptability. This information is maintained on file.
- All equipment or instruments taken out of service are tagged "DO NOT USE". The following minimum information is documented:
 - Date taken out of service
 - Employee who took the equipment/instrument out of service
 - Reason for tag-out
- The date that the equipment/instrument is returned to service, the corrective action taken, and performance checks performed is documented.

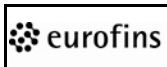
6.4.2. Standard Operating Procedures

Information regarding operation, maintenance, and calibration of equipment and instrumentation are found in respective SOPs. The procedures include a routine schedule for applicable preventive maintenance and calibration along with acceptance criteria and remedial action to be taken in the event of failure. These procedures are maintained in the document control system and reviewed on a regular basis to verify they remain current and accurate. Vendor supplied manuals are also available to provide additional information in regard to operation and maintenance.

6.4.3. Maintenance

- Instrument and equipment maintenance is performed as either a preventive or corrective operation.
- Preventive maintenance procedures and schedules are developed for each instrument or piece of equipment, where applicable. Preventive maintenance operations are performed by an analyst, equipment maintenance specialist, or contracted (manufacturer's representative or service firm personnel). Documentation is maintained in the associated maintenance log for the procedure(s) performed as part of the preventive maintenance operation. It is the responsibility of departmental management to ensure that a preventive maintenance schedule is addressed by a procedure where appropriate and is followed.
- Corrective maintenance is performed by an analyst, equipment maintenance specialist, or contracted (manufacturer's representative or service firm personnel) in response to indications of equipment or instrument malfunctions. The unit must be clearly tagged as out of service. All corrective actions taken to bring the unit back into service are documented in the associated maintenance log. After repair, further notation is made in the log regarding the functional status. Calibration activities are performed, as applicable, and documented in the log before the unit is placed back into service.

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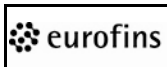
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- A supply of commonly needed replacement parts is maintained by the laboratory.
- A preventive maintenance schedule for major instruments is given in Appendix G. Maintenance of equipment used in microbiological testing is documented in Appendix K.

6.4.4. Calibration

- Calibration is the establishment of, under specified conditions, the relationship between the values/response indicated by a measuring instrument or system and the corresponding known/certified values associated with the standards used. Some types of calibrations are performed with a set frequency (e.g. daily) while others provide intermediate checks to ensure that the instrument response has not changed significantly.
- All measuring and testing instruments and equipment having an effect on the accuracy, precision, or validity of calibrations and tests are calibrated and/or verified on an on-going and routine basis. Methods for calibration of instruments and equipment vary widely with the nature of the device and the direction given by analytical procedures, departmental procedures, or manufacturer recommendations. Frequency of calibration can also depend on additional factors including ruggedness of the instrument or equipment and the frequency of use.
- Departmental management is responsible for developing or acquiring written calibration procedures for the types of instruments and equipment employed within their area, as applicable. Procedures address the following aspects: description of the calibration method, frequency/schedule for calibration, acceptance criteria, and corrective actions if failure occurs.
- Calibration information is recorded in a logbook that is associated with the instrument/equipment and/or a calibration certificate is maintained and/or data is generated and filed to document the activity.
- Calibration measurements are traceable to national standards of measurement (e.g., NIST) where available. Physical standards, such as NIST certified weights or thermometers are re-certified on a routine basis. Calibration certificates are maintained on file, where applicable, to indicate the traceability to national standards of measurement. These physical standards are used for no other purpose than calibration.
- Calibration failures are documented in the associated logbook and/or within the data generated from the instruments or equipment. Management personnel perform an evaluation and review of failures and assess any potential impact the failure might have on previously generated data. The laboratory utilizes "real-time" controls to ensure the accuracy of the data. These controls are used to assist in assessing the impact of the situation.
- After repair, adjustments, or relocation that could affect instrument response, calibration/verification activities are performed, as applicable, before the unit is returned to service.
- Analytical data is not reported from instrumentation or equipment that fails to meet calibration requirements.
- A summary of the calibrations for most major instruments and equipment is given in Appendix H.

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- Procedures for calibration of equipment used in microbiological testing are documented in Appendix K.

6.5. Computerized Systems and Computer Software

6.5.1. Computer Usage

The laboratory provides computer equipment for employees to use as a tool in performing their work. Computer equipment is the property of the laboratory and used in accordance with defined terms and conditions. Our goal is to provide standard hardware and software that meets the needs of the user. The majority of desktop PCs in use are standardized using cloning software.

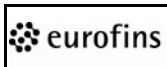
6.5.1.1. Physical security of computer systems – It is company policy to protect computer hardware, software and data documentation from misuse, theft, unauthorized access and environmental hazards. The corporate computer area and computer “Hot-Site” is locked and requires identification/building card access. All vendors, contractors, or other visitors must be escorted into this area. Controlled access of the laboratory buildings is outlined in Section 3.2.

6.5.1.2. Passwords – Passwords are important for the security of company data and resources. The laboratory’s primary network operating system is Windows and each employee must have a user ID and password combination to access the system. Other computer systems also require a user ID password combination for access. The following procedures apply regardless of which system(s) is being utilized:

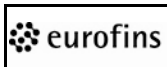
- Passwords must be kept confidential
- Users must log-out of a system when not in use to prevent unauthorized access. In addition, the network access will automatically timeout after a set period of inactivity, requiring a user to log-in to access the system.
- Forgotten passwords can only be reset by the Computer Systems Department or by an appropriate System Administrator.
- Network and LIMS passwords automatically expire every 90 days. The computer prompts a user to change the password when the expiration date nears.

6.5.1.3. Computer viruses – The laboratory centrally and continuously monitors the computer network for computer viruses. Employees are prohibited from using the company’s computer equipment to propagate any virus. Anti-virus software is employed to detect viruses on the Windows network. A notification is sent when there is a particularly dangerous or virulent data destructive program that employees need to be aware of. However, employees are reminded to always be cautious and observant even if there are no current warnings. Employees must report any virus concerns to the anti-virus administrator or Computer Service Management as soon as possible. Employees who share files between their home computer and the laboratory should install anti-virus software on their home computer. If an employee does not have such software, the laboratory can suggest various no-cost anti-virus software products.

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- 6.5.1.4. Internet and e-mail system – The e-mail system is used primarily for the laboratory's business purposes. The *Eurofins Lancaster Laboratories' Employee Handbook* provides additional information in regard to system usage. Employee access to the internet is restricted to those employees who have a business need for it. All employees have access to e-mail. Access to the internet is configured through a user's Windows network account. All internet and e-mail activity is subject to monitoring. All messages created, sent or received over the internet are company property and can be regarded as public information. E-mail and website filtering software is utilized.
- 6.5.1.5. The laboratory's Intranet (LabLinks) – The Intranet is designed to be a useful tool for employees to acquire company information and to provide a company communication system. The *Eurofins Lancaster Laboratories' Employee Handbook* provides additional information in regard to usage.
- 6.5.1.6. Software policy
- Copyright laws protect software, and the laboratory's intent is to abide by all software agreements.
 - Software purchases must be formally requested and approved by management and/or validation personnel, as necessary.
 - All software is used in accordance with applicable license agreements.
 - Employees are not to install any software on computer(s) unless authorized by the Computer Systems Department.
 - Software upgrades must occur in accordance with applicable change control procedure
 - Employees must not give software to outsiders (e.g., clients, contractors), unless approval is granted by management.
 - Users must not make copies of any licensed software or related documentation without permission. Any user that illegally reproduces software is subject to civil and criminal penalties including fines and imprisonment.
- 6.5.1.7. Computer system backup, data restoration, and data archival – Mission critical data is stored on several computers throughout the laboratory. These computers are connected through the local area network. Selected files on these computers are backed up using an enterprise-level backup software program. The objective of this backup is to have the ability to restore data after a total loss (e.g., theft, fire, natural disaster). Procedures are in place to perform data backups and restores.
- 6.5.1.8. Remote access to computer systems – Employees are able to remotely connect to the laboratory computer systems through an encrypted (SSL) login. When logging in, users are authenticated with their Windows Active Directory account and password.

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6.5.1.9. Electronic data – Instrument software used for processing data must, when available, have password access and audit trails enabled. All data processed through the LIMS includes tracking features to document who and when data was entered and/or changed.

6.5.2. System and Software Verification – The laboratory LIMS is an in-house developed program. The design and updates to the system are written following typical Software Development Life Cycle (SDLC) processes for initial planning through testing and implementation. Before a new computer system/program or significant modification of an existing system/program is implemented in our laboratory, it is necessary to generate and Validation Project Plan which specifies the level of documentation required for the new or updated application. The following are the typical documents that are required for these updates:

- Requirements documents – Describe the required system functionality and specifications
- Design documents – System overview, screen design, report layout, data description, system configuration, file structure and module design
- Testing documentation for system development/verification – Structural testing of the internal mechanisms and user testing of the installation and system qualification
- Standard operating procedures and/or manuals

6.6. Change Control

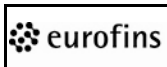
Procedures are in place to define how to maintain processes, instrumentation, equipment, computerized systems, and computer software in a validated or controlled state through a plan of change control. Successful changes require a thorough evaluation and testing for potential consequences prior to implementation. Planning, authorizing, testing, and reviewing of proposed changes are documented throughout the change process. Changes are planned or could be made in response to an emergency situation. The following “general” elements apply to changes, as appropriate:

- Request to perform a change
- Evaluation of a change
- Authorization of a change request
- Preparation for an authorized change
- Execution and testing of the change
- Documentation of the change
- Approval of the change
- Change implementation and follow-up (Formal approval of the change is performed by designated responsible individuals and QA.)

6.7. Labware Cleaning

Dedicated washroom personnel support the laboratory operations in regard to labware preparation, washing, rinsing, and drying. Labware can include, but is not limited to glassware, plastic ware, utensils, and pipettes. Procedures are in place to outline the washing process for each type of labware. Most labware is cleaned using a Miele glass washing machine. Some labware is still washed by hand and either air-dried or dried in specifically designed ovens.

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Most of the labware used in the laboratory is “common or non-dedicated” labware (common to a department), but some of the labware used in the laboratory is identified as “dedicated” labware and exclusively used for certain analyses. Examples of dedicated labware include glassware used for MBAS and Ortho Phosphate analyses (acid washed) and “oils” glassware. This labware is isolated and cleaned only with “like” labware.

All glassware is class A and 100% visually inspected for breakage (e.g., cracks, chips), cleanliness, and dryness before being returned to the laboratory for use.

Generally, each test has controls in place to ensure that results are not adversely affected by unclean labware. These controls include blanks to detect positive interferences and recovery controls to detect negative interferences.

7. PURCHASING EQUIPMENT AND SUPPLIES

7.1. Procurement

It is the responsibility of management personnel within each department to ensure that the appropriate supplies are available and/or ordered with sufficient lead-time to perform analytical testing or to provide support to the testing areas. The individual technical departments have trained personnel who enter the supply order into the company’s requisition software system. The selection of these products is based on technical input at the analyst level and authorized by technical departmental management. The Purchasing Department maintains an ordering system in which purchase requisitions are managed. Common laboratory items (e.g., beakers, flasks, reagents) are ordered directly through the Purchasing Department. Purchase orders over a specified dollar amount require verification from the appropriate member(s) of the Executive Management Group before an order can be placed.

Upon receipt of an order, the Purchasing Department checks the order to ensure that all items were received as specified. Products that have specific storage requirements are taken to the technical area upon receipt. It is the technical area’s responsibility to ensure that the product is stored in the appropriate manner. Any checks on the quality of the materials received for use in a specific test are the responsibility of the laboratory using them. This is based upon the experience of the laboratory with the usability of the product. Generally, each test has controls in place to ensure that test results are not adversely affected by the materials.

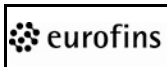
Any problems encountered when using a material in the laboratory must be brought to the attention of the Purchasing Department and/or Quality Assurance as applicable, to ensure that follow-up and corrective action occur.

7.2. Supplier Evaluation

Procedures are in place to evaluate vendors who supply us with: new equipment, instrumentation, computerized systems and computer software; commercially purchased glassware, including sample bottleware, reagents, chemicals, solvents, gases, media, and standards; and contracted and subcontracted services.

The laboratory strives to ensure that our suppliers continually improve their quality systems and we reserve the right to purchase from suppliers of our choice in order to best fulfill the needs of our clients and our business. When directed by a client to purchase from a specific supplier, we will do so. In this instance it is the client’s responsibility to “qualify” the specified supplier. We attempt to purchase from businesses that we have an established purchase history or have previously acquired information regarding the supplier’s quality programs.

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The laboratory does not evaluate every supplier. Risk assessment is taken into consideration when making this decision. The risk assessment analysis includes system, material, services, and number of samples or operations the purchase may affect or support. Evaluations are not required for computer operating systems, utilities, toolsets, or systems software. They also are not required for any off-the-shelf configurable software package that has an extensive market performance history (e.g., Microsoft Word, Excel, Access).

Additional quality systems are also in place within the laboratory to further verify and support the materials used:

- C of A for every lot of purchased prepared microbiological media and for purchased chemicals, where available, are reviewed and maintained on file.
- For most chemical analyses a blank and a recovery check are routinely analyzed and serve as real time suitability testing of the reagent being used.
- Microbiological testing often employs positive and negative controls, which serve as real time control checks.

8. ANALYTICAL METHODS

8.1. Scope of Testing

Samples are analyzed in accordance with official published methods, standard methods, client-supplied methodology, or validated in-house methods. We recognize the importance of providing verifiable results and, therefore, use methods accepted and approved by a broad range of federal and state regulatory agencies. In order to meet the needs of our clients as well as regulatory agencies, the laboratory sometimes needs to support different versions of the same method (i.e. SW-846 8081A and 8081B). The laboratory can also assist in developing and validating analytical methods for specific products and matrices. All methods submitted for our review, as well as all analytical results, are considered confidential.

The laboratory performs a wide variety of environmental testing in support of the Safe Drinking Water Act (SDWA); Clean Water Act (CWA); Resource Conservation and Recovery Act (RCRA); Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA/Superfund); and the Clean Air Act (CAA). Methods approved by ASTM are also used in testing. Potable water, wastewater, soil, sediment, sludge, oils, biota, tissue, soil gas, and air are among the matrices typically analyzed.

Our areas of expertise include:

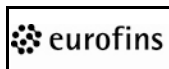
Standard Services	Specialty Services
<ul style="list-style-type: none"> • Volatiles • Semivolatiles • Metals • Pesticides/PCBs/Herbicides • Petroleum Analysis • Waste Characterization • Water Quality • Drinking Water • Vapor & Air Analysis • Sediment & Ecological • Method Development • Shale Oil & Gas Analysis • Dioxins & Furans • Explosives • PCB Congeners 	<ul style="list-style-type: none"> • Hydrazines/NDMA • Perchlorate • 1,4-Dioxane • Pharmaceutical Manufacturing Industry (PMI) • Method 25D • Alkyl PAHs, Alkanes, Biomarkers • PFC (PFOA) • Organic Acids • Aldehydes • Low-Level Mercury

A list of tests covered under the laboratory's NELAP accreditation can be found in Appendix I. All current certificates and scopes of accreditation are available on the laboratory's website at <http://env.lancasterlabs.com/resources/certifications>. A complete list of the tests routinely performed by the laboratory can be found in the *Schedule of Services*.

8.2. Analytical Test Methods

Each laboratory is required to establish and maintain analytical procedures for all the methods referenced in standard testing. The sources for these methods include the most recent versions of these compendia:

- Test Methods for Evaluating Solid Waste, SW-846
- Standard Methods for the Examination of Water and Waste
- Code of Federal Regulations, Chapter 40
- EPA 100 through 600 and 1600 series methods
- ASTM

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The test methods used are re-written into a laboratory standard format, which provides consistency in content and allows the analysts to locate the information they need quickly. Procedures are in place to define the format, required approvals, and the control system for these method documents. The format requirements include:

- Uniquely assigned method number, which is used extensively for scheduling and documentation purposes.
- Reference to the original source of the method (e.g. SW-846)
- Scope
- Basic Principles
- Apparatus and Reagents
- Personnel Training and Qualifications
- Safety and Waste Disposal
- Detailed procedure (including any method modifications)
- Calculations
- QA/Quality Control
- Revision Log
- Approval signatures from technical management and QA personnel

Analytical methods are maintained as controlled documents to ensure that analysts are always working with the most current version and are reviewed periodically for accuracy.

8.3. Client Supplied Methods

Most of the client-supplied method requirements presented to us involve achieving specific quality control criteria or limits of quantitation using standard EPA methods. These requirements are communicated to the appropriate technical groups prior to the project start up. Each technical group evaluates the scope of work and the requirements to ensure the criteria can be met using the standard EPA method. The data is monitored to ensure the criteria are met throughout the project. A client service representative notifies the client if there is a more appropriate method available or if the client's criteria cannot be achieved on a certain sample matrix (i.e., due to matrix or dilutions).

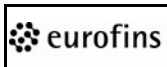
Occasionally, we are asked to transfer a non-standardized method from a client into our lab or to develop a new method, when one is not available. In the case of a method transfer, we set up the client's method and perform some initial evaluation. After the initial evaluation, we may make recommendations on how to improve method performance. If the method appears to be adequate, we determine linearity, specificity, precision, accuracy, LOD, and LOQ by performing calibrations, analyzing method blanks, and carrying out method detection limit and quad studies.

In the case of method development, we work with the client and/or data user to determine the level of validation required ensuring that the method meets its intended purpose. In addition to the elements above, we also determine standard and sample stability and robustness depending on the scope of the project. Typically, a standard operating procedure is written and submitted to the client with the results of the validation. These steps are completed prior to analysis of field samples. Data related to the set up of the method are archived.

8.4. Method Validation

Before new or revised analytical methods are authorized for routine use in the laboratory, validation data is required to demonstrate that the method as performed in our laboratory and analysts performing it are capable of meeting data quality objectives for precision and accuracy. A procedure is in place to outline this process.

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Many methods published by USEPA include instructions for performing an initial demonstration of capability, which typically consist of determining the method detection limit and analyzing fortified samples in quadruplicate. This demonstration is performed and compared to acceptance limits for precision, accuracy, and detection limits, when available.

Methods that do not include specific validation requirements are validated by analyzing fortified samples or standard reference materials in replicate. The results of these analyses are used to assess accuracy and precision. Results of validation studies are documented and subject to review and approval.

8.5. Procedural Deviations

Analysts are required to follow a documented method for all tests performed. Procedures are in place to ensure that deviations from analytical methods are documented, approved, and justified in an appropriate and consistent manner (Note: Deviation from the OH EPA approved SOPs is not permitted). We classify method deviations as either being a planned deviation or an unplanned deviation. In general, the following information is captured to document both types of situations:

- Description of the deviation
- Reason or justification for the deviation
- Impact the deviation had on the testing
- Signature/date of analyst performing the test
- Signature/date of Quality Assurance and Laboratory Management approving the deviation
- Signature/date of client approval, if necessary

Deviations to written procedures are documented in raw data records or through the ICAR (Investigation and Corrective Action Report) system. Both types of documentation require management and QA review and approval.

9. INTERNAL QUALITY CONTROL CHECKS

9.1. Laboratory Quality Control Samples and Acceptance Criteria

Quality control (QC) samples are analyzed with each batch of samples to demonstrate that all aspects of the analysis are in control within established limits of precision and accuracy. Management is responsible for ensuring that QC is analyzed as required in the procedure on written methods, each analytical method specifies (or cross-references another procedure) the type of QC sample, frequency of analysis, acceptance criteria for QC sample results, and corrective action to be taken if QC sample results fall outside of the acceptable range.

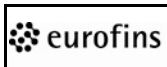
QA staff, at the direction of the technical department, must program the LIMS with the acceptance criteria for each QC type (other than blanks). The acceptance criteria are based on statistically generated limits from historical laboratory data, on method defined limits, government agency recommendations, or on client/project specific limits.

These limits are used to flag samples that are out-of specification.

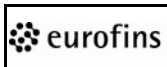
The types of QC samples and the information each provides are discussed in the following paragraphs.

Quality control checks used for microbiological tests can be found in Appendix K.

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- 9.1.1. Blanks - A blank is a designated sample designed to monitor for sample contamination during the analysis process. A volume of reagent laboratory water is typically used to monitor water sample analysis, while solid sample analysis blanks consist of a purified solid matrix or just the reagents used in the test. The blank and field samples are treated with the same reagents, internal standards, and surrogate standards and carried through the entire analytical procedure. Ideally, blanks demonstrate that no artifacts were introduced during the analysis process. The specific acceptance criteria for each test are given in the analytical method and are usually based on the required reporting limit.
- 9.1.2. Surrogates - Surrogates are organic compounds, which are chemically similar to the analytes of interest but are not naturally occurring in environmental samples. When required by the analytical method, surrogates are spiked into all the field and QC samples to monitor analytical efficiency by measuring recovery on an individual sample basis. The percent recovery is determined and compared to the acceptance criteria. Acceptance criteria limits are set as required by the method or based on a statistical determination from laboratory data.
- 9.1.3. Matrix Spikes - A matrix spike sample is created by fortifying a second aliquot of a water or soil sample with some or all of the analytes of interest. Blanks are not used to for matrix spike QC. The concentration added is known and compared to the amount recovered to determine percent recovery. Matrix spike recoveries provide information about the accuracy of the method in light of the matrix analyzed. Matrix effects can cause results to be outside of the acceptance criteria. The acceptance criteria are given in the analytical method and limits are set as required by the method or based on a statistical determination from laboratory data.
- 9.1.4. Laboratory Control Samples - Laboratory control samples (LCS) are samples of known composition that are analyzed with each batch of samples to demonstrate laboratory accuracy. Laboratory fortified blank (LFB) is another term used to describe a LCS. The samples either naturally contain the analytes of interest or are clean samples fortified with known concentrations. Percent recovery is calculated and compared to acceptance criteria, which are set as required by the method or based on a statistical determination from laboratory data.
- 9.1.5. Duplicates and Matrix Spike Duplicates and Laboratory Control Sample Duplicates - A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test. To compare the values for each compound, the relative percent difference (RPD) is calculated by dividing the difference between the numbers by their average. Precision for analytes that are not typically found in environmental samples (i.e., organic contaminants) is determined by analyzing a pair of matrix spike duplicates, defined as two spiked samples and comparing the RPD for the spiked compounds. The acceptance criteria are described as a maximum for the RPD value, which are set as required by the method or based on a statistical determination from laboratory data.

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- 9.1.6. Internal Standards - Internal standards are organic compounds, which are chemically similar to the analytes of interest but are not naturally occurring in environmental samples. When required by the method, internal standards are added to every field and QC sample after extraction but prior to analysis. Comparison of the peak areas of the internal standards is used for quantitation of target analytes. Internal standard peak area and retention time also provide a check for changes in the instrument response. The acceptance criteria are stipulated in the analytical method.
- 9.1.7. Serial Dilutions - A serial dilution is the dilution of a sample with sufficiently high concentration by a factor of five to check for the influence of interferences. This QC check is performed for inorganics analyzed by ICP or ICP-MS. When corrected by the dilution factor, the diluted sample result must agree with the original sample within specified limits.
- 9.1.8. Interelement Correction Standard – Analyzed to verify interelement and background correction factors. A solution containing both interfering and analyte elements of known concentration is analyzed at the beginning and end of each analytical run or a minimum of twice per 8 hours.
- 9.1.9. Second Source Check - A second source check is analyzed using either the LCS and/or an ICV (Initial Calibration Verification). The second source is a standard that is made from a solution or neat purchased from a different vendor than that used for the calibration standards. For some organic custom mixes, the same vendor but a different lot and preparation is used. This ensures that potential problems with a vendor supply would be evident in the analysis. Some areas of the lab use the continuing calibration verification standards as a second source from the initial calibration.

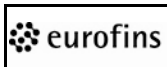
9.2. Quality Control Sample Frequency and Corrective Action

Each analytical method defines the frequency for the required QC samples and the corrective action required when a QC result fails to meet the acceptance criteria. A summary is provided in Appendix J.

The QC acceptance criteria are available to analysts in the laboratory. If the method reference requires the use of specific limits then the laboratory uses the published limits that are documented as part of the analytical method. Many methods require that each laboratory determine their own acceptance criteria based on statistical data obtained from performance of the method. In these cases, the limits are available to the analysts and are entered into the LIMS described below. Statistically determined acceptance criteria are subject to change as the laboratory recalculates its control limits. Due to their dynamic nature, acceptance criteria are not included in this manual.

The results of all quality control samples are entered into the computer in the same way as the results of client samples. The LIMS compares the individual values with the acceptance limits (statistically determined or method specified) and identifies quality control sample results that are out of specification. If the results are not within the acceptance criteria, corrective action suitable to the situation must be taken. This includes, but is not limited to, checking calculations, examining other quality control analyzed with the same batch of samples, qualifying results with a comment stating the observed deviation, and reanalysis of the samples in the batch.

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Each month, a summary of all QC entries (except blanks and surrogates) is generated from the LIMS. This summary is reviewed by QA staff and evaluated for changes in data that may indicate that an analysis is trending towards an out-of-control situation. The technical department is notified if a trend is observed.

The laboratory allows for marginal exceedances based on the number of analytes in the LCS. The exceedances are carefully monitored so that any systemic problems would be identified and corrective action taken. If the LCS is being reported based on the marginal exceedance allowance, a comment is added to the analytical report. Note: The use of marginal exceedance is not allowed for OH VAP work.

9.3. Quality Control Charts

Quality control results entered into the computer are used to generate control charts that are plotted via computer and can be accessed at any time by all employees. The system charts results from blanks, surrogates, matrix spike/matrix spike duplicates, duplicates, and laboratory control samples/laboratory control samples duplicate. These charts provide a graphical method for monitoring precision and bias over time. They can be used to detect quality problems by observation of patterns. The computerized quality control system is used to report QC data to clients and to collect data for assessment of precision and accuracy statistical limits.

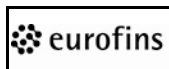
9.4. Measurement Uncertainty

(ISO 17025) "All uncertainty components which are of importance in a given situation shall be taken into account using appropriate methods of analysis" (5.4.6.3). This means the laboratory must determine the uncertainty contribution of all steps in the testing process such as equipment, calibration, standards, reagents, preparation, cleanups, etc. Since, in most methods, the laboratory control sample (LCS) goes through the entire process of preparation to analysis; all factors that would contribute to uncertainty is evident through the LCS results. LCSs are performed with every batch of samples where appropriate for the method.

Measurement uncertainty is calculated as two times the standard deviation of the LCS recoveries for the group and date range of data points selected for all applicable methods. This is reported as a percentage.

Tests that do not have LCSs (e.g. TCLP and paint filter test), are evaluated on a case-by-case basis by taking into account the uncertainty of each of the steps taken to perform the test.

Reports for uncertainty are generated and submitted to QA on an annual basis. It is not necessary to apply or report the uncertainty determination with sample results. When a client requests the measurement uncertainty it is applied by multiplying the determined analyte concentration by the uncertainty percentage.

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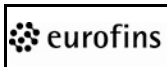
10. ASSURING QUALITY OF TEST RESULTS

10.1. Data Management

At a minimum, data management is initiated when the laboratory receives the samples from the client. More often the process begins with client communication of their needs and requirements for a specific project and/or testing. The CSRs are responsible for entering the information in the sample set up function of the LIMS. Upon receipt of the samples the unique tracking number is generated based on this information. At this point, computer technology becomes an integral part of tracking the samples through laboratory operations. The flow of data from the time samples enter the laboratory until the data is reported is summarized in the following table:

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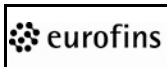
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Sample and Data Flow

Action	Personnel Involved
Sample received at Lancaster Labs <ul style="list-style-type: none"> Unpacked and reconciled against the client paper work or COC SA Documentation log completed 	Sample Administration
Sample is entered into the LIMS <ul style="list-style-type: none"> Lab ID number assigned Analyses entered Chain of custody started Storage location assigned Electronic record of sample number Labels generated Acknowledgement printed (record of samples received and analysis entered) 	Sample Administration
Sample stored in assigned location (refrigerator, freezer, etc.) <ul style="list-style-type: none"> Electronic record of sample #, bottle code, and location 	Sample Support
Acknowledgment sent to client (when requested)	Sample Administration
Sample removed from storage for analysis <ul style="list-style-type: none"> Electronic requisition of sample number by bottle code Necessary aliquot taken Sample returned to storage 	Technical Personnel
Analysis is performed according to selected analytical method <ul style="list-style-type: none"> Raw data recorded Reviewed Transferred to computer by analyst* (This is tracked by the unique sample number and batch number.) 	Technical Personnel
Computer performs calculations as programmed according to methods	Data Processing
Second analyst or supervisor verifies raw data	Technical Personnel
Generation/release of reports (automated through LIMS)	Billing and Reporting Group
Data package deliverables are assembled	Data Package Group
Electronic Data Deliverables (EDDs) are generated	EDD Group
Data packages are reviewed prior to sending to client	QA, Data Package Personnel, and Laboratory Management
Data packages are scanned Hard copy of batch raw data is archived Electronic files are backed up and archived	Data Package Personnel, Office Services, Computer Services

*Analyses requiring the analyst's interpretation may involve manual data reduction before entry into the computer.

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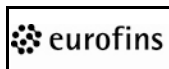
10.2. Data Documentation

Analytical data generated in the laboratory is collected from the instruments or associated data system or is manually documented in bound notebooks. Analysts review data as it is generated to determine that the instruments/systems are performing within specifications. If any problems are observed during an analytical run or the testing process, corrective action is taken and documented.

Procedures are in place to ensure that all data is traceable, authentic, and complete. Electronic data records are maintained and tracked through the LIMS, requiring authorized, password protected user access. The following general requirements outline our system for notebook, logbook, and documentation recording:

- Observations, data, and calculations are recorded at the time they are made and are identifiable to the specific task.
- Entries must be legible, signed, and dated. The signature may be a wet or electronic signature.
- Errors are corrected in a manner that does not obliterate the original entry, initialed and dated, and coded with an explanatory identifier. Changes to electronic data are tracked through audit trail functions.
- Blank pages or substantial portions of pages which are left blank are crossed-out to eliminate the possibility of data entry at a later date.
- Notebook pages and instrument printouts are signed/dated to indicate second party data review; this may be a wet or electronic signature.
- At periodic intervals a supervisor or data reviewer checks equipment/instrument logbook entries and temperature recordings for completeness, legibility, and conformance to procedures.
- At a minimum, the following information is recorded as part of data documentation:
 - Date of analysis/operation
 - Signature/date of analyst performing test/operation
 - Identification of client sample(s) and material(s) analyzed
 - Materials, reagents, standards used to perform the testing/operation
 - Method used to perform testing/operation (including version number and/or effective date)
 - Equipment/instrumentation used to perform testing/operation
 - Calculations and how they were derived
 - Departures, planned or unplanned, from the analytical method
 - Signature/date of person reviewing data documentation
- For computer generated data, the following information is recorded:
 - Sample(s) analyzed/operations performed
 - Date of analysis/operation
 - Unique instrument identification
 - Name/date of person operating the instrument
 - Name/date of person reviewing data
 - Any manual notations or interpretations made on instrument printouts are signed, dated, and reviewed

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10.3. Data Calculations

Most instruments either include or are connected to a data system programmed to perform calculations to reduce the raw data to a reportable form. All calculations are maintained in the instrument manuals and/or as part of the analytical method.

In many cases, the data from the local instrument system are uploaded directly to the LIMS for review and reporting. This direct upload eliminates the need to retype data and an associated source of transcription errors from the analytical scheme.

Some instruments report data that require application of additional factors before the data is in final form. For example, an extract concentration may be reported by the instrumental data system, but additional dilution and preparation factors may be needed before the result represents the concentration of analyte in the sample. Analysts input these additional factors into the LIMS, where final calculations are performed.

Analysts manually enter collected data, such as titration data, into the LIMS, which is programmed to perform calculations for final reporting. Documentation of the programming for each calculation performed by the LIMS is maintained.

10.4. Reporting Limits

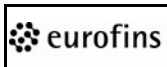
It is important to ascertain the limit of quantitation (LOQ) that can be achieved by a given method, particularly when the method is commonly used to determine trace levels of analyte. The Environmental Protection Agency has set forth one method for determining method detection limits (MDLs) from which LOQs can be extrapolated which is summarized in a laboratory procedure.

MDLs are verified or determined annually on each instrument and are the basis for the LOQ used in the default reporting format. Because MDLs change each time they are re-evaluated, they are not included in this manual, but are available in each laboratory and available to clients upon request.

The reporting limit used to determine whether a result is significant and reported as detectable is dependent upon agency and client requirements. A variety of formats are available and include use of the MDL, LOQ, method specified limits, and project specific limits. The MDL and LOQ for each analyte are programmed into LIMS for reporting purposes.

Under the DoD program, the laboratory must establish a Detection Limit (DL) and Limit of Detection (LOD). As defined by the DoD program, the DL is the smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. The laboratory determines the DL using the calculated value from the MDL Study. The DL can be derived from pooled MDL values obtained across instruments. The LOD is the smallest amount of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. It is established by spiking a quality system matrix at a concentration of 2-4 times the DL. The LOD must be verified on a quarterly basis or with each batch of samples.

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10.5. Data Review

Final review and verification of the data are performed by designated employees using the sample results, quality control information, method criteria and Project Notes entered into the LIMS. Data are initially evaluated by the analyst and then a second designated employee knowledgeable in the test, other than the employee responsible for performing the test, reviews the data. The reviews include checks for correct transcription, calculations, passing calibrations, compliant quality control results, holding time compliance, and project specific requirements. Any issues or errors identified during this stage are addressed, corrected, and reviewed with the responsible person.

After determining that all necessary requirements for valid data and for the project are met, the reviewer electronically approves the data by changing the LIMS status of the data from "complete" to "verified". The computer is programmed with a list of approved reviewers for each test, and the system is password protected to ensure that only qualified individuals verify the data.

10.6. Data Qualification

Data qualifiers are used to provide additional information about the results reported. The most typical use for data qualifiers is for results that fall below the quantitation limit, in the region where it becomes more difficult to distinguish a positive result from the background instrument signal. The data systems used to generate and report results are programmed to flag values in this range as estimates.

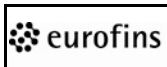
Other qualifiers are applied to advise data users of any validation issues associated with the data. The laboratory makes every effort to meet all of the requirements for generation of data. Occasionally, generation of data that does not meet all the method requirements occurs due to sample matrix or other analytical problems. If the test can not be repeated or reanalysis would not yield better quality data, qualified data is reported. Qualifiers can be in the form of comments on the analytical report or flags applied to the results.

10.7. Data Reporting

When all analyses are completed, reviewed and verified, a report is generated. The client receives a copy of the report containing the results of the analysis, associated QC data, and where necessary, explanatory comments to address non-conformances. To avoid ambiguity in interpreting results, a summary page that contains an explanation of all symbols and units used in reporting data is included with the Analysis Report submitted to clients. Some regulatory agencies also require the laboratory accreditation identification on the Analysis Reports. Where required, this information is added. The current list of agencies can be accessed in the LIMS. Copies of reports and associated supporting raw data are retained in our archives. The report contains the signature of the assigned client service representative who is the key contact for any questions concerning the results. Personnel authorized to review, sign, and release Analysis Reports are noted in the key personnel list provided in Appendix C.

The laboratory offers a variety of data levels and formats, from a basic report of sample and QC results only, to a comprehensive data package of QC/calibration information and raw data. The client and any agency involved direct the selection of report type. A summary of report formats and data packages types is provided in the laboratory *Schedule of Services*. Various electronic formats are also available formatted to client-specified file structure and sent via e-mail, direct upload, web-site access (LLabWeb), or common courier. LLabWeb is used for clients that require secure transfer of electronic data.

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Client confidentiality of LLabWeb data is ensured by the use of a secured firewall internet environment coupled with the use of a user ID and password to gain login access to the system. User accounts are configured to only allow access to specific data associated with the user's business account number.

Amendments to a final report after issue are in the form of an additional document or data transfer and include a reference to the original report. When a completely new final report is required, it is uniquely identified and includes a reference to the original report it replaces.

10.7.1. Reporting the Results

Analytical reports are generated with a cover page that summarizes all samples in that group. This page lists the laboratory assigned sample number and the corresponding client description. The cover page identifies the laboratory contact person's name and phone number if there is a question about the report. Within this package, each page is uniquely identified and paginated. Analytical test results for methods listed on the laboratories' accreditation scope meet all requirements of NELAP accreditation and ISO 17025 unless noted otherwise. Ohio EPA VAP requires that a signed, notarized affidavit accompany each analytical report.

10.8. Data Storage, Security, and Archival

The laboratory has documented procedures and instructions for the identification, collection, access, indexing, filing, storage, maintenance, and disposition of data records. Records are in the form of paper records, electronic data files, magnetic tape, and CD-ROMs.

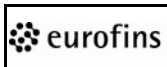
All data records are maintained in a confidential manner in an environment to minimize deterioration or damage and to prevent loss. Some records are stored in off-site facilities, in such a way that they are readily retrievable. Retention time for records is in accordance with specific procedures or instructions. Prior to the destruction of data/records, and if requested by a client or agency, the laboratory will notify the client/agency that their data is scheduled for destruction so arrangements can be made to have the original data sent to the client.

If specified in client contract(s), archived records are transferred according to their instructions in the event of a change in laboratory ownership or if the laboratory goes out of business. If not specified by the client, the sale agreement must require that archived records be maintained as scheduled by the new owners. In the case of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records must be followed.

The laboratory maintains all documentation which is necessary for historical reconstruction of data:

- Analysis reports
- Data notebooks
- Data logbooks
- Instrument output
- Correspondence and client files
- Instrument and equipment logbooks
- QA records
- Corporate documents
- Electronic records

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11. AUDITS AND INSPECTIONS

11.1. Internal Quality Assurance Audits

The QA Department, which is independent of laboratory activities, performs routine and on-going system, traceability, and observation audits to objectively review current systems, operations, and procedures as well as automated data integrity audits of electronic data records. The goal of the audits is to ensure that the quality system activities are effective and in compliance with regulatory programs, including NELAP, ISO 17025, DoD, and state agencies, as well as internal policies and procedures. Audits are documented and tracked in a QA database.

Audits are scheduled and conducted following a predefined schedule, based on criticality of operation and prior audit results, with the goal of evaluating systems and technologies across the operation. If warranted, additional audits are performed to follow up on promised corrective action or areas of concern.

Results of an audit are documented in a report format and distributed to applicable management personnel responsible for the area(s) under audit. Management is responsible to address all non-conformances found during an audit.

Audit reports and responses are circulated to Management to communicate the outcome of the audit and the proposed plan(s) for corrective action, if warranted. If any of the audit findings cast doubt on the validity of the results, the clients must be notified within three business days of the investigation.

All records maintained as part of an audit are kept on file for three years.

On an annual basis, an audit of the QA Department is performed as directed by the company Executive Management. The auditors assigned to carry out this operation are qualified staff members independent of the QA Department.

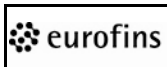
The specific content and findings of internal audits are not shared with clients.

11.2. Review of the Quality Assurance Program

All levels of management are continually updated on the status of quality and compliance by circulation of pertinent documents. Management review is documented by signatures on the route list, along with any comments or request for additional follow-up. The types of documents circulated real-time include:

- Internal, client, and agency audit reports and responses
- Proficiency test results
- Investigation and corrective action reports
- Monthly and quarterly QA status reports

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Executive management reviews the elements of the total QA program on an annual basis to ensure its continuing suitability and effectiveness in meeting the stated objectives outlined in Section 2.4 of this manual. The evaluation entails review of reports to management, all audit findings, client complaints, laboratory investigations, staff adequacy and training, and projected growth in workload. Patterns or trends in any of these areas are reviewed as a means to continually improve the quality system. This review also includes an evaluation of any audit findings resulting from the audit of the QA Department. At the conclusion of this quality system review, executive management determines the need to introduce changes or improvements into the quality systems at the laboratory. The minutes from the meeting and any recommendations for improvement are documented and a copy is forwarded to the QA staff for review and follow-up.

11.3. Good Laboratory Practice Critical Phase Inspections

Any project that is subject to Good Laboratory Practice (GLP) regulations is audited by the QA Department at intervals adequate to ensure the integrity of the study, as required by the regulations. Inspections of a GLP project include direct observation of analysts as they perform various phases of the study. Data documentation is reviewed as part of the inspection. The purpose of this type of audit is to ensure that there are no deviations from written methods, procedures, or study protocols.

Results of inspections are documented in a report format and distributed to applicable management personnel responsible for the area(s) under audit. Management is responsible to address all non-conformances found during an inspection. Inspection reports and responses are circulated to applicable laboratory management and an off-site study director, as applicable, to communicate the outcome of the inspection and the proposed plan(s) for corrective action, if warranted.

All records maintained as part of an inspection are kept on file.

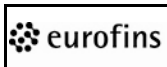
11.4. Client Audits

Because clients place great importance on compliance with applicable regulations, data quality, and project requirements, they may audit our facility as assurance that their objectives are being met. QA, management staff, CSRs, and the analytical laboratories play a key role in these audits. Visits by clients can range anywhere from a tour (to verify laboratory facilities and instrumentation) to an intensive inspection of technical operations, procedures, regulatory compliance, and/or review of specific project(s).

- Audits are scheduled directly with the CSR or QA. The request to audit is communicated to all applicable laboratory departments.
- In accordance with our policy on client confidentiality, a client is permitted to review only data and results that apply to their work, or which have been approved by laboratory management.
- An escort (designated laboratory employee) remains with an auditor at all times.

Responsibilities are assigned to the following groups in regard to client audits:

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11.4.1. QA Department

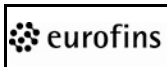
- Research previous audit reports and laboratory responses to past deficiencies.
- Follow-up with the applicable analytical laboratory areas to ensure action items were completed from the last audit, as necessary.
- Work with client to set audit agenda.
- Function as an escort during the audit
- Answer questions the auditor has in regard to laboratory and quality systems.
- Take notes of areas where corrective action or suggestions are recommended during the audit.
- Communicate audit issues to management at the completion of the audit.
- Respond to client audit reports.
- Ensure follow-up to cited items are performed in a timely manner.

11.4.2. CSRs

- Gather and organize relevant information (e.g., client correspondence, analysis/project requests, copies of analytical data from archives).
- Be knowledgeable about client-specific project requirements and issues.
- Function as an escort during the audit.
- Communicate issues/problems to appropriate personnel.

11.4.3. Laboratories

- Gather and organize laboratory data and documentation in preparation for client review.
- Assure corrective action was implemented from past audit findings, if necessary.
- Be prepared to discuss project data/testing results during the audit.
- Be familiar with client-specific project requirements and be prepared to answer client questions.
- Be familiar with the location of routine laboratory information and equipment (e.g., SOPs, data notebooks, calibration data, etc.).
- Be prepared to answer specific technical questions in regards to laboratory procedures and instrumentation within the area.
- Functions as an audit escort within the department during the audit.
- Laboratory managers may function as an escort during the audit

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11.5. Agency Inspections

It is laboratory policy to cooperate to the fullest extent and maintain cordial relations with all government agencies. The QA Department is assigned the responsibility of hosting and working with agency representatives. Their role includes, escorting the investigator(s); ensuring all questions are answered promptly and accurately; making note of all unresolved issues; informing management of the audit status and outcome; responding to the audit report and ensuring that appropriate corrective action is completed.

Inspections can be performed by investigators or auditors from the EPA, states, third-party accreditation bodies (i.e. A2LA, United States Department of Agriculture (USDA), or other regulatory agencies.

Government agencies have the right to investigate and inspect the laboratory during normal business hours and permission to inspect is granted by Executive Management.

Designated members of the QA Department are primary contacts for announced inspections. The QA Manager is the primary contact for all unannounced agency inspections. If the QA Manager is unavailable, Executive Management is notified, in addition to a member of the QA Department. The QA Manager, or their designee, must obtain evidence of the investigator's authority either in the form of a letter or examination/explanation of credentials.

Inspections include the examination of records or the inspection of facilities. Investigators are usually concerned only with the records relating to their responsibilities. As a general rule, they are given copies of records and documents, if requested. All copied records taken by an investigator must be stamped as being confidential material. The laboratory must have a record of all items taken by an investigator.

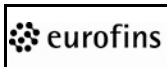
Investigators must be escorted through the laboratory. The laboratory is not obligated to show an investigator the following types of information: sales, financial or pricing information, or any personnel data other than training or qualification documentation. On a case-by-case basis, internal QA audit reports and investigation reports are made available for agency review. Any questions or concerns about a request made by an investigator in regard to recording devices or photographs must be reviewed with legal counsel.

The laboratory personnel are not permitted to sign affidavits. If an affidavit is presented during an inspection, all personnel are directed not to sign it, read it, nor listen to it being read. The only document that is acceptable to sign is an acknowledgement that an inspection report has been received. If there is any doubt as to what should be signed, legal counsel must be consulted.

11.6. Proficiency Testing

Many of the organizations that certify our laboratory to perform various analyses require proof of our competency. Laboratory performance is checked regularly by participation in a variety of proficiency testing programs. When available, blind samples are obtained from vendors that are accredited to provide PT samples for NELAP for all test and matrices routinely tested at the laboratory. In addition, some individual certification programs require analysis of specific sets of proficiency samples, and the laboratory also chooses to participate in a double blind program.

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Generally, the proficiency test programs consist of samples or ampulated spiking solutions used to fortify laboratory samples. The laboratories analyze the samples in the same manner as a client sample and the data is sent to the agency or vendor for evaluation. After the study results are returned to the laboratory, any data falling outside the acceptance criteria is investigated and corrective action is implemented, if needed. Results are circulated to management and communicated to the analyst. No proficiency testing samples or portion of a proficiency test sample are sent to another laboratory for analysis.

Double blind samples are submitted to the laboratories by the Client Services Department using a fictitious client name so that the analysts are not aware that the samples are proficiency tests. The samples are submitted quarterly and include a cross-section of organic and inorganic tests. The acceptance criteria for these double blind samples are developed statistically using data from participating laboratories, providing a source of inter-laboratory comparison. Results are reviewed, investigated as needed, and circulated to management.

If a trend in PT failures is identified, additional blind samples are ordered for that specific test as corrective action.

Clients routinely submit blind and double blind samples to evaluate the laboratory's performance. If a report is issued to the laboratory, it is handled in the same manner as a scheduled PT study evaluation and follow-up.

12. CORRECTIVE AND PREVENTIVE ACTION

12.1. Laboratory Investigations and Corrective Action

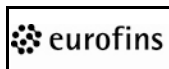
Due to the technical nature of laboratory work and the encompassing nature of our QA program, a wide variety of laboratory issues can require investigations, documentation, and corrective action. Prompt investigation and implementation of corrective action ensure that only data of known quality are reported and prevent the reoccurrence of errors. The following list provides "examples" of the type of issues that warrant investigation:

- Out-of-specification QC results
- Failed performance evaluation samples
- Reporting incorrect results
- Contamination issues
- Client technical complaints
- Procedural errors
- Missed holding times
- Systematic problems that compromise the accuracy or compliance of the data generated
- Problems with instrumentation and equipment which could compromise the data generated

These investigations must include the following:

- Identification of the problem
- Steps taken to investigate the problem
- Explanation of probable root cause(s) of the problem
- Steps taken to prevent future occurrence
- Determination of samples or systems affected by the problem

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Management is informed of problem situations and the QA Department tracks documentation and the status of the investigation activities. Technical management and/or QA may issue a stop work notice if issues indicate the potential for problems on a broad scale. The goal is to identify root cause, have the corrective action implemented promptly, and to the degree appropriate for the magnitude and risk of the problem. Corrective action issues are subject to follow up by the QA Department. Tracking and trending of laboratory issues is performed by the QA Department and reported to management on a monthly and quarterly basis.

12.2. Investigation Processes

All results from quality control (QC) samples are logged into the computerized quality control system, which is programmed to alert analysts to unacceptable results. Analysts are required to review the results and determine the source of the problem. The source of the problem and proposed corrective action must be documented. Corrective action may include, but is not limited to, re-analysis, re-extraction or re-digestion, instrument maintenance, or re-calibration. If these actions do not yield compliant data within the required hold time, a Nonconformance Form is initiated to document actions and communication with the client. The original form is archived with the associated raw data. Nonconformance Forms are reviewed by the technical department's management, or designee. A copy of the form is reviewed by QA.

Missed holding times are investigated and documented according to a procedure specific to this issue. A standard form is used for documenting this type of incident and signed by a representative of all areas involved, in addition to management and QA. Clients are informed of any problems involving holding time.

Other types of problems having the potential for impact on the quality of data are investigated and documented using a form titled Investigation and Corrective Action Report (ICAR). This process was developed to ensure that laboratory problems are investigated, evaluated for root cause, documented, and corrective action is put into place to prevent reoccurrence. Any employee can initiate an ICAR to document a laboratory problem. Once initiated, the QA Department is notified to assign a unique tracking number and the due date for the investigation. The QA Department reviews and approves the completed ICAR then monitors the corrective action.

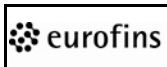
If a laboratory error is identified from the outcome of the investigation that impacts client data, the client must be immediately notified in writing of the situation. If the root cause of the problem has affected any other client sample results, all affected clients are notified immediately of the problem.

12.3. Client Feedback

The laboratory is in the business of providing high quality analytical testing services. The data that we supply to our clients must be technically complete, accurate, and compliant with applicable regulations. Complaints can be received via letter, phone call, e-mail, or face-to-face meeting.

When a complaint is received, it is our responsibility to determine, to the best of our ability, the extent of the issue and what data is in question. The person receiving the complaint documents this information and promptly forwards it to the appropriate management personnel where the work in question was performed. If a transcription or calculation error is discovered, the final report and/or data must be regenerated with the correct value(s).

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The Client Service Representative is responsible for entering client concerns into the LIMS and an automated summary report is sent to QA on a weekly basis for review. In some cases, an investigation is initiated to address and document the situation.

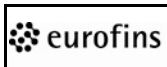
On an annual basis, the Client Services and Business Development Groups send a client satisfaction survey to all clients. The results of these surveys are compiled and used to identify areas of improvement for the laboratory.

12.4. Preventive Actions

All employees are empowered and encouraged to use the concept of Preventive Action to avoid a problematic situation. The company supports, embraces and drives the process for continuous quality improvement by several means, such as: Ethics Committee and the Suggestion Box (accessible to all employees on the company's Intranet 'LabLinks'), and training classes that include "Making Quality a Science" and Ethics. If an employee identifies a potential problem or an area of concern or it should be brought to the attention of his/her supervisor, Human Resources or the Ethics Officer. Employees are also encouraged to communicate to their supervisor any area(s) or operation(s) that they believe could be streamlined, make their job easier, would provide a quality improvement, or could provide a cost savings to the company.

Various training courses are provided to all employees to assist with building quality and efficiency into their daily jobs. They stress a proactive approach/environment to problem solving and to review quality systems and operational efficiencies.

- "Making Quality a Science" is an introductory total quality management (TQM) course required for all employees to teach why quality is important and to explain the laboratory's quality philosophy and processes, and how to apply quality thinking and techniques on the job. Topics discussed include: communication, teamwork, serving the client, measurement, quality tools, and continuous process improvement. To foster continuous improvements of laboratory systems, process improvement teams are formed, as needed, if an employee needs help in solving a problem or addressing an issue. The goal of these groups is to have representation from various areas of the laboratory work together to look at a problem, evaluate the need for a temporary fix, brainstorm root causes, plan process improvement, implement the process improvement, evaluate and follow-up to the corrective action.
- "Putting our Values to Work" is a seminar required for all employees to teach the laboratory's Statement of Values by examining how it translates to our everyday jobs and ethical decision making. Topics discussed include: Statement of Values, ethical paradigms, and ethical decision making. Mandatory ethics training refresher seminars are offered on an annual basis.
- The laboratory has an Ethics Committee that meets on a regular basis to discuss and handle ethical issues or situations that cause concern or make employees feel uncomfortable. The mission of this group is to promote sharing of concerns on ethical issues; encourage and maintain commitment among employees to our core ethical values; and to maintain an environment that ensures open access to committee members and all levels of management and the confidential handling of ethical issues.

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- The laboratory also utilizes a formal program to encourage preventive action through development of lean processes. The goal of this program is to optimize processes to ensure efficiency and operational improvements while maintaining compliance. The efficiency gains are inherently coupled with minimizing errors and rework. Teams of employees learn the tools and techniques to evaluate a process, identify potential sources of errors, delays or problems in an operation, determine system changes that will minimize these and work to implement the improvements. Each project includes thorough documentation of the evaluation, measurement, and implementation phases. The process is continually monitored to ensure that the anticipated results are sustained.
- The Quality Assurance Group prepares monthly and quarterly program status reports for management. The reports include a variety of metrics and graphs which are used to evaluate trends in laboratory performance across all quality and compliance areas. Management responds to any negative trends by developing a corrective action plan.

13. SERVICE TO CLIENTS

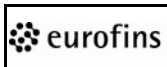
13.1. Service to Clients

We value our client relationships and support these partnerships through the following principles:

- **Honesty and Fairness** – Our corporate culture is founded on the principles of professionalism and high ethical standards in dealing with our clients. This may mean declining to provide the service requested (if we are convinced that to do so would be meaningless) or it may mean referring clients outside of our Lab if we believe that another company can better meet their needs.
- **Complete Service** – We will give our clients full value on every service provided. We will provide detailed information on our methods, procedures, and QA programs if requested, and take a personal interest and initiative in helping solve our client's problems within the area of our professional expertise.
- **Trustworthiness** – All data and information developed for a client will be held confidential and not disclosed to a third party except on written request of the client. If information is subpoenaed, we must, by law, release it, but the client will be informed of the release.
- **Commitment to Quality** – We constantly strive to improve our service in quality, flexibility, and dependability, to keep our competitive edge. We will achieve this through: meeting the requirements of those we serve, staying apprised of regulatory and industry expectations, and providing prompt responses to client concerns.
- **Basics of Superlative Service** – Our focus is on our client's success. Through proactive collaborative communication, our leadership ensures we understand our client's expectations and strives to exceed them. We foster a service culture in our training, reward and recognition, and performance management process so each employee takes ownership to deliver superlative service to our clients. Feedback from clients, whether positive or negative, is an important part of our continuous improvement system. Ways in which feedback is gathered can include, but is not limited to, customer satisfaction surveys, client audits, and the customer complaint system, which is described within section 12.3.

We also view our fellow employees as our clients since they frequently receive the results of our labor. Meeting the requirements of the next employee in the workflow process is just as important as meeting the needs of an external client.

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13.2. Review of Work Requests, Tenders, and Contracts

The laboratory places great importance on understanding client requirements for a project. We ensure, to the best of our ability, that client/project requirements are identified. Project evaluation can be achieved in various ways, including the review of analytical methods, protocols, business contracts, and quality agreements. Project kick-off meetings can also be arranged through the Business Development and/or the Environmental Project Management Group. These meetings allow the client and key technical personnel to discuss project issues and requirements prior to project initiation. The project review encompasses our Project Cycle process and individual topics to be evaluated for a project include, but are not limited to: scope of testing; required accreditations (i.e. individual state agencies, NELAP, DoD, and ISO17025) held by the laboratory; appropriate and current testing methods; ability to meet project required reporting limits and QC (if applicable); inconsistencies clarified; and nonstandard work requests. Any differences between laboratory processes and the project requirements are discussed and addressed with the client and the laboratory staff before the project is accepted and samples arrive. Testing that cannot be performed at the laboratory may be subcontracted to another laboratory (see 13.4).

A key client contact, the CSR is assigned to oversee the project. Communication between the client and laboratory staff is available and is coordinated through the CSR.

As a project continues, the CSRs provide continuous communication and status reports (if requested) about the project to the client. The CSR relays any project changes or modifications to the technical groups. If the client submits revised project documents (QAPPs, etc.) then the Project Cycle review process is repeated. The CSR also communicates any issues encountered by the technical laboratories back to the client and vice-versa.

13.3. Timely Delivery

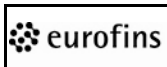
Evaluating laboratory capacity and ability to perform specific projects is a joint responsibility between the Technical Director, Business Development, and the laboratory managers. We recognize that one of the most important aspects of the service we offer is turnaround time.

Many analysts are cross-trained to perform a variety of tests, and there is redundant equipment available in the laboratory area creating operation flexibility for routine work. Larger projects are reviewed against capacity estimates before bids are submitted to ensure that the client's schedule is met. Turnaround time is continually measured.

Regularly scheduled meetings are held with technical and support management, and project management personnel to review progress with current projects, as well as special requirements of new work scheduled for the laboratory.

Management receives a daily report of the status of all samples in the lab, including those with priority status or those that have exceeded a preset turnaround time. This is of inestimable value in planning and organizing the workload through efficient scheduling.

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Any changes to the established timeline by the client or the laboratory must be communicated to the client or laboratory as soon as possible. Upon communication of changes, a new timeline is established and agreed upon by both parties. If a client requires a change in the scope of the project (e.g., number of samples submitted, change in analyses, revised protocol) the laboratory must be informed in writing and a new timeline and cost estimate is be provided.

13.4. Subcontracting

The laboratory may subcontract tests to other laboratories if the requested testing is not routinely performed in our laboratory. To a lesser extent, samples may need to be subcontracted to an overflow laboratory to ensure hold times and/or turn-around-times (TAT) are met.

Testing is only subcontracted with the client's knowledge and approval. The CSR must notify the client in writing when any of their requested analyses will be subcontracted to another lab. Client approval must be obtained in writing before samples are shipped.

Subcontract laboratories are selected based on their qualifications and accreditations. The subcontractor is requested to sign a statement that they warrant all testing procedures they perform and that they are solely liable and responsible for the accuracy of tests performed. If projects require a specific agency certification (i.e. individual state agencies, National Environmental Laboratory Accreditation Program (NELAP), Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP), and ISO17025), only an appropriately accredited laboratory is used. The client may also have a list of laboratories to be used for subcontracting. In these cases, the evaluation of the subcontract laboratory is made by the client.

Data obtained from subcontract laboratories is clearly marked as such when reported by the laboratory. The data are submitted to the client in the format obtained from the subcontractor.

13.5. Use of NELAP and A2LA logo

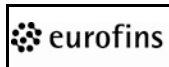
It is not laboratory policy to use these logos on any company letterhead, including analytical reports.

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Effective Date	Aug 8, 2014	Status	Effective
Historical/Local Document Number	DOD - Environmental Quality Policy Manual Appendix A		
Local Document Level	Level 1		
Local Document Type	POL - Policy		
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Prepared by	Christiane Sweigart and Kathryn Brungard
Reviewed and Approved by	Duane Luckenbill;Review;Tuesday, July 29, 2014 11:15:02 AM EDT Robert Strocko;Review;Wednesday, July 30, 2014 1:19:46 PM EDT Dorothy Love;Approval;Wednesday, July 30, 2014 2:05:44 PM EDT

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Procedure Cross Reference List

NOTE: SOPs and Forms are indicated in the table with the unique Document Control Database number starting with "90...". The topic of the document is given in parentheses.

Section #	Title	Procedure(s)
1	Introduction	
1.1.	Mission Statement	Employee Handbook
1.2.	Quality Policy	9007879 (Statement form) Employee Handbook
1.3.	Statement of Values	Employee Handbook
1.5.	Certifications, Accreditations, and Registrations	9007852 (Cert Summary form)
2	Organization and Personnel	
2.1.1	Business Continuity and Contingency Plans	9017347 (Incident Response Plan) 9017681 (Preparedness ... Policy 0010) 9017358 (Archiving SOP) 9021762 (Deputies form)
2.2.	Organizational Structure	Organization Charts
2.3.	Management Responsibilities	PQDs (job descriptions) PMDs (individual job plans)
2.4.	Overview of the Quality Assurance Program	Dept 4052 SOP Series
2.5.	Quality Assurance Responsibilities	Dept 4052 SOP Series
2.6.	Communication of Quality Issues to Management	9020717 (QA Reports)
2.7.	Personnel Qualifications and Responsibilities	9017379 (Employee Training) PQDs (job descriptions) PMDs (individual job plans) Task Specific Training
2.8.	Relationship of Functional Groups and the Quality Assurance Program	Quality Orientation TQM Training PMDs (individual job plans) Dept 4052 SOP Series 9017338 (Project Cycle)
2.9.	Balancing Laboratory Capacity and Workload	PMDs (individual job plans) LIMS reports for mgt
2.10.	Identification of Approved Signatories	9017322 (Date Entry, Verification and Reporting)
2.11.	Personnel Training	9017379 (Employee Training) 9015390 (DOCs) PQDs (job descriptions) PMDs (individual job plans) Task Specific Training
2.12.	Regulatory Training	9022322 (GLP)

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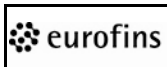
Section #	Title	Procedure(s)
2.13.	Employee Safety	Analytical Methods Chemical Hygiene Plan 9017681 (Preparedness ... Policy 0010) Dept 6098 SOP Series PMDs (individual job plans)
2.14.	Client Services/Project Management Responsibilities	Dept 4039 SOP Series 9017338 (Project Cycle)
2.15.	Confidentiality	Employee Handbook 9017360 (E-mail System) 9022134 (Client and Agency Audits)
2.16.	Business Conduct	Employee Handbook
2.17.	Operational Integrity	9017675 (Manual Integration Policy 0001) 9017333 (Chromatographic Integration) 9017679 (Ethics Policy 0007) 9007879 (Quality Statement form)
3	Buildings and Facilities	
3.1.	Facility	Floor Plans
3.2.	Security	9017366 (Building Security)
3.3.	Disaster Recovery	9017347 (Incident Response Plan)
3.4.	Environmental Monitoring	9017311 (VOA Storage) 9021509 (ETM)
3.5.	Water Systems	9017368 (Reagent Water)
3.6.	Housekeeping/Cleaning	9017373 (Housekeeping)
3.7.	Insect & Rodent Control	9017367 (Insect & Rodent Control)
3.8.	Emergency Power Supply	9017347 (Incident Response Plan)
3.9.	Facility Changes	9017364 (Facility Change Control) 9028515 (Change Control)
4	Document Control	
4.1.	Hierarchy of Internal Operating Procedures	9017356 (Writing SOPs)
4.2.	Document Approval, Issue, Control, and Maintenance	9017357 (Document Control) 9017329 (Method Validation)
4.3.	Client-Supplied Methods and Documentation	9021833 Analytical Decision Making) 9022599 (QA review of QAPPs) 9017338 (Project Cycle) 9015436 Auditing Paperwork)
4.4.	Laboratory Notebooks, Logbooks, and Forms	9017357 (Document Control) 9021767 (Notebooks)

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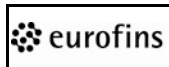
Section #	Title	Procedure(s)
4.5.	Control of External Documents	9017357 (Document Control) Departmental "Controlled Documents" forms
5	Sample Handling	
5.1.	Sample Collection	Dept 4031 SOP Series
5.2.	Sample Receipt and Entry	Dept 6042 SOP Series
5.3.	Sample Identification and Tracking	Dept 6042 SOP Series 9017318 (LSAR)
5.4.	Sample Storage	Dept 6055 SOP Series
5.5.	Sample Return/Disposal	9015512 (Sample Discard) 9017352 (Hazardous Wastes - Lab) 9017756 (Hazardous Wastes – Storage)
5.6.	Legal Chain of Custody	9017335 (Legal COC)
5.7.	Representativeness of Samples	Analytical Methods 9017334 (Representative Solid Samples)
6	Technical Requirements - Traceability of Measurements	
6.1.	Reagents and Solvents	9017328 (Reagents and Standards) Analytical Methods
6.3.	Calibration Standards	9017328 (Reagents and Standards) Analytical Methods
6.4.	Equipment and Instrumentation	9017325 (Inst. & Equip M&C) 9015389 (Balance, Syringe, Pipette Verification) Departmental Technical Procedures
6.5.	Computerized Systems and Computer Software	9028515 (Change Control) 9017361 (Network Accounts) 9017360 (E-mail System) 9017710 (Computer Backup) Employee Handbook 9017712 (Computer Viruses)
6.6.	Change Control	9028515 (Change Control)
6.7.	Labware Cleaning	Departmental Procedures
7	Purchasing Equipment and Supplies	
7.1	Procurement	9021705 (Procurement) 9018236 (Receipt of Lab Supplies)
7.2	Supplier Evaluation	9021705 (Procurement) 9017310 (Subcontracting) 9017328 (Reagents and Standards) 9015516 Preservative Checks)

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Section #	Title	Procedure(s)
8	Analytical Methods	
8.1.	Scope of Testing	Schedule of Services
8.2.	Analytical Test Methods	9017329 (Method Validation) 9023483 Writing Procedure Guidance form)
8.3.	Client Supplied Methods	9017329 (Method Validation)
8.4.	Method Validation	9017329 (Method Validation)
8.5.	Procedural Deviations	9017331 (ICARs)
9	Internal Quality Control Checks	
9.1.	Laboratory Quality Control Samples and Acceptance Criteria	9017313 (QC Limits) Analytical Methods
9.2.	Quality Control Sample Frequency and Corrective Action	9017315 (Noncompliant Data) Analytical Methods
9.3.	Quality Control Charts	9018253 (End of Month QC Reports)
9.4.	Measurement Uncertainty	9017313 (QC Limits)
10	Assuring Quality of Test Results	
10.1.	Data Management	9021767 (Notebooks)
10.2.	Data Documentation	9021767 (Notebooks) 9017322 (Date Entry, Verification and Reporting) 9007879 (Statement form)
10.3.	Data Calculations	9017322 (Date Entry, Verification and Reporting) Analytical Methods
10.4.	Reporting Limits	9017309 (MDLs & LOQs)
10.5.	Data Review	9021767 (Notebooks) 9017322 (Date Entry, Verification and Reporting)
10.6.	Data Qualification	9017315 (Noncompliant Data)
10.7.	Data Reporting	9017322 (Date Entry, Verification and Reporting) 9017330 (MCL Exceedance)
10.8.	Data Storage, Security, and Archival	9017358 (Data Archiving) 9017710 (Computer Backup)
11	Audits and Inspections	
11.1.	Internal Quality Assurance Audits	9020535 (Internal Audits) 9022322 (GLP) 9008821 Internal Audit Checklist form)
11.2.	Review of the Quality Assurance Program	9020535 (Internal Audits) 9020717 (QA Reports)
11.3.	Good Laboratory Practice Critical Phase Inspections	9022322 (GLP)
11.4.	Client Audits	Employee Handbook 9022134 (Client and Agency Audits)

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Section #	Title	Procedure(s)
11.5.	Agency Inspections	Employee Handbook 9022134 (Client and Agency Audits)
11.6.	Proficiency Testing	9017321 (PT Program) 9018237 (PT Entry)
12	Corrective and Preventive Action	
12.1.	Laboratory Investigations and Corrective Action	9017315 (Noncompliant Data) 9017331 (ICARs) 9017332 (Client Complaints)
12.2.	Investigation Processes	9017326 Missed Hold Procedure) 9007810 (Missed Hold form) 9017331 (ICARs)
12.3.	Client Feedback	9017332 (Client Complaints) Annual Client Survey
12.4.	Preventive Actions	Corporate Training Lean Projects 9017338 (Project Cycle) 9028515 (Change Control) 9020535 (Internal Audits)
13	Service to Clients	
13.1.	Service to Clients	Employee Handbook Ethics Statement 9007879 (Statement form) TQM Training
13.2.	Review of Work Requests, Tenders, and Contracts	9015436 (Client Paperwork) 9017338 (Project Cycle) 9018254 (QAPP Review)
13.3.	Timely Delivery	9015434 (Tracking Rush Samples) 9015437 (Scheduling Rush Samples) Departmental LIMS reports
13.4.	Subcontracting	9017310 Subcontracting) 9017338 (Project Cycle) 9018248 (QA Approval of Subcontractors)

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Eurofins Document Reference	1-P-QM-GDL-9015379	Revision	3
Effective Date	Aug 8, 2014	Status	Effective
Historical/Local Document Number	DOD - Environmental Quality Policy Manual Appendix B		
Local Document Level	Level 1		
Local Document Type	POL - Policy		
Local Document Category	ES - Environmental Sciences		

Prepared by	Christiane Sweigart
Reviewed and Approved by	Duane Luckenbill;Review;Tuesday, July 29, 2014 10:47:11 AM EDT Robert Strocko;Review;Wednesday, July 30, 2014 1:31:56 PM EDT Dorothy Love;Approval;Wednesday, July 30, 2014 2:07:59 PM EDT

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<div>  Lancaster Laboratories Environmental </div>		Document Title: Certifications, Accreditations, Registrations and Contracts		
Eurofins Document Reference: 1-P-QM-FOR-9007852		Revision: 22		
Effective date: Jun 23, 2014		Historical Reference: Form 2528		
		Status: Effective		
Agency	Parameter	Applicable Matrices	Lab ID No.	Certificate No
Federal Programs: American Association for Laboratory Accreditation (A2LA)	Organics, inorganics, dioxin per ISO 17025 and DoD QSM 4.2	Nonpotable water, solid and hazardous waste, air, tissue and tobacco	0001.01	
USDA Quarantine Soil Permit	All	All	P330-13-00350	
State Programs: State of Alaska, Department of Environmental Conservation	Organics, inorganics, UST analysis	Nonpotable water, solid and hazardous waste	UST-061	
State of Arizona, Department of Health Services	Dioxins	Potable water, nonpotable water, solid and hazardous waste	AZ0780	
State of Arkansas, Department of Environmental Quality	Organics, inorganics, dioxin	Nonpotable water, solid and hazardous waste	88-0680	
State of California, Department of Health ELAP	Organics, inorganics	Potable water, nonpotable water, solid and hazardous waste	2792	
State of California, Department of Health NELAC	Dioxin and NDMA	Potable water, nonpotable water, hazardous waste	10278CA	
State of Colorado, Department of Public Health and Environment	Organics, inorganics, dioxin	Potable water	None	
State of Connecticut, Department of Public Health	Organics, inorganics, dioxin, micro	Potable water, nonpotable water, solid and hazardous waste	PH-0746	
State of Delaware, Health and Social Services	Organics, inorganics, dioxin, micro	Potable water	None	
State of Florida, Department of Health	Organics, inorganics, dioxin, micro	Air and emissions, potable water, nonpotable water, solid and chemical materials	E87997	
State of Illinois, Environmental Protection Agency	Organics, inorganics, dioxin	Nonpotable water, solid and chemical materials	200027	003345
State of Iowa, Department of Natural Resources	Organics, inorganics, UST analysis	Nonpotable water, solid and hazardous waste	361	
State of Kansas, Department of Health and Environment	Organics, inorganics, dioxin	Potable water, nonpotable water, solid and chemical materials	E-10151	
Commonwealth of Kentucky, Department of Environmental Protection, Division of Water	Organics, inorganics, dioxin	Potable water	90088	
Commonwealth of Kentucky, Department for Environmental Protection - UST Branch	Metals only	Nonpotable water, solids	89	
State of Louisiana, Department of Environmental Quality	Organics, inorganics, dioxin	Air emissions, nonpotable water, solid chemical materials, biological tissue	Lab ID:02055	AI No.:30729
State of Maryland, Department of the Environment	Organics, inorganics, dioxin, micro	Potable water	100	
Commonwealth of Massachusetts, Department of Environmental Protection	Organics, inorganics	Nonpotable water	M-PA009	

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	Effective date: Jun 23, 2014		Status: Effective

Agency	Parameter	Applicable Matrices	Lab ID No. Certificate No.
State of Michigan, Department of Environmental Quality	Organics, inorganics, dioxin	Potable water	9930
State of Missouri, Department of Natural Resources	Organics	Potable water	450
State of Montana, Department of Public Health and Human Services	Organics, inorganics, dioxin	Potable water	CERT0098
*State of Nevada, Division of Environmental Protection	Organics, inorganics, dioxin	Nonpotable water, solid and chemical materials	PA00009
*State of New Hampshire, Department of Environmental Services	Organics, inorganics, micro	Potable water, nonpotable water, solid and chemical materials	2730
*State of New Jersey, Department of Environmental Protection (NJDEP)	Organics, inorganics, dioxin, micro	Air and emissions (direct accreditation), potable water, nonpotable water, solid and chemical materials	PA011
*State of New York, Department of Health	Organics, inorganics, dioxin	Air, nonpotable water, potable water, solid and chemical materials	10670
State of North Carolina, Department of the Environment and Natural Resources	Organics, inorganics	Nonpotable water	521
State of North Carolina, Department of Health and Human Services	Organics, micro	Potable water	42705
State of North Dakota, Department of Health	Inorganics	Nonpotable water	R-205
State of Ohio, Environmental Protection Agency (Voluntary Action Program)	Organics, inorganics	Nonpotable water, solid and hazardous waste	CL0070
State of Oklahoma, Department of Environmental Quality	Organics, inorganics, dioxin	Nonpotable water, solid and hazardous waste	9804
*State of Oregon, Public Health Laboratory	Organics, inorganics, dioxin	Air, nonpotable water, solid and chemical materials	PA200001
*Commonwealth of Pennsylvania, Department of Environmental Protection (Bureau of Laboratories)	Organics, inorganics, dioxin, micro	Potable water, nonpotable water, solid and chemical materials	36-00037 013
State of Rhode Island, Department of Health	Organics, inorganics	Potable water, nonpotable water	LA000338
State of South Carolina, Department of Health and Environmental Control	Organics, inorganics, dioxin	Potable water, nonpotable water, solid and hazardous waste	89002 89002002
State of Tennessee, Department of Environment & Conservation	Organics, inorganics, dioxin	Potable water	TN02838
*State of Texas, Commission on Environmental Quality	Organics, inorganics, dioxin	Air and emissions, potable water, nonpotable water, solid and chemical materials, biological tissue (direct accreditation)	T104704194-14 13
*State of Utah, Department of Health	Organics, inorganics, dioxin	Potable water, nonpotable water, solid and hazardous material	PA00009

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	Document Title: Certifications, Accreditations, Registrations and Contracts		
	Eurofins Document Reference: 1-P-QM-FOR-9007852	Revision: 22	Historical Reference: Form 2528
	Effective date: Jun 23, 2014		

Status: Effective

Agency	Parameter	Applicable Matrices	Lab ID No. Certificate No.
State of Vermont, Department of Health Laboratory	Organics, inorganics, dioxin, micro	Potable water	VT 36037
Commonwealth of Virginia, Department of General Services	Organics, inorganics, micro	Potable water	00187 2417
Commonwealth of Virginia, VELAP	Organics, inorganics, dioxin, micro	Air, Potable water, nonpotable water, solid and chemical materials	460182
State of Washington, Department of Ecology	Organics, inorganics, dioxin	Air, Potable water, Nonpotable water, solid and chemical materials	2754 C457
State of West Virginia, Department of Health and Human Resources	Organics, inorganics	Potable water	9906C
State of West Virginia, Department of Environmental Protection	Organics, inorganics, dioxin, micro	Nonpotable water, solid and chemical materials, hazardous waste	055
State of Wisconsin, Department of Natural Resources	Organics, inorganics, dioxin	Nonpotable water, solid and hazardous waste	998035060
State of Wyoming and all Tribal Public Water Systems in Region 8	Organics, inorganics, dioxin, micro	Potable water	8TMS-L

¹NELAP Primary AB: Air and Emissions

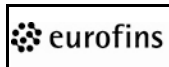
²NELAP Primary AB: Potable Water, Nonpotable water, solid and chemical materials

³NELAP Secondary AB

⁴Approval for UST work by A2LA

⁵NELAP Primary AB: Biological Tissue

NOTE: This list accurately reflects the certifications, accreditations, registrations, and contracts held at the time of publication and is subject to change. Check with your account manager on the status of any certification needed for a specific project.

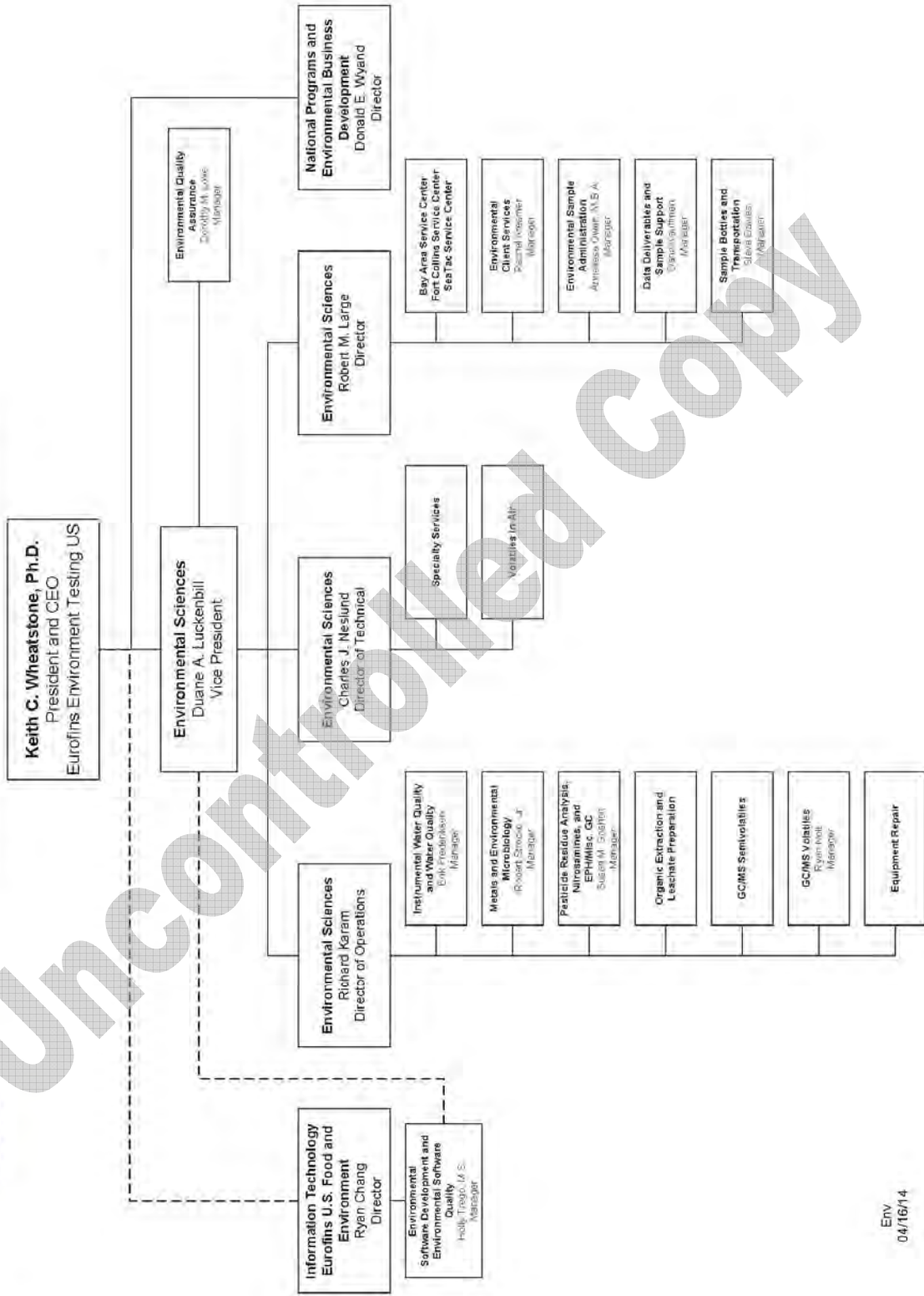
 <div>Lancaster Laboratories Environmental</div>	Document Title: Organizational Charts Personnel to Sign Reports	Eurofins Document Reference: 1-P-QM-GDL-9015380
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Eurofins Document Reference	1-P-QM-GDL-9015380	Revision	3
Effective Date	Aug 8, 2014	Status	Effective
Historical/Local Document Number	DOD - Environmental Quality Policy Manual Appendix C		
Local Document Level	Level 1		
Local Document Type	POL - Policy		
Local Document Category	ES - Environmental Sciences		

Prepared by	Christiane Sweigart
Reviewed and Approved by	Duane Luckenbill;Review;Tuesday, July 29, 2014 10:52:10 AM EDT Robert Strocko;Review;Wednesday, July 30, 2014 1:03:25 PM EDT Dorothy Love;Approval;Wednesday, July 30, 2014 2:19:54 PM EDT

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Name	Degree	Title
Quality Assurance		
Dorothy Love*	B.S.	Manager
Barbara Reedy*	B.S.	Senior Specialist
Christiane Sweigart	B.S.	Senior Specialist
Kathryn Brungard*		Senior Specialist
Environmental Sciences		
Duane Luckenbill	B.S.	Vice President
Donald Wyand	B.S.	Director
Robert Large	B.S.	Director
Richard Karam*	B.S.	Director
Charles Neslund*	B.S.	Director
Environmental Client Services and Inside Business Development		
Rachel Kreamer	B.S.	Manager
Lynn Frederiksen*	B.S.	Principal Specialist GL
Nicole Maljovec*	M.S.	Principal Specialist GL
Wendy Kozma*	B.S.	Principal Specialist GL
Angela Miller*	B.S.	Specialist
Barbara Weyandt*	M.S.	Specialist
Irene Dodd*	M.S.	Principal Specialist
Kaitlin Plasterer*	B.S.	Senior Specialist
Katherine Klinefelter*	M.S.	Principal Specialist
Loran Carter*	B.S.	Specialist
Luz Garcia*		Specialist
Lyssa Longenecker*	B.S.	Senior Specialist
Marianne Bragg*	B.S.	Principal Specialist
Megan Moeller*	B.S.	Senior Specialist
Melissa McDermott*	B.A.	Principal Specialist
Nancy Bornholm*	B.S.	Principal Specialist
Natalie Luciano*	B.A.	Senior Specialist
Tara Spaide*		Senior Specialist
Teresa Cunningham*	B.S.	Principal Specialist
Additional support personnel in this group: 1		
Data Deliverables		
Dana Kauffman*		Manager
F. Bradley Ayars		Principal Chemist Group Leader
Grace Salm		Specialist Group Leader
Luz Torres		Senior Specialist Group Leader
Audrey McClune		Specialist
Betty Umble		Specialist
Jessica Baron		Specialist
Judi Brown		Specialist
Kathy Fair		Specialist
Lydia Steinke	B.S.	Specialist
M Susan Kreider		Senior Specialist

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Name	Degree	Title
Patricia Madrigal-Kauffman	A.S.	Specialist
Tina McNeil		Specialist
Tracy Pang-Ward		Specialist
Additional support personnel in this group: 5		
Service Centers		
Rachel Kreamer	B.S.	Manager
Kay Hower*	B.A.	Principal Specialist Group Leader
Larry Starkey		Specialist
Vincent Yu	B.S.	Specialist
Cassandre Pelto*	B.S.	Project Manager
Additional support personnel in this group: 1		
Environmental Microbiology		
Robert Strocko*	B.S.	Manager
Hannah Cottman	B.S.	Microbiologist
Extractable Petroleum Hydrocarbons (EPH)/Miscellaneous GC		
Susan Goshert*	B.S.	Manager
Michele Hamilton*	B.S.	Senior Chemist Group Leader
Christine Dolman	B.S.	Chemist
Elizabeth Marin	B.S.	Chemist
Glorines Suarez-Rivera		Chemist
Heather Williams	B.S.	Senior Chemist
Nicholas Rossi	B.S.	Senior Chemist
Tracy Cole*		Senior Specialist
Tyler Griffin	B.S.	Chemist
Field Sampling		
Samuel Huber*	B.S.	Manager
Jeffrey Allen		Specialist Group Leader
Timothy Hauck		Specialist
GC/MS Semivolatiles		
Richard Karam*	B.S.	Director
Rachel Cochis*	B.A.	Senior Specialist Group Leader
Beth Rubino	B.S.	Senior Specialist
Brian Graham	B.A.	Senior Chemist
Catherine Bachman	B.S.	Chemist
Chad Moline*	B.S.	Senior Chemist
Holly Berry	B.S.	Senior Chemist
Joseph Gambler	B.S.	Senior Chemist
Linda Hartenstine	B.A.	Senior Chemist
Mark Clark	B.S.	Principal Chemist
Mark Ratcliff*	B.A.	Senior Specialist
Matthew Barton*	B.S.	Senior Specialist
GC/MS Volatiles		
Ryan Nolt	B.S.	Manager
Kenneth Boley*	B.S.	Senior Chemist Group Leader

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Name	Degree	Title
Roy Mellott	B.S.	Senior Chemist Group Leader
Kathrine Muramatsu	B.S.	Senior Chemist Group Leader
Amanda Richards		Chemist
Andrea Lando	B.S.	Chemist
Angela Sneeringer	B.S.	Chemist
Anita Dale		Chemist
Brett Kenyon	B.S.	Chemist
Chelsea Stong	B.S.	Senior Chemist
Christine Dulaney*	B.S.	Senior Specialist
Christopher Torres	B.S.	Chemist
Daniel Heller	B.S.E.	Senior Chemist
Jason Long	B.S.	Senior Chemist
Kelly Keller		Chemist
Kerri Legerlotz	B.S.	Senior Chemist
Kevin Sposito	B.S.	Chemist
Laura Krieger	B.S.	Chemist
Lawrence Taylor*	B.S.	Senior Specialist
Linda Pape	B.A.	Senior Chemist
Marie Beamenderfer	B.S.	Senior Chemist
Marla Brewer*	B.S.	Senior Specialist
Miranda Tillinghast	B.S.	Chemist
Robin Runkle*	B.S.	Senior Specialist
Sara Johnson	B.S.	Senior Chemist
Sarah Guill	B.S.	Chemist
Stephanie Selis	B.S.	Senior Chemist
Additional support personnel in this group: 3		
Instrumental Water Quality		
Erik Frederiksen*	B.A.	Manager
Nicole Veety		Senior Chemist Group Leader
Clinton Wilson	B.A.	Chemist
James Mathiot		Chemist
Joseph McKenzie		Chemist
Sandra Miller		Chemist
William Hamaker		Chemist
Additional support personnel in this group: 2		
Metals		
Robert Strocko*	B.S.	Manager
Nina Haller*		Senior Specialist Group Leader
Debra Bryan		Specialist Group Leader
Choon Tian	B.A.	Chemist
Damary Valentin		Chemist
Deborah Krady	B.S.	Specialist
Eric Eby	B.S.	Senior Chemist
Jennifer Moyer	B.S.	Senior Specialist

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Name	Degree	Title
John Hook	B.S.	Senior Chemist
Katlin Cataldi	B.S.	Chemist
Maria Orrs	M.S.	Chemist
Micaela Dishong	B.S.	Chemist
Parker Lindstrom*	B.S.	Senior Chemist
Tara Snyder	B.S.	Chemist
Additional support personnel in this group: 7		
Organic Extraction		
Richard Karam*	B.S.	Director
Wanda Oswald		Chemist Group Leader
Joseph Feister		Chemist Group Leader
Anna Stager	B.A.	Chemist
Darin Wagner	B.A.	Chemist
David Hershey		Chemist
Edwin Ortiz		Chemist
Heidi Roberts*	B.S.	Senior Chemist
Kelli Barto	B.S.	Chemist
Kerrie Freeburn	B.S.	Chemist
Maria Davenport		Chemist
Robert Vincent	B.S.	Principal Chemist
Seth Farrier	B.S.	Chemist
William Saadeh	B.S.	Chemist
Additional support personnel in this group: 19		
Pesticide Residue Analysis		
Susan Goshert*	B.S.	Manager
James Place	B.S.	Senior Chemist
Jamie Brillhart	B.S.	Senior Chemist
Jessica Miller	B.S.	Senior Chemist
Lisa Reinert	B.S.	Chemist
Matthew Listner	B.S.	Chemist
Monica Souders	B.S.	Chemist
Richard Shober	B.S.	Principal Chemist
Valerie Tomayko*	B.S.	Principal Specialist
Specialty Services Group		
Charles Neslund*	B.S.	Director
Brett Weidman	B.S.	Chemist
Deborah Zimmerman		Chemist
Ginelle McQuaid		Chemist
Joseph Anderson	B.S.	Senior Chemist
Meng Yu	M.S.	Principal Chemist
Michael Ziegler	B.S.	Senior Chemist
Michele Smith*	B.S.	Senior Specialist
Paul Cormier	B.A.	Principal Specialist
Robert Brown		Principal Chemist

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Name	Degree	Title
Timothy Trees	A.S.	Principal Chemist
Additional support personnel in this group: 1		
Volatiles in Air		
Charles Neslund*	B.S.	Director
Chin Ly	B.S.	Chemist
Christine Ratcliff	B.S.	Principal Specialist
Florida Cimino	B.S.	Senior Chemist
Jeffrey Smith	B.A.	Senior Chemist Group Leader
Water Quality		
Erik Frederiksen*	B.A.	Manager
Kenneth Bell*	B.S.	Principal Chemist Group Leader
Hannah Royer	B.A.	Chemist
Michele Graham	B.S.	Chemist
Michelle Lalli		Chemist
Robert Heisey*	B.A.	Senior Specialist
Susan Engle		Chemist
Susan Hibner	B.S.	Chemist
Yolunder Bunch		Chemist
Additional support personnel in this group: 1		
Environmental Software Development		
Sooyun Chang		IT Director
Holly Trego	B.S.	Manager
John Riggs	B.S.	Senior Specialist Group Leader
Andrew Strebel		Principal Chemist
Bret Winey	B.S.	Senior Specialist
Catherine Holt	B.S.	Principal Specialist
Chadwick Hershey	B.S.	Senior Specialist
Christopher Stauffer	B.S.	Specialist
Diana Holmes	M.S.	Senior Specialist
Ryan Pettit	B.S.	Specialist
Susan Shorter	B.S.	Principal Specialist
Tiffany Betz	B.S.	Principal Specialist
Timothy Weaver	B.A.	Senior Specialist
Environmental Sample Administration		
Anneliese Owen	M.B.A.	Manager
Carolyn Cymys	B.S.	Senior Specialist Group Leader
Tamara Helsel		Senior Specialist Group Leader
Christine Knoedler	B.A.	Specialist
Deborah Neslund		Senior Specialist
Katherine Metzger	B.A.	Specialist
Katie Hartlove		Specialist
Kristin Zeigler	B.S.	Specialist
Additional support personnel in this group: 4		

 <div>Lancaster Laboratories Environmental</div>	<p align="center">Document Title: Organizational Charts Personnel to Sign Reports</p>	<p align="center">Eurofins Document Reference: 1-P-QM-GDL-9015380</p>
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Name	Degree	Title
Equipment Maintenance & Repair		
Robert Allison		Specialist
Additional support personnel in this group: 3		
Training		
Beth DiPaolo	M.A.	Vice President of PSS & Recruiting/Organizational Development
Kimberly Davies	M.B.A.	Director
Harry Ward	PHD	Principal Specialist GL
Barbara Weaver	M.S.	Principal Specialist
Dennis Urban	M.S.	Principal Specialist
Lindsay Deibler-Wallace	M.S.	Senior Specialist
Sample Bottles		
Steven Davies	B.S.	Manager
Jeffrey Moyer	B.S.	Senior Specialist Group Leader
Karen Guito		Specialist
Samantha DeFalcis		Specialist
Sandra Muckle		Specialist
Additional support personnel in this group: 3		
Sample Support		
Dana Kauffman*		Manager
Chad Wettig		Chemist Group Leader
Lisa Cooke		Chemist
Stephanie Sanchez		Chemist
Additional support personnel in this group: 7		
Transportation		
Steven Davies	B.S.	Manager
Christopher Winters		Specialist
L Kenneth Miller		Specialist
Leon Wolf		Specialist On-Call
Timothy Miller		Specialist
Tony Luque		Specialist
Additional support personnel in this group: 19		
Safety		
Matthew Gehman	B.S.	Principal Specialist Group Leader
Beth Rich		Senior Specialist
William Gambler	B.S.	Senior Specialist

*Denotes those employees who are authorized to release Analysis Reports.

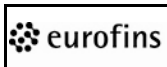
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Eurofins Document Reference	1-P-QM-GDL-9015381	Revision	3
Effective Date	Aug 8, 2014	Status	Effective
Historical/Local Document Number	DOD - Environmental Quality Policy Manual Appendix D		
Local Document Level	Level 1		
Local Document Type	POL - Policy		
Local Document Category	ES - Environmental Sciences		

Prepared by	Christiane Sweigart
Reviewed and Approved by	Duane Luckenbill;Review;Tuesday, July 29, 2014 11:12:48 AM EDT Robert Strocko;Review;Wednesday, July 30, 2014 1:27:29 PM EDT Dorothy Love;Approval;Wednesday, July 30, 2014 2:11:21 PM EDT

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Joseph D. Anderson, B.S., Senior Chemist, Specialty Services Group

Education:

B.S. General Science, Pennsylvania State University (2004)

Professional Experience:

ALSI, GC GC/MS Analyst (2004-2010)

Responsibilities included preparing, running, and reviewing samples according to client and industry methods using various instrumentations including GC and GC/MS; performing analysis for various departments as determined by work volume and staffing needs; reviewing and reporting data within client specified criteria

With Lancaster Laboratories since 2010

Senior Chemist, Flexible Staffing (2010)

Responsibilities included preparing, running, and reviewing samples according to client, compendia, and industry methods using various wet chemistry techniques and instrumentation, which may include but is not limited to, gas chromatography, liquid chromatography, IC, and TOC instrumentation; performing analysis for various departments as determined by work volume and staffing needs

Senior Chemist, Specialty Services Group (2012)

Responsibilities include maintaining instrumentation; tuning and calibrating instrument daily; analyzing quality control and client samples; reviewing and assembling data in an efficient manner with a high degree of quality; evaluating current organizational and analytical systems; diagnosing complex problems and offering solutions with a high degree of independence; suggesting and implementing improvements to maximize quality and productivity; acting as technical resource for internal problems and projects; assisting in "brainstorming" client problems and projects; training new employees in all aspects of instrumentation; researching new and emerging technologies

F. Bradley Ayars, Principal Specialist Group Leader, Data Deliverables

Continuing Education:

Environmental Law & Policy, Franklin & Marshall College (1991)

Professional Experience:

With Eurofins Lancaster Laboratories since 1988

Client Services Specialist (1992)

Environmental Project Management (1994)

Senior Specialist Coordinator, Electronic Data Deliverables (1997)

Responsibilities included supervising EDD staff; developing and maintaining EDD formats; overchecking lab data for EDDs; primary contact for EDD issues

Senior Specialist Group Leader, Electronic Data Deliverables (2005)

Responsibilities included supervising EDD staff; developing and maintaining EDD formats; overchecking lab data for EDDs; primary contact for EDD issues

Principal Specialist Group Leader, Electronic Data Deliverables (2014)

Responsibilities include supervising EDD staff; developing and maintaining EDD formats; overchecking lab data for EDDs; primary contact for EDD issues

Matthew Rusty E. Barton, B.S., Senior Specialist, GC/MS Semivolatiles

Education:

B.S. Biochemistry, East Stroudsburg University (1991)

Professional Experience:

With Lancaster Laboratories since 1991

Senior Chemist (1998)

Senior Chemist/Coordinator (1999)

Responsibilities included: supervise personnel; schedule lab work; perform purge and trap gas chromatography testing; operate O.I. 4560/4551, Tekmar 3000, Archon 5100, and HP5890 Series II OC instruments; review and approve data; and developing and evaluating new methods.

Senior Chemist, Nitrosamines (2003)

Responsibilities included: Analysis of nitrites in tobacco samples

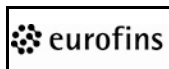
Senior Chemist, EPH/Misc. GC (2004)

Responsibilities include: Analysis of environmental samples for diesel range organics via gas chromatography

Senior Specialist, GC/MS Semivolatiles (2008)

Responsibilities include: audit and upload of departmental data

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Marie D. Beamenderfer, B.S., Senior Chemist, GC Volatiles

Education:

B.S. Biology, The Pennsylvania State University (2006)

Professional Experience:

With Eurofins Lancaster Laboratories since 2006

Chemist, GC Volatiles (2006)

Responsibilities included maintaining GC instrumentation; calibrating instruments as needed; analyzing quality control and client samples; reviewing and assembling data in an efficient manner with a high degree of quality; evaluating current organizational and analytical systems; suggesting and implementing the necessary corrective action to ensure the above can be performed in alignment with client and/or regulatory requirements; performing all duties with minimal supervision; training new employees; tracking inventory of instrument parts and standards and entering them into the standards database as received; verifying data on an as needed basis

Senior Chemist, GC Volatiles (2012)

Responsibilities include maintaining GC instrumentation; calibrating instruments as needed analyzing quality control and client samples; reviewing and assembling data in an efficient manner with a high degree of quality; evaluating current organizational and analytical systems; suggesting and implementing the necessary corrective action to ensure the above can be performed in alignment with client and/or regulatory requirements; performing all duties with minimal supervision; training new employees; tracking inventory of instrument parts and standards and entering them into the standards database as received; working on special assignments; diagnosing complex problems and offering solutions with a high degree of independence; assisting in "brainstorming" client problems and projects; completing assigned projects on time; verifying data on an as needed basis

Kenneth A. Bell, B.S., Principal Chemist Group Leader, Water Quality

Education:

B.S. Chemistry, Millersville University (1997)

Professional Experience:

Johnsons Chemical, Laboratory Assistant (1989-1992)

Responsibilities included collecting samples and performing testing on raw material

With Eurofins Lancaster Laboratories since 1994

Senior Laboratory Technician, Water Quality (1994)

Responsibilities included routinely performing analytical testing using wet chemistry methods

Chemist/Coordinator, Water Quality (1994)

Responsibilities included performing wet chemistry analyses, sample verification, and coordinating workflow

Senior Chemist/Coordinator, Water Quality (1994)

Responsibilities included coordinating workflow, performing sample verification, back-up report signing, training new employees, revising standard operating procedures, writing annual job plans and reviews

Senior Chemist Group Leader, Water Quality (2005)

Responsibilities included coordinating workflow, performing sample verification, back-up report signing, training new employees, revising standard operating procedures, writing annual job plans and reviews

Principal Chemist Group Leader, Water Quality (2014)

Responsibilities include coordinating workflow, performing sample verification, back-up report signing, training new employees, revising standard operating procedures, writing annual job plans and reviews

Holly Berry, B.S., Senior Chemist, GC/MS Semivolatiles

Education:

B.S. Forensic Chemistry, Buffalo State College (SUNY) (2006)

Professional Experience:

New York State Police, Toxicology Intern (2005-2006)

Responsibilities included performing analysis of alternative medicines using FPIA, SPE, GC/NPD, and GC/MS

With Lancaster Laboratories since 2006

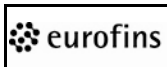
Chemist, GC/MS Volatiles (2006)

Responsibilities included analyzing soils and waters for VOAs using purge and trap and GC/MS instrumentation

Senior Chemist, GC/MS Volatiles (2010)

Responsibilities included analyzing performing GC/MS analysis of water and soil samples along with other matrices by various analytical methods such as EPA 8260B and CLP; evaluating analytical data generated; calibrating and troubleshooting GC/MS instrumentation; assisting other employees with any questions that may arise and helping to train new employees

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Senior Chemist, GC/MS Semivolatiles (2011)

Responsibilities include maintaining GC/MS instrumentation; tuning and calibrating instruments daily; analyzing quality control and client samples; reviewing and assembling this data in an efficient manner with a high degree of quality to meet client requirements; working on special assignments; running 8270C, 625, THPA, and TEL methods

Memberships and Appointments:

Emergency Response Team (Hazmat technician) – LLI (2006-2011)

Tiffany D. Betz, B.S., Principal Specialist, Environmental Software Development

Education:

B.S. Computer Science, Millersville University (2001)

Continuing Education:

Oracle Exam #1Z0-007, Introduction to Oracle 9i: SQL (May 17, 2004)

Oracle Exam #1Z0-147, Oracle 9i: Program with PL/SQL (August 4, 2004)

Professional Experience:

With Eurofins Lancaster Laboratories since 2000

Specialist, Computer Applications Development (2000)

Responsibilities included performing computer applications development and maintenance.

Senior Specialist, Computer Applications Development (2006)

Responsibilities included performing computer applications development and maintenance.

Principal Specialist, Environmental Software Development (2012)

Responsibilities include analyzing, designing, developing, documenting, validating, and deploying custom software in a regulated environment; conforming to FDA guidelines and CFR Part 11 in all duties; strictly adhering to Lancaster Laboratories Software Development Lifecycle (SDLC) policies and procedures; preparing and executing software test plans for custom developed Laboratory Information Management System (LIMS) and other software in accordance with internal procedures; spending a large portion of time writing documentation in support of various software development stages and in accordance with SDLC procedures; spending some portion of time supporting and assisting users with new software applications; at times, conducting formal training sessions with a small group of users to familiarize them with a new computer system

Kenneth L. Boley, Jr., B.S., Senior Chemist Group Leader, GC/MS Volatiles

Education:

B.S. Chemistry, Messiah College (1995)

Professional Experience:

Heritage Custom Kitchens, Inc., Face Frame Assembler (1997–2001)

Responsibilities included reading and interpreting job orders; overseeing daily production of department; performing various manufacturing duties daily; member of the safety committee, first aid team, and security team

With Lancaster Laboratories since 2001

Chemist, GC/MS Volatiles (2001)

Responsibilities included analyzing samples and QC by purge and trap GC/MS; generating and reviewing raw data; performing maintenance on GC/MS, purge and traps, and various autosamplers; following methods and SOPs

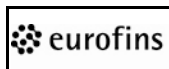
Senior Chemist, GC/MS Volatiles (2005)

Responsibilities included performing routine and non-routine analyses; diagnosing and solving technical problems; maintaining and troubleshooting instrumentation; writing and revising SOPs; training new analysts; auditing and uploading data as work load deems necessary

Senior Chemist Group Leader, GC/MS Volatiles (2009)

Responsibilities include maintaining GC/MS instrumentation; tuning and calibrating instrument daily; analyzing quality control and client samples; reviewing and assembling data in an efficient manner with a high degree of quality; evaluating current organizational and analytical systems; suggesting and implementing corrective action and system improvements when necessary; performing all duties with minimal supervision; working on special assignments; diagnosing complex problems and offering solutions with a high degree of independence; assisting in "brainstorming" client problems and projects; completing assigned projects on time; researching new and emerging technologies; producing written and oral reports on research activities; performing both technical and personnel aspects of group operations; performing work within the department or other areas as required; acting as a technical resource, trainer, and troubleshooter to specific department; making recommendations for operational and/or technical improvements; communicating effectively within the group; coaching and developing direct reports; planning and monitoring workflow

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Nancy J. Bornholm, B.S., Principal Specialist, Environmental Client Services

Education:

B.S. Chemistry (magna cum laude), Muhlenberg College (1981)

Continuing Education:

Instrumental Analysis of Paints and Polymers, FBI Academy (1984)

Analytical Chemistry of Contaminants in Surface and Groundwater, ACS Short Course (1986)

Professional Experience:

University of Connecticut Health Center, Laboratory Technician (1977-1980)

Institute for Cancer Research, Research Technician (1981)

Baltimore City Crime Laboratory, Mobile Crime Unit Trainee (1981-1982)

Maryland State Police Crime Laboratory, Forensic Chemist III (1982-1985)

With Lancaster Laboratories since 1985

Senior Specialist, Environmental Client Services (1987)

Responsibilities included project management; audit sample entries; answer client questions; communicate client requirements to lab areas; and schedule sample submissions and provide sampling containers

Principal Specialist, Environmental Client Services (2004)

Responsibilities include performing project management for large clients/projects; auditing sample entries for accuracy; providing price quotes; answering client questions; understanding and communicating client requirements to lab personnel; scheduling sample submissions; ordering sampling containers and providing pre-printed COCs; serving as a technical resource to both internal and external clients and notifying management of any client issues

Awards, Citations, Honorary Societies, and Publications:

Quarterly Impact Award (2008)

Superlative Service President's Award (2008)

Marianne L. Bragg, B.S., Principal Specialist, Environmental Business Development

Education:

B.S. Biology, Millersville University (1987)

Professional Experience:

With Lancaster Laboratories since 1985

Coordinator

Group Leader (1990)

Principal Specialist (1994)

Responsibilities included: advise clients on testing; provide price quotes and proposals; answer client questions; schedule sample submissions and provide sampling containers; communicate client requirements to lab areas; and assist with client visits to the lab.

Principal Specialist/Coordinator, Environmental Business Development (2002)

In addition to the responsibilities listed above, manage workload and workflow among business development staff.

Principal Specialist/Group Leader, Environmental Business Development (2005)

In addition to the responsibilities listed above, manage workload and workflow among business development staff.

Principal Specialist, Environmental Business Development (2007)

Responsibilities include: advise clients on testing; provide price quotes and proposals; answer client questions; schedule sample submissions and provide sampling containers; communicate client requirements to lab areas; and assist with client visits to the lab.

Marla S. Brewer, B.S., Senior Specialist, GC/MS Volatiles

Education:

B.S. Industrial Hygiene, Purdue University (2000)

Continuing Education:

OSHA 8-Hour (2000)

Comprehensive GC/MS Seminar, Restek (2002)

Practical Process Improvement Facilitator Training (2010)

Professional Experience:

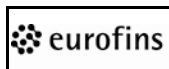
ALCOA, Industrial Hygiene Intern (1999)

Responsibilities included performing air sampling for a variety of substances; conducting noise survey including area and personal sampling; testing plant environment for heat stress and evaluated reports; assisting in formulation of written program

BP-Amoco Refinery/Orr Professional Services, Industrial Hygiene Technician (2000)

Responsibilities included performing air sampling to reevaluate Benzene Exposure Surveillance Program; conducting noise surveys including area and personal monitoring to reevaluate Hearing Conservation Program

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With Eurofins Lancaster Laboratories since 2000

Senior Technician, Volatiles by GC (2000)

Responsibilities included performing prescreen analysis, sample prep, GC maintenance, and data review

Chemist, GC/MS Volatiles (2001)

Responsibilities included analyzing samples and QC by purge and trap GC/MS; generating and reviewing raw data; performing maintenance on GC/MS, purge and traps, and various autosamplers

Senior Specialist, GC/MS Volatiles (2006)

Responsibilities include performing GC/MS volatile data interpretation; reviewing and approving data; signing reports; analyzing samples; generating raw data; sample verification; SOP revisions and updates

Jamie L. Brillhart, B.S., Senior Chemist, Pesticide Residue Analysis

Education:

B.S. Physical Science, York College of Pennsylvania (2003)

Professional Experience:

B-H Laboratories Inc./Analytical Laboratory Services Inc., Inorganic Laboratory Technician/Inorganic Chemist (2003-2005)

Responsibilities included performing wet chemistry testing on drinking waters and waste water; being responsible for analyses included fluoride, cyanide, phosphorus, nitrate/nitrite, cadmium reduction, and grease and oil testing when needed; prepping and analyzing for mercury on a mercury analyzer; analyzing for various metals on a graphite furnace; prepping leachates; prepping standards as needed

Hercon Laboratories, Inc., QC Analyst I (2005-2007)

Responsibilities included performing Quality Control Testing on Transdermal Systems; performing assays, dissolutions, degradation, residual solvents, and raw material testing; prepping necessary standards and performing instrument maintenance as needed

With Lancaster Laboratories since 2007

Chemist, Pesticide Residue Analysis (2007)

Responsibilities included analyzing soils for PPL Pesticides using 5890 and 6890 GCs with ECD detectors; performing instrument maintenance; prepping standards; auditing calibrations as necessary; being able to analyze for OPPAs, ACOMOs, EDBs, PCBs, and Herbicides as needed

Senior Chemist, Pesticide Residue Analysis (2011)

Responsibilities include analyzing soils for PPL Pesticides using 5890 and 6890 GCs with ECD detectors; performing instrument maintenance; prepping standards; auditing calibrations as necessary; being able to analyze for OPPAs, ACOMOs, EDBs, PCBs, and Herbicides as needed

Robert Brown, Principal Chemist, Specialty Services Group

Education:

Attended 2.5 years at Pennsylvania State University towards B.S. in Microbiology (1988)

Completed 20 credits towards B.S. in Environmental Biology, Millersville University (1993)

Professional Experience:

With Lancaster Laboratories since 1988

Chemist (1993)

Senior Chemist (1997)

Responsibilities included performing extractable petroleum testing; operating multiple Hewlett-Packard gas chromatograph (GC) instruments; data interpretation and entry; developing and evaluating new methods

Principal Chemist (2004)

Responsibilities included performing extractable petroleum testing; operating multiple Hewlett-Packard gas chromatograph (GC) instruments; data interpretation and entry; developing and evaluating new methods; serving as primary technical contact for client service representatives and their clients

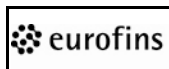
Principal Chemist Group Leader, EPH/Misc. GC (2005)

Responsibilities included performing extractable petroleum testing; operating multiple Hewlett-Packard gas chromatograph (GC) instruments; data interpretation and entry; developing and evaluating new methods; serving as primary technical contact for client service representatives and their clients

Principal Chemist, Specialty Services Group (2011)

Responsibilities include: acting as technical resource within the environmental division; developing and validating analytical protocols; troubleshooting and solving analytical chemistry problems; optimizing instrument configuration and performance; evaluating and interpreting analytical results; writing SOPs; assisting in responding to and eliminating ICARs, assisting in optimizing procedures in prep lab; communicating effectively within department; performing routine work as required

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Kathryn A. Brungard, Senior Specialist, Environmental Quality Assurance

Continuing Education:

Clinical Laboratory Science, Temple University (1984-1988)

Professional Experience:

Environmental Partners, Inc., Environmental Technician/Health and Safety Coordinator (2003-2005)

Responsibilities included determining personnel health and safety risks on each work site and determining appropriate measures to be taken for personal protection; maintaining and servicing sampling equipment; calibrating meters and analytical equipment; collecting and processing representative samples at each monitoring site following state mandated procedures; routinely measuring field water and soil quality parameters; performing product recovery as part of site remedial measures; evaluating and reporting upon trends and/or results that were out-of-range

Maxwell House Coffee/Kraft Foods, Quality Assurance Technician (2004-2005)

Responsibilities included conducting hourly audits on operating production lines which included weight of product, oxygen content, density, caffeine level by HPLC, moisture content, inspection for foreign or incidental materials, and packaging compliance; performing weekly water testing for level of chlorine and microbial contamination; producing result spreadsheets and accurate logs; notifying upper management of all results in a timely manner

Columbia Analytical Services, Inc, Quality Assurance Program Manager (2005-2009)

Responsibilities included being responsible for the overall coordination of the NELAP certified environmental laboratory program; monitoring laboratory quality systems through audits; identifying potential problem areas, recommending corrective actions, and providing technical assistance and training as necessary; informing management of potential problems and recommending remedial measures in a timely basis both orally and by written communication; maintaining performance evaluation records; maintaining accreditations for regulatory agencies and client programs; providing audit responses and initiating changes in procedures; maintaining the calibration of all weights, balances, and thermometers

With Eurofins Lancaster Laboratories since 2010

Senior Specialist, Environmental Quality Assurance (2010)

Responsibilities include ensuring quality of data being produced in the laboratories by performing data review, auditing laboratories, and reviewing written procedures; ensuring laboratory adherence to government regulations and client requirements; reviewing client and government documents for requirements outside our usual laboratory practices; setting up and testing new analysis in the laboratory sample management system as required by the departments

Memberships and Appointments:

Florida Society of Environmental Analysts (2005-2009)

Florida A. Cimino, B.S., Senior Chemist, Volatiles in Air

Education:

B.S. Chemistry, Shippensburg University (2004)

Professional Experience:

With Lancaster Laboratories since 2005

Chemist, Flexible Staffing (2005)

Responsibilities included preparing, running, and reviewing samples according to client, compendia, and industry methods using various wet chemistry techniques and instrumentation including, but not limited to, gas chromatography, liquid chromatography, IC and TOC instrumentation; performing analysis for various departments as determined by work volume and staffing needs

Senior Chemist, Flexible Staffing (2008)

Responsibilities included preparing, running, and reviewing samples according to client, compendia, and industry methods using various wet chemistry techniques and instrumentation including, but not limited to, gas chromatography, liquid chromatography, IC and TOC instrumentation; performing analysis for various departments as determined by work volume and staffing needs

Senior Chemist, Volatiles in Air (2010)

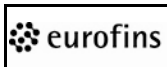
Responsibilities include maintaining instrumentation; tuning and calibrating instrument daily; analyzing quality control and client samples; reviewing and assembling data in an efficient manner with a high degree of quality; evaluating current organizational and analytical systems; diagnosing complex problems and offering solutions with a high degree of independence; suggesting and implementing improvements to maximize quality and productivity; acting as technical resource for internal problems and projects; assisting in "brainstorming" client problems and projects; training new employees in all aspects of instrumentation; researching new and emerging technologies

Awards, Citations, Honorary Societies, and Publications:

Girl Scout Gold Award (2000)

Who's Who Among College Students (2001-2004)

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Mark A. Clark, B.S., Principal Chemist, GC/MS Semivolatiles

Education:

B.S. Biochemistry, Millersville University (1986)

Professional Experience:

With Eurofins Lancaster Laboratories since 1985

Associate Chemist, Water Quality (1985)

Responsibilities included performing wet chemistry analyses; operated departmental instrumentation including TOC, TOX, Technicon, IC

Chemist, Water Quality (1987)

Responsibilities included coordinating, performing, and verifying 24/48 hour hold time analyses; performing wet chemistry analyses

Senior Chemist, Expresslab (1989)

Responsibilities included performing rush analyses operating AA, GC, IR; analyses included BTEX, Petroleum Hydrocarbons by IR, Metals by AA

Senior Chemist, Food Chemistry (1993)

Responsibilities included operating department instrumentation including Fatty Acid Profile by GC, assorted analyses by HPLC including Artificial Sweeteners, Vitamins D, E, etc.

Principal Chemist, GC/MS Semivolatiles (2001)

Responsibilities included performing PAH by HPLC analysis and assisting with GC/MS operations on third shift

Principal Chemist, GC/MS Semivolatiles (2012)

Responsibilities include performing GC/MS semivolatiles testing; operating GC/MS instruments; performing data interpretation and entry; calibrating and repairing instruments

Rachel R. Cochis, B.A., Principal Specialist Group Leader, GC/MS Semivolatiles

Education:

B.A. Science, Pennsylvania State University (1992)

Continuing Education:

Introduction to Mass Spec Interpretation, Hewlett-Packard (1995)

Gas Chromatography Principles & Practices (1994)

Professional Experience:

With Eurofins Lancaster Laboratories since 1993

Chemist (1994), GC/MS Semivolatiles (1993)

Responsibilities included performing semivolatiles analysis on water and soil samples

Senior Chemist Coordinator, GC/MS Semivolatiles (1996)

Responsibilities included scheduling lab work; performing data interpretation and entry; reviewing and approving data; revising and updating SOPs and analytical methods; monitoring turnaround time; communicating client requirements to lab areas

Senior Specialist Group Leader, GC/MS Semivolatiles (2005)

Responsibilities included scheduling lab work; performing data interpretation and entry; reviewing and approving data; revising and updating SOPs and analytical methods; monitoring turnaround time; communicating client requirements to lab areas

Principal Specialist Group Leader, GC/MS Semivolatiles (2013)

Responsibilities include scheduling lab work; performing data interpretation and entry; reviewing and approving data; revising and updating SOPs and analytical methods; monitoring turnaround time; communicating client requirements to lab areas

Tracy A. Cole, Senior Specialist, EPH/Miscellaneous GC

Continuing Education:

Gas Chromatography: Principles and Practice, LLU (1997)

Professional Experience:

With Lancaster Laboratories since 1991

Laboratory Technician, Volatiles in Air (1991)

Responsibilities included preparing samples and standards; washing glassware; loading samples on instruments

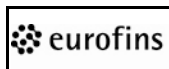
Senior Technician, Volatiles in Air and EPH/Miscellaneous GC (1994)

Responsibilities included analyzing routine samples and QC by Gas Chromatography for DRO and miscellaneous organic compounds; preparing direct injection samples for analysis; preparing standards; reviewing chromatography data and uploading to the LIMS

Chemist, EPH/Miscellaneous GC (1999)

Responsibilities included analyzing routine and nonroutine samples and QC by Gas Chromatography for various organic analyses including DRO, TPH, and other petroleum related methods and miscellaneous organic compounds by direct injection; reviewing chromatography data and uploading to the LIMS; performing instrument maintenance; calibrating instruments for various methods

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Senior Specialist, EPH/Miscellaneous GC (2008)

Responsibilities include reviewing/verifying data for technical correctness including raw chromatography data, initial calibrations, and analytical reports; ensuring that method and project requirements were followed and entry into the LIMS is correct; acting as a technical resource for the department; assisting in reviewing/writing SOPs and other technical documents

Paul R. Cormier, B.A., Principal Specialist, Specialty Services Group

Education:

B.S. Microbiology, Virginia Tech (1984)

B.A. Chemistry, Virginia Tech (1984)

Continuing Education:

Hewlett-Packard GC/MS Advance Operations/System Manager Course (1990)

Mass Spectral Interpretation, Finnigan MAT Institute (1991)

Technical Training, OI Analytical (1995)

Professional Experiences:

Environmental Testing & Certification (1985-1989)

Analytikem, Inc. (1989-1990)

With Lancaster Laboratories since 1990

Senior Chemist (1990)

Responsibilities included: operate GC/MS instruments; data interpretation; review and approve data; repairing instruments; and train other analysts.

Senior Specialist (2005)

Responsibilities included: operate GC/MS instruments; data interpretation; review and approve data; repairing instruments; and train other analysts.

Principal Specialist, GC/MS Volatiles (2006)

Responsibilities include: operate GC/MS instruments; data interpretation; review and approve data; repairing instruments; and train other analysts.

Principal Specialist, Specialty Services Group (2010)

Responsibilities include acting as technical resource within the environmental division; developing and validating analytical protocols; troubleshooting and solving analytical chemistry problems; optimizing instrument configuration and performance; evaluating and interpreting analytical results; writing SOPs; assisting in responding to and eliminating ICARs, assisting in optimizing procedures in prep lab; communicating effectively within department; performing routine work as required

Memberships & Appointments:

American Chemical Society

Teresa L. Cunningham, B.S., Principal Specialist, Environmental Client Services and Inside Business Development

Education:

B.S. Biology, St. Joseph's University (1999)

Continuing Education:

Chemical Monitoring Assistance Program, Pennsylvania Rural Water Association (2000)

How to Deliver Exceptional Customer Service, Fred Pryor Seminars (2000)

Organizational Behavior, Penn State University (2005)

Professional Experience:

With Eurofins Lancaster Laboratories since 1999

Specialist, Environmental Client Services (1999-2000)

Senior Specialist, Environmental Client Services (2001)

Senior Specialist Coordinator, Environmental Client Services (2001)

Responsibilities included serving as project manager for clients with petroleum-related testing accounts; coordinating client requests with laboratory groups to ensure that the client's needs are met; scheduling bottle shipments and sample pickups; preparing quotations; coordinating staff

Senior Specialist Group Leader, Environmental Client Services (2005)

Responsibilities included serving as project manager for clients with petroleum-related testing accounts; coordinating client requests with laboratory groups to ensure that the client's needs are met; scheduling bottle shipments and sample pickups; preparing quotations; coordinating staff

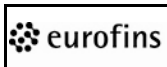
Manager, Environmental Client Services (2006)

Responsibilities included overseeing implementation of new projects; coordinating client requests with laboratory groups to ensure that the client's needs are met; coordinating staff

Principal Specialist, Environmental Client Services and Inside Business Development (2008)

Responsibilities include performing project management; training new client service representatives; auditing sample entry; answering client questions; communicating client requirements to lab areas

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Carolyn M. Cyms, B.S., Senior Specialist Group Leader, Environmental Sample Administration

Education:

B.S. Secondary Education/Chemistry, Bloomsburg University of Pennsylvania (1993)
Post Baccalaureate Certificate, Biology and MS Math, Millersville University (2002)

Continuing Education:

Accounting I, HACC (1996)
Introduction to the Internet, PC Focus (1996)
Self-Discipline & Emotional Control, Franklin-Covey (1997)
Child Growth & Development, HACC (1998)
Cell Biology, Millersville University (2000)
Botany; Genetics; Zoology; Biochemistry; Ecology, and Ecology Lab, Millersville University (2001)
Immunology; Animal Behavior; Teaching Biological Issues; Entomology, Millersville University (2002)
Introduction to Computer Programming, Millersville University (2003)

Professional Experience:

Lancaster Theological Seminary, Field Education Assistant-Special Project Coordinator (1996-1999)
Responsibilities included assisting with mailings, organization of the field education program; creating and preparing a student field education manual for the ministerial studies program; acting as liaison between Field Ed Professor, Field Ed sites, and students; preparing all written correspondences for the field ed office; organizing and preparing materials for meetings; tracking student progress through the program; assisting with other special projects requiring computer skills of PageMaker, WordPerfect, Quattro Pro, and Envoy

Self-Employed, Tutor (1994-2005)
Responsibilities included tutoring HACC students in Introduction to Chemistry, Chemistry, Biology, and Algebra

Millersville University – Biology Department, Assistant (2003)
Responsibilities included preparing Power Point presentations for a stream restoration monitoring program; photographing various stages of the project

With Lancaster Laboratories since 1994
Administrator III, Environmental Sample Administration (1994)
Responsibilities included receiving samples, entering samples, auditing, filing, noting discrepancies, and unpacking samples

Administrator III/Coordinator, Environmental Sample Administration (1995)
Responsibilities included relaying technical/client information when it became available; answering questions from clients/technical areas when CSR was unavailable; coordinating/prioritizing entry; supervising and evaluating work of 2nd Shift Environmental Entry Staff; training new personnel in the entry/interpretation process; preparing Job Plans on an as-needed basis

Specialist I, Environmental Sample Administration (1996)
Responsibilities included receiving samples; entering samples; auditing; filing; noting discrepancies; unpacking samples; acting as project coordinator on an as-needed basis

Senior Specialist, Environmental Sample Administration (2000)
Responsibilities included receiving samples; entering samples; auditing; filing; noting discrepancies; unpacking samples; acting as project coordinator on an as-needed basis; training; preparing resource materials; working on special projects as needed

Senior Specialist Coordinator, Environmental Sample Administration (2004)
Responsibilities included receiving samples; entering samples; auditing; filing; noting discrepancies; unpacking samples; acting as project coordinator on an as-needed basis; training; preparing resource materials; working on special projects as needed

Senior Specialist Group Leader, Environmental Sample Administration (2005)
Responsibilities include receiving samples; entering samples; auditing; filing; noting discrepancies; unpacking samples; acting as project coordinator on an as-needed basis; training; preparing resource materials; working on special projects as needed

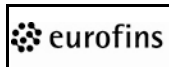
Awards, Citations, Honorary Societies & Publications:

Residential Life Award of Merit (1990)
Bloomsburg University Dean's List 6 of 8 semesters, graduated cum laude (1990-1993)
Kappa Delta Phi (National Co-Ed Honor Society) (1994)
Spirit of LLI (2001)

Memberships & Appointments:

Elizabethtown Fire Company (1993-present)
Safety Committee (1994-1998)
Alpha Phi Omega (National Co-Ed Service Fraternity) (1991-1993)
NSTA (2000-2008)
Kappa Delta Phi (1994, 2001-2003)

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Kimberly A. Davies, M.B.A., Director, Divisional Support Services

Education:

B.S. Biology, Shippensburg University of Pennsylvania (1991)
M.B.A., Pennsylvania State University (1999)

Professional Experience:

Polybac Corporation, Technical Services (1991-1992)
Upper Saucon Township Wastewater Treatment Plant, Technician (1992-1993)
With Eurofins Lancaster Laboratories since 1993
Client Services Senior Specialist (1996)
Senior Specialist/Coordinator, Pharmaceutical Project Management (1998)
Principal Specialist/Coordinator, Pharmaceutical Project Management (2000)
Group Leader, Pharmaceutical Project Management and Data Support (2001)
Responsibilities included managing pharmaceutical project management and data support staff; facilitating group meetings to communicate with staff; supporting company and division policies and provide information to department; supporting employee development and acknowledge innovative ideas; promoting group and department teamwork and collaboration
Manager (previously titled Group Leader), Pharmaceutical Project Management (2003)
Responsibilities included managing pharmaceutical project management staff; facilitating group meetings to communicate with staff; supporting company and division policies and provide information to department; supporting employee development and acknowledge innovative ideas; promoting group and department teamwork and collaboration
Manager, Flexible Staffing (2005)
Responsibilities included managing labor resources across departments and divisions, coordinating continuous improvement activities including Management Operating System (MOS) audits, new management MOS training, and MOS tool maintenance
Manager, Flexible Staffing and Technical Training (2006)
Responsibilities included managing labor resources across departments and divisions, coordinating continuous improvement activities including Management Operating System (MOS) audits, new management MOS training, and MOS tool maintenance; managing the technical training staff responsible for designing and facilitating technical training
Manager, PPI Process and Flexible Staffing (2008)
Responsibilities included managing labor resources across departments and divisions, coordinating continuous improvement activities including Management Operating System (MOS) audits, new management MOS training, and MOS tool maintenance; managing the technical training staff responsible for designing and facilitating technical training; qualified Practical Process Improvement process manager responsible for facilitating PPI project team training and PPI efforts within LLI
Director, Divisional Support Services (2012)
Responsibilities include managing Billing and Reporting, Office Services, Shipping & Receiving, Purchasing and Flexible Staffing; moving labor resources across departments and divisions, coordinating continuous improvement activities through Practical Process Improvement and the Management Operating System; managing the technical training staff responsible for designing and facilitating technical training; qualified Practical Process Improvement process manager and PPI Master Facilitator

Steven C. Davies, B.S., Manager, Transportation and Sample Bottles

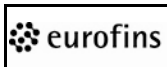
Education:

B.S. Elementary Education, Lancaster Bible College (1987)

Professional Experience:

With Lancaster Laboratories since 1990
Transportation Coordinator (1991)
Transportation Group Leader (1994)
Transportation and Sample Bottles Group Leader (1998)
Responsibilities included supervise personnel; schedule lab work; manage financial resources; answer client questions; communicate client requirements to lab areas; and schedule sample submissions and provide sampling containers.
Transportation and Sample Bottles Manager (2005)
Responsibilities include supervise personnel; schedule lab work; manage financial resources; answer client questions; communicate client requirements to lab areas; and schedule sample submissions and provide sampling containers.

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Beth E. DiPaolo, M.A., SPHR, Vice President of PSS & Recruiting/Organizational Development

Education:

B.S. Business Management, Human Resources, State University of New York, Empire State College (2007)
M.A. Human and Organizational Systems, Fielding Graduate University (2010)
Certified as Senior Professional in Human Resources, SHRM, HRCI
Certifications for Leader Instructor/Consulting in: Working with Emotional Intelligence, Seven Habits of Highly Effective People, Social Styles Facilitation, Contributing Team Member, Signature Service Client Service Training, Targeted Selection Interviewing, Achieve Global Leadership Series, and Speed of Trust

Professional Experience:

People Unlimited (1985-1987)
Responsibilities included recruitment, supervision, sales, and client service for temporary and permanent placement service
With Lancaster Laboratories Human Resources Department since 1987
Recruiting Specialist (1987)
Senior Recruiting Specialist (1990)
Senior Recruiting Coordinator (1991)
Recruiting & Training Group Leader (1992)
Manager of Recruiting, Training, Organizational Development (2001)
Director of Recruiting, Training, and Organizational Development (2005)
Director, Professional Scientific Staffing, Recruiting, and Organizational Development (2005)
Managing Director, Professional Scientific Staffing, Recruiting, and Organizational Development (2007)
Responsibilities included managing operations including client service, business development, recruiting, and training of PSS internationally; providing strategic senior leadership in accordance with vision, values, and strategic goals of company for PSS, recruiting, and organizational development
Vice President of PSS & Recruiting/Organizational Development (2012)
Responsibilities include managing operations including client service, business development, recruiting, and training of PSS internationally; providing strategic senior leadership in accordance with vision, values, and strategic goals of company for PSS, recruiting, and organizational development

Awards, Citations, Honorary Societies, and Publications:

Society for Human Resource Management, Pennsylvania Chapter
Past President of LCAHRM, SHRM Lancaster Chapter
Outstanding Member of the Year (1996)
Two Superior Merit Awards during Presidency

Memberships and Appointments:

American Society for Training and Development
Society for Human Resource Management

Irene Lynn Dodd, M.B.A., Principal Specialist, Environmental Business Development

Education:

B.A. Chemistry, Washington & Jefferson College (1988)
M.B.A. Pennsylvania State University (1993)

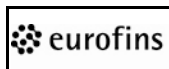
Continuing Education:

Mass Spectral Interpretation Course (1991)
High Impact Communication Skills (1992)
GC Troubleshooting Course (1993)
Selected courses at Millersville University (1996)
Effective Technical Communication (2000)
Business Writing for Results (2002)
Signature Service (2002)
The Counselor Salesperson (2004)
Pennsylvania Chamber Annual Environmental Laws and Regulations Conference (2004, 2005, 2006, 2007)
Conceptual Selling (2009)
Intermediate II and Advanced Excel (2011)

Professional Experience:

Stauffer Chemical Company, Food Chemist (1987-1988)
With Lancaster Laboratories since 1988
Chemist (1991)
Senior Chemist (1995)
Senior Specialist (1997)
Principal Specialist, Environmental Business Development (2003)
Responsibilities include: project management; review and approve data; consult with clients regarding testing needs; work with external auditors; assist with client visits to the lab, advise clients on testing; provide price quotes; monitoring turnaround time; audit sample entry; answer client questions; communicate client requirements to lab areas; provide status reports, including results, to clients; provide sampling containers; schedule sample submissions

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Memberships and Appointments:

American Chemical Society
National Society of Collegiate Journalists
American Business Women's Association
President (1998-1999); Vice President (1994-1995, 1997-1998); Secretary (2000-2001); Newsletter Chair (1993-1994, 2001-2003); Business Associate Night Chair (2000); Woman of the Year (1999, 2004); Thelma Farley Memorial Award (1995); Hospitality Chair (2003-2004) with Wheatland Conestoga Chapter
Vice President of Communications (2006-2007, 2007-2008) and Formation committee (2006-2007); Woman of the Year (2007) for Lancaster Area Express Network; Regional and National Newsletter Award Winner (2008)
Girl Scouts in the Heart of Pennsylvania
Leader (2008-Present); Outstanding Leader of the Year 2012

Christine M. Dulaney, B.A., Senior Specialist, GC/MS Volatiles

Education:

B.A. Biology, Meredith College (1984)

Continuing Education:

Waters Fundamentals of HPLC, Compuchem Laboratories (1989)

Professional Experience:

Compuchem Laboratories (1984-1998)
Extraction Technician (1984-1986)
Responsibilities included performing extraction of various environmental matrices for pesticide GC analysis and semivolatile GC/MS analysis; extracting quarterly PE samples
GC Technician (1986-1989)
Responsibilities included performing analysis of environmental extracts for pesticides, PAHs, and volatile organic compounds using GC, HPLC, and purge and trap, respectively; performing routine instrument maintenance
Senior Chemist, Pesticide Review (1990-1995, 1996-1998)
Responsibilities included performing qualitative and quantitative review of pesticide, PAH, and volatile organic data; reviewing instrument maintenance and standard logbooks
With Eurofins Lancaster Laboratories since 1998
Chemist, Pesticide Residue (1998)
Responsibilities included reviewing GC pesticide residue data packages; responding to client inquiries and ICARs
Project Management Specialist, Pharmaceutical Client Services (2003)
Responsibilities included managing details of various pharmaceutical client accounts using the laboratory information management system; acting as liaison between the client and internal laboratory personnel
Senior Specialist, GC/MS Volatiles (2005)
Responsibilities include auditing data for various GC and GC/MS volatile analyses; verifying data within the laboratory information management system, communicating and following up on outstanding data issues

Eric L. Eby, B.S., Senior Chemist, Metals

Education:

B.S. Biology, Millersville University (1988)

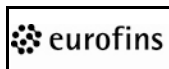
Continuing Education:

OSHA 40-hour Hazardous Waste Management, Phoenix Safety Associates (1991)
DX500 Maintenance and Troubleshooting, Dionex (1996)
The Chemistry Behind the Techniques, EAS, Inc. (1996)
Cleaning Validation Strategies, Applied Analytical Industries, Inc. (1997)
Gas Chromatography Practical Theory and Applications, Lancaster Laboratories (1998)

Professional Experience:

With Lancaster Laboratories since 1988
Associate Chemist (1993)
Responsibilities included environmental wet chemistry testing and field sampling.
Chemist (1997)
Senior Chemist, Pharmaceutical Raw Materials (1998)
Responsibilities included IC, TOC analysis, IC maintenance, USP purified water testing, raw materials testing, USP <661> container closure testing.
Senior Chemist, Pharmaceutical Product Testing (2000)
Responsibilities included pharmaceutical product testing per client specific methods, IC and HPLC maintenance.
Senior Chemist, Metals (2005)
Responsibilities include ICP analysis for environmental testing and ICP instrument maintenance.

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Erik J. Frederiksen, B.A., Manager, Water Quality and Instrumental Water Quality

Education:

B.A. Chemistry, University of Virginia (1990)

Continuing Education:

Infrared Spectral Interpretation (1993)

Professional Experience:

With Lancaster Laboratories since 1990

Chemist/Coordinator (1993)

Group Leader (1994)

Responsibilities included supervising personnel; managing laboratory operations; project management; managing financial resources; reviewing and approving data

Manager, Water Quality and Instrument Water Quality (2005)

Responsibilities include supervising personnel; managing laboratory operations; project management; managing financial resources; reviewing and approving data

Lynn Frederiksen, B.S., Principal Specialist Group Leader, Environmental Client Services

Education:

B.S. Conservation and Resource Development, University of Maryland (1981)

Professional Experience:

University of Missouri, Senior Research Lab Technician (1982 – 1984)

GPU Nuclear Corporation, Data Analyst (1985 – 1989)

With Lancaster Laboratories since 1989

Senior Specialist (1989)/Team Leader, Environmental Client Services (2006)

Responsibilities included: consult with clients regarding testing needs; revise and update SOPs; provide price quotes; audit sample entry; answer client questions; communicate client requirements to lab areas; provide status reports, including results, to clients; schedule sample submissions and provide sampling containers; assist Group Leader with training of new employees and delegating new projects.

Senior Specialist Group Leader, Environmental Client Services (2007)

Responsibilities included: managing a team of client service representatives, training of new employees, setting up and delegating new projects, serving as primary project manager for several large petroleum clients and consultants.

Principal Specialist Group Leader, Environmental Client Services (2011)

Responsibilities include serving as the primary contact or back-up with the laboratory for a number of assigned clients requiring specialized testing or complex projects; understanding and communicating technical information and client requirements to laboratory personnel, helping to ensure that requirements are met; leading broad-based complex projects to a satisfactory conclusion according to client technical and schedule requirements; developing strong relationships with major accounts resulting in additional sales; advising and training other members of the department; serving as a technical resource both internally and externally; proactively assisting Outside Business Development with client visits, presentations, and internal audits for assigned clients; participating on PPI teams

Joseph M. Gambler, B.S., Senior Chemist, GC/MS Semivolatiles

Education:

B.S. Chemistry, Millersville University (1996)

Professional Experience:

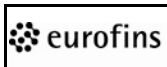
Wyeth, Biological Manufacturing Technician (1996)

With Lancaster Laboratories since 1996

Senior Chemist, GC/MS Semivolatiles (1996)

Responsibilities include training new hires; maintaining GC/MS systems; preparing standards/stocks/spikes; maintaining Helium supply system; performing data interpretation; ordering supplies; auditing; cross trained in Pesticides Department

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William E. Gambler, B.S., Senior Specialist, Safety

Education:

B.S. Occupational Safety and Environmental Health, Millersville University (2011)

Continuing Education:

Principles and Practices of Bio Safety, American Biological Safety Association (2012)
Radiation Safety Officer, Dade Moeller Training Academy (2012)
Certified Safety Committee Training, High Safety Consulting Services (2013)
Hazardous Material Technician Training, High Safety Consulting Services (2013)
Visible Emissions Evaluation Program, Penn State University (2013)
First Aid, CPR, and AED, Respond First Aid Systems (2013)
Basic IATA/49CFR Dangerous Goods Training, Dangerous Goods International Training Center (2013)

Professional Experience:

With Eurofins Lancaster Laboratories since 2011
Specialist, Environmental Health and Safety, Human Resources (2011)
Responsibilities included managing employee health programs; maintaining current and developing new safety programs; managing environmental compliance program
Senior Specialist, Safety (2013)
Responsibilities include managing employee health programs; maintaining current and developing new safety programs; managing environmental compliance program

Memberships and Appointments:

Lancaster County Industrial Safety Council (2011-present)
Board of Certified Safety Professionals (GSP designation) (2011-present)

Matthew R. Gehman, B.S., Principal Specialist Group Leader, Environmental Health and Safety Officer, Human Resources

Education:

B.S. Occupational Safety and Environmental Health, Millersville University (2002)

Continuing Education:

24-Hour Emergency Response (HAZWOPER), Lancaster Laboratories (2004)
8-Hour Emergency Response Refresher, High Safety Consulting (2013)
IATA/DOT 49 CFR, DGI Training Center (2013)
American Heart Association First Aid, CPR, AED certified, Respond First Aid (2013)
Advanced RCRA, Environmental Resource Center (2004)
In-depth Environmental Compliance, PA Chamber (2005)
In-depth Environmental Compliance, PA Chamber (2006)
National Incident Command System, Command School, Inc. (2006)
Life Safety Code, NFPA (2006)
International Conference on Biocontainment Facilities, Tradeline (2006)
In-depth Environmental Compliance, PA Chamber (2007)
Principals of Biosafety, ABSA (2010)
Potent Compound Boot Camp, SafeBridge Consulting (2012)

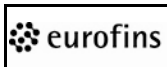
Professional Experience:

With Eurofins Lancaster Laboratories since 2004
Senior EHS Specialist, Environmental Health and Safety, Human Resources (2004-2007)
Responsibilities included employee health program administration; maintaining current and developing new safety programs; managing environmental compliance program
Senior Specialist, Environmental Health and Safety Officer, Human Resources (2007)
Responsibilities included managing employee health programs; maintaining current and developing new safety programs; managing environmental compliance program
Principal Specialist Group Leader, Environmental Health and Safety Officer, Human Resources (2011)
Responsibilities include managing employee health programs; maintaining current and developing new safety programs; managing environmental compliance program

Memberships and Appointments:

Central PA section of American Industrial Hygiene Association (AIHA)
Member (2004-present)
VFW, Post 7362
Member (2004-present)
American Biological Safety Association (ABSA)
Member (2007-present)

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Susan M. Goshert, B.S., Manager, EPH/Miscellaneous GC, Pesticide Residue Analysis, Nitrosamines

Education:

B.S. Chemistry, Juniata College (1988)

Continuing Education:

Advanced Aquarius Report Training, Hewlett-Packard (1989)

How to Handle People with Tact and Skill, Harrisburg Area Community College (1992)

Positive Attitude and Peak Performance, Harrisburg Area Community College (1992)

Professional Experience:

With Lancaster Laboratories since 1988

Chemist (1990)

Senior Chemist Coordinator (1997)

Responsibilities included supervising personnel; reviewing and approving data; monitoring turnaround time

Senior Specialist Group Leader, EPH/Misc. GC (2005)

Responsibilities included supervising personnel; reviewing and approving data; monitoring turnaround time

Principal Specialist Group Leader, GC/MS Volatiles (2008)

Responsibilities included supervising personnel; reviewing and approving data; monitoring turnaround time

Manager, EPH/Miscellaneous GC, Pesticide Residue Analysis, Nitrosamines (2012)

Responsibilities include supervising personnel; managing laboratory operations and financial resources; project management; reviewing and approving data; consulting with clients regarding testing needs

Brian K. Graham, B.A., Senior Chemist, GC/MS Semivolatiles

Education:

B.A. Mathematics, Millersville University (1996)

Professional Experience:

With Lancaster Laboratories since 1989

Chemist, GC/MS Semivolatiles (1989-2006)

Senior Chemist, GC/MS Semivolatiles (2006)

Responsibilities include maintaining GC/MS Instrumentation; tuning and calibrating GC/MS; analyzing samples by GC/MS; reviewing and assembling all supporting GC/MS data; preparing standards for calibrations; training new analysts

Nina C. Haller, Senior Specialist Group Leader, Metals

Continuing Education:

State Dairy Lab Cert., State of PA (1993)

Butterfat Testing License, State of PA (1995)

Seminar ICP/ICPMS, Fisons Instruments (1995)

Three-day ICP Trace Training Course, Thermo Jarrell Ash, MA (1996)

Professional Experience:

Hazleton Research Products, Lab Technician (1981-1984)

Responsibilities included rabbit production facility, removal of ovaries, care, and maintenance

With Lancaster Laboratories since 1987

Technical Associate, Foods (1987)

Responsibilities included coordinating Listeria Testing Program; performing data entry and verification

Chemist, Metals (1993)

Responsibilities included performing daily tracking of rushes; operating and maintaining ICP instrumentation; reviewing and verifying of ICP data, data package review

Specialist Group Leader, Metals (2003)

Responsibilities included overseeing the ICP/ICPMS personnel and instrumentation workflow; verifying

ICP/ICPMS/GFAA/Hg data

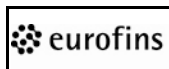
Senior Specialist Group Leader, Metals (2006)

Responsibilities included overseeing the ICP/ICPMS personnel and instrumentation workflow; verifying ICP/ICPMS/GFAA/Hg data

Senior Specialist Group Leader, Metals (2007)

Responsibilities include overseeing metals instrument and verification personnel and instrumentation workflow; verifying metals data

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Michele D. Hamilton, B.S., Senior Chemist Group Leader, EPH/Misc. GC

Education:

B.S. Chemistry, Temple University (1990)

Continuing Education:

Gas Chromatography: Practical Theory and Applications for LL (1993)

Practice of Modern HPLC, LC Resources (1996)

Professional Experience:

With Eurofins Lancaster Laboratories since 1991

Senior Chemist (1997)

Senior Chemist Coordinator (2000)

Responsibilities included supervising personnel; coaching and developing new employees; sample tracking; reviewing rush request; communicating client requirements; operating GC and HPLC instruments; data interpretation and entry; calibrating; repairing instruments and verifying data

Senior Chemist Group Leader, Pesticide Residue Analysis (2005)

Responsibilities included supervising personnel; coaching and developing new employees; sample tracking; reviewing rush request; communicating client requirements; operating GC and HPLC instruments; data interpretation and entry; calibrating; repairing instruments and verifying data

Senior Chemist Group Leader, EPH Misc. GC (2011)

Responsibilities include supervising personnel; coaching and developing new employees; sample tracking; reviewing rush request; communicating client requirements; operating GC instruments; data interpretation and entry; calibrating; repairing instruments and verifying data

Linda M. Hartenstine, B.A., Senior Chemist, GC/MS Semivolatiles

Education:

B.A. Chemistry, Millersville University (1994)

Professional Experience:

With Lancaster Laboratories since 1994

Associate Chemist (1994)

Chemist (1997)

Senior Chemist, GC/MS Semivolatiles (1998)

Responsibilities include performing GC/MS semivolatiles testing; operating GC/MS instruments; data interpretation; developing and evaluating new methods; calibrating and repairing instruments; preparing standards; revising and updating SOPs and analytical methods; training other analysts

Robert G. Heisey, Jr., B.A., Senior Specialist, Water Quality

Education:

B.A. Chemistry, Millersville State College (1972)

Professional Experience:

RCA Corp., Engineering Technician (1972-1987)

With Lancaster Laboratories since 1988

Chemist Coordinator (1989)

Senior Chemist Coordinator (1997)

Responsibilities included: supervise personnel; schedule lab work; review and approve data; develop and evaluate new methods; prepare test standards.

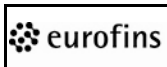
Senior Chemist Group Leader (2005)

Responsibilities included: supervise personnel; schedule lab work; review and approve data; develop and evaluate new methods; prepare test standards.

Senior Specialist, Water Quality (2006)

Responsibilities include: review and approve data; develop and evaluate new methods; prepare test standards; order laboratory supplies; maintain department's chemical inventory.

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Daniel H. Heller, B.A., Senior Chemist, GC/MS Volatiles

Education:

A.S.T. Machine Technology, Stevens State College (1998)
B.A. Secondary Education Biology, Millersville University (2003)

Professional Experience:

Tyco Electronics, Machinist B (1998-2004)
Responsibilities included machining various materials using various machines
Columbia Junior/Senior High School, Teacher (2005)
Responsibilities included teaching 9th and 10th grade biology
Penn State Cooperative Extension, Biologist (2005-2006)
Responsibilities included treating and surveying mosquito populations
With Lancaster Laboratories since 2006
Chemist, GC/MS Volatiles (2006)
Responsibilities included evaluating water samples for volatiles using GC/MS instrumentation
Senior Chemist, GC/MS Volatiles (2012)
Responsibilities include evaluating water samples for volatiles using GC/MS instrumentation

Tamara J. Helsel, Senior Specialist Group Leader, Environmental Sample Administration

Professional Experience:

Willow Valley Retirement Communities, Certified Nursing Assistant (2000-2001)
Responsibilities included assisting nursing home residents with their daily activities and personal hygiene
Bayada Nurses, Certified Nursing Assistant (2000-2001)
Responsibilities included assisting people with disabilities in their homes with their personal hygiene and daily activities
With Eurofins Lancaster Laboratories since 2001
Senior Administrator, Environmental Sample Administration (2001)
Responsibilities included performing sample receipt, interpretation, and entry
Specialist, Environmental Sample Administration (2001)
Responsibilities included performing sample receipt, interpretation, and entry
Senior Specialist, Environmental Sample Administration (2007)
Responsibilities included performing sample receipt, interpretation, and entry
Senior Specialist Group Leader, Environmental Sample Administration (2013)
Responsibilities include performing sample receipt, interpretation, and entry

Memberships and Appointments:

Lancaster Laboratories Safety Committee (2003-2007)

Chadwick J. Hershey, B.S., Senior Specialist, Environmental Software Development

Education:

B.A. Economics, Millersville University (2001)
B.S. Computer Science, Millersville University (2001)

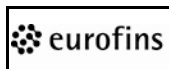
Continuing Education:

Mastering Microsoft Visual Basic 6 Development, IntelliMark (2001)
Oracle Exam #120-007, Introduction to Oracle 9i: SQL (2004)

Professional Experience:

With Eurofins Lancaster Laboratories since 1999
Intern, Computer Applications Development (1999-2001)
Responsibilities included maintaining and developing departmental computer systems
Specialist, Computer Applications Development (2001)
Responsibilities included maintaining and developing departmental computer systems
Senior Specialist, Environmental Software Development (2006)
Responsibilities include maintaining and developing departmental computer systems

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Diana G. Holmes, M.S., Senior Specialist, Environmental Software Development

Education:

B.A. Physics, Cornell University (1983)
M.S. Computer Science, Rensselaer Polytechnic Institute (1985)

Professional Experience:

AT&T Bell Laboratories, Technical Staff Member (1985-1986)
Responsibilities included developing software for testing software
Prime Computer, Software Engineer II (1986-1988)
Responsibilities included designing, implementing, and testing software for PRIMOS and mini-supercomputers
Banyan Systems, Principal Software Engineer (1988-1999)
Responsibilities included developing, enhancing, and maintaining suite of services for VINES mail service; worked with 3rd party developers; third line customer support
Progressive Systems/Cobalt Networks, Senior Software Engineer (1999-2000)
Responsibilities included managing and leading software releases; designed and implemented software features; third line customer support
Sun Microsystems, Project Manager (2000-2005)
Responsibilities included project manager for Linux Operation System releases
Innovative Emergency Management, Inc., Applications Systems Engineer (2005-2006)
Responsibilities included providing system administration support, development of software tools for deployment
Pennington Biomedical Research Center, IT Applications Developer III (2006-2013)
Responsibilities included analyzing, designing, developing, executing, documenting, and supporting software applications for the Basic Science labs
With Eurofins Lancaster Laboratories since 2013
Senior Specialist, Environmental Software Development (2013)
Responsibilities include providing technical support for maintenance of installed software applications and assistance with development, installation, and maintenance of new applications for general use; assistance in development, implementation, and maintenance of software intended to improve quality and efficiency of work performed

Catherine M. Holt, B.S., Principal Specialist, Environmental Software Development

Education:

B.A. Mathematics, Franklin & Marshall College (1984)
B.S. Computer Science, Millersville University (1987)

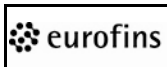
Continuing Education:

Novell Network Seminar, Novell (1989)
Clarion Database Management Seminar, Clarion Software (1991)
Operations Process Optimization, Penn State University (1992)
Fast Track to Powerbuilder Seminar, Actium (1997)
Mastering Visual Basic 6 Development, Microsoft Corporation (1999)
Introduction to Oracle9i: SQL, Online Testing (2004)
Programming with the Microsoft .NET framework using Microsoft Visual Studio 2005 (2008)
Windows Forms 3.5 Programming for Experienced VB .NET Programmers (2010)

Professional Experience:

R.R. Donnelley & Sons Company, Technician (1985-1987)
Responsibilities included scanning and developing photographs for use in catalogs
Shared Medical Systems, Programmer (1987-1989)
Responsibilities included customizing and installing software at hospitals
With Eurofins Lancaster Laboratories since 1989
Principal Specialist, Computer Applications Development (1989)
Responsibilities included developing and maintaining computer systems/programs for laboratory use
Principal Specialist/Coordinator, Computer Applications Development (1995)
Responsibilities included supervising personnel; developing and maintaining computer systems/programs for lab use; communicating with clients about disk requirements
Principal Specialist, Environmental Software Development (1997)
Responsibilities include developing and maintaining computer systems in VB6 and VB.net for use within Parallax shell

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John P. Hook, B.S., Senior Chemist, Metals

Education:

B.S. General Science, Pennsylvania State University (2002)

Continuing Education:

ICP/ICP-MS Seminar, Perkin-Elmer (2003)

ICP-MS Seminar, Agilent (2004)

ICP-MS training, Perkin-Elmer (2005)

PPI Team Training, Lancaster Laboratories (2008)

Facilitator Training, ThermoFisher Scientific (2009)

Professional Experience:

Sony Technology Corporation, Manufacturing Staff (2002-2003)

Responsibilities included assembly, final inspection, and packaging of television sets

ALCOA Primary Metals, Laboratory Technician (2003)

Responsibilities included observation and maintenance of aluminum production pilot test operation; analysis of product

With Lancaster Laboratories since 2003

Chemist, Metals (2003)

Senior Chemist, Metals (2006)

Responsibilities include performing setup, analysis, and review of ICP, ICP-MS runs; maintenance and troubleshooting of ICP, ICP-MS instruments; yearly, quarterly and start-up ICP instrument qualifications including IECs, IDLs, MDLs, and LDRs; maintaining adequate laboratory supply inventory; disposing of acid waste; writing SOPs

Kay G. Hower, B.S., Principal Specialist Group Leader, Bay Area Service Center

Education:

B.S. Animal Science, University of Delaware (1988)

Professional Experience:

U.S. Fish and Wildlife Service, Research Assistant (1990-1991)

RMC Environmental Services, Biological Technician (1992-1994)

Lancaster Laboratories

Senior Specialist, Project Manager, Environmental Client Services (1994-2001)

Responsibilities included managing client projects; auditing sample entry; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions and providing sampling containers.

Principal Specialist, Environmental Business Development (2001-2007)

Responsibilities included providing price quotes and proposals; advising clients on testing; assisting on client visits/audits; answering client questions; communicating client requirements to lab areas

Principal Specialist, Pharmaceutical Client Services (2007-2008)

Responsibilities included acting as the pharmaceutical client liaison within the laboratory by communicating client's requirements to the technical staff by maintaining project-related documentation, communicating desired turnaround times, and managing information flow; other duties include facilitating and organizing client audits, visits, and conference calls; monitoring ongoing projects and providing status updates as needed; auditing client sample paperwork and resolving discrepancies; overseeing the general administration of pharmaceutical projects (issuing quotations, answering billing and reporting questions, and scheduling sample pickups)

Urological Associates of Lancaster, Surgical Coordinator (2010-2012)

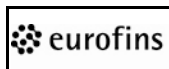
Responsibilities included coordinating surgical procedures for seven urologists at four facilities; meeting with patients to explain procedure details including pre-hospital testing, day-of timeline and post-op appointments and testing; obtaining insurance authorizations

With Lancaster Laboratories since 2012

Principal Specialist Group Leader, Bay Area Service Center (2012)

Responsibilities include serving as the primary contact with the laboratory for a number of assigned clients; communicating technical information and conveying client requirements to laboratory personnel, ensuring that those requirements are met; managing large/complex projects according to client technical and schedule requirements; developing strong relationships with major accounts resulting in additional sales; performing both technical and personnel aspects of group operations; performing work within the department or other areas as required; acting as a technical resource, trainer, and troubleshooter to specific department; making recommendations for operational and/or technical improvements; communicating effectively within the group; coaching and developing direct reports; planning and monitoring workflow

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Samuel A. Huber, B.S., Manager, Physical Services/Equipment Maintenance & Repair

Education:

B.S. Biology, Lebanon Valley College (1988)
Certificate of Business Administration, Penn State University (1995)

Continuing Education:

24-hour HAZWOPER (spill response) (1995-2004)
40-hour HAZWOPER (2005-present)
DOT/IATA training (2004-2010)
Incident Command System IS-00100 (2006)
National Incident Management System IS-00700 (2006)
Total Productive Maintenance (2007)
Basic Electricity for the Non-Electrician (2009)
Air Conditioning and Refrigeration (2010)
OSHA Asbestos 2- Hour Awareness Training (2012)
Applied Structural Drying (4-Hours) (2012)
Siemens APOGEE Workstation Operations (2012)
NFMT (National Facilities Management & Technology) – annual conference attendance (2008-present)
I2SL (International Institute for Sustainable Laboratories) – annual conference attendance (2012)

Professional Experience:

With Eurofins Lancaster Laboratories since 1988
Environmental department responsibilities (1988-2007)
Responsibilities included supervising personnel; scheduling lab work; managing laboratory operations and financial resources; project management; supervising method development
Manager, Physical Services/Equipment Maintenance & Repair (2007- present)
Responsibilities include overseeing facilities staff and operation of physical plant and grounds; growth planning; overseeing security functions

Awards, Citations, Honorary Societies & Publications:

Dawson-Grundmann Innovation Award, Lancaster Laboratories (1999)
Design and oversee installation of bulk solvent delivery system for organic extractions; annual savings in waste reduction and labor costs of greater than \$12,000
Organizing the Laboratory to Efficiently and Accurately Process Soil Samples, Pittcon poster session (2006)
NFPA Industrial Fire Protection Section Member (2009-present)
NFMT (National Facilities Management & Technology) Member (2010-present)
I2SL (International Institute for Sustainable Laboratories) Member (2012-present)
AFE (Association for Facilities Engineering) Member (2012-present)
LCISC (Lancaster County Industrial Safety Council) Member (2009-present)

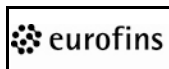
Sara E. Johnson, B.S., Senior Chemist, GC/MS Volatiles

Education:

B.S. Chemistry, Biochemistry option, Millersville University (2006)

Professional Experience:

With Lancaster Laboratories since 2006
Chemist, Flexible Staffing (2006)
Responsibilities included flexing to various departments as needed and performing analysis ranging from GC/MS to SDS-PAGE Electrophoresis with colloidal blue or silver staining
Chemist, GC/MS Volatiles (2008)
Responsibilities included performing GC/MS analysis of water and soil samples along with other matrices by various analytical methods such as EPA 624, 8260B, and CLP; evaluating analytical data generated; calibrating and troubleshooting GC/MS instrumentation
Senior Chemist, GC/MS Volatiles (2010)
Responsibilities include performing GC/MS analysis of water and soil samples along with other matrices by various analytical methods such as EPA 624, 8260B, and CLP; evaluating analytical data generated; calibrating and troubleshooting GC/MS instrumentation; assisting other employees with any questions that may arise and helping to train new employees

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Richard H. Karam, B.A., Director of Operations, Eurofins Lancaster Laboratories Environmental

Education:

B.A. Environmental Studies, Green Mountain College (2000)

Professional Experience:

Severn Trent Laboratories

Analytical Chemist (2000-2005)

Responsibilities included analyzing environmental samples for various general chemistry parameters, metals by ICP/ICPMS, pesticides/PCBs/herbicides by GC, and semivolatiles by GC/MS

Project Manager (2005-2006)

Responsibilities included managing environmental projects; writing case narratives; project set up

With Eurofins Lancaster Laboratories since 2006

Group Leader, GC/MS Semivolatiles (2006)

Responsibilities included coordinating production in GC/MS Semivolatiles; reviewing and signing reports

Manager, GC/MS Semivolatiles (2007)

Responsibilities included ensuring the accuracy and acceptability of all data generated by the GC/MS

Semivolatiles group; coordinating daily prioritization of workload and monitoring the holding time and turnaround time status of samples; responding to client questions regarding GC/MS Semivolatiles data and methods and communicating technical issues or concerns about samples to project managers for clarification or resolution with the client

Manager, Organic Extraction/Leachate Preparation/GC/MS Volatiles/GC/MS Semivolatiles (2008)

Responsibilities included ensuring the accuracy and acceptability of all data generated by the groups; coordinating daily prioritization of workload and monitoring the holding time and turnaround time status of samples; responding to client questions regarding data and methods and communicating technical issues or concerns about samples to project managers for clarification or resolution with the client

Director, Eurofins Lancaster Laboratories Environmental (2014)

Responsibilities include leading departments in accordance with vision, values, and strategic goals of company; overseeing and facilitating efficient operations and systems, sound business practices, consistent client service, and motivated staff

Dana M. Kauffman, Manager, Sample Support and Data Deliverables

Continuing Education:

Introduction to Electronics, Lancaster County Career & Technology Center, Brownstown (1994)

AC/DC Electronics, Lancaster County Career & Technology Center (1995)

Entry Level Management (1997)

Gas Chromatography: Principles and Practices, Lancaster Labs University (2003)

Practical Process Improvement Facilitator Training (2009)

Practical Process Improvement Process Manager Training (2011)

Professional Experience:

With Lancaster Laboratories since 1994

Lab Technician (1995)

Senior Technician (1996)

Sample Support Coordinator (1997)

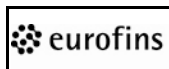
Group Leader, Sample Support (1999); Group Leader, Volatiles by GC (2002)

Responsibilities included supervising personnel; managing laboratory operations; project management; sample preparation; developing and evaluating new methods; reagent preparation; revising and updating SOPs; ordering supplies; training other analysts; running the automated storage and retrieval system; lab cleaning and maintenance; monitoring laboratory activities; performing internal audits; enforcing regulatory compliance requirements; maintaining required certifications; communicating client requirements to lab areas

Manager, Sample Support and Data Deliverables (2005)

Responsibilities include overseeing all upfront sample handling requirements including storage, preservation, homogenization, moisture determination, volatile prescreen, and volatile soil prep; supervising group leader personnel; project management; revising and updating SOPs; performing internal audits; enforcing regulatory compliance requirements; maintaining required certifications; communicating client requirements to lab areas; data package and EDD TAT monitoring; overseeing all data package processes including data assembly, review, and processing; Practical Process Improvement (PPI) process manager responsible for facilitating PPI project team training and PPI efforts within LLI

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Katherine A. Klinefelter, M.S., Principal Specialist, Environmental Client Services

Education:

B.S. Chemistry, Rutgers University (1983)
M.S. Physiology, Rutgers University (1985)

Continuing Education:

Additional graduate work in Physiology, Rutgers University (1985-1989)
Practical Process Improvement (Team Member Training), Lancaster Labs University (2009)

Professional Experience:

Rutgers University, Research and Teaching Assistant (1984-1989)
M. S. Hershey Medical Center of Penn State University, Senior Research Technician (1990-1993)
With Lancaster Laboratories since 1993

Environmental Project Management
Senior Specialist, Environmental Client Services (1993)
Senior Specialist/Coordinator, Environmental Client Services (1996)
Senior Specialist, Environmental Client Services (2000)
Principal Specialist, Environmental Client Services (2007)

Responsibilities include project management; training new client service representatives; auditing sample entry; answering client questions; communicating client requirements to lab areas

Awards, Citations, Honorary Societies & Publications:

Dean's Graduate Student Dissertation Research Award, Rutgers University
Dean's Graduate Student Travel Award, Rutgers University
Steinetz Memorial Fund Award, Department of Biological Sciences, Rutgers University
10 abstracts and 3 scientific papers on membrane transport physiology
4 presentations on membrane transport physiology
Quarterly Impact Award for Practical Process Improvement (2009)

Wendy A. Kozma, B.S., Principal Specialist Group Leader, Environmental Client Services

Education:

B.S. Environmental Science, Allegheny College (1991)

Professional Experience:

Roy F. Weston, Inc. (1992-1993)

With Lancaster Laboratories since 1993

Senior Specialist, Environmental Client Services (1996)

Responsibilities included performing project management; advising clients on testing; providing price quotes; monitoring turnaround time; auditing sample entries; answering client questions; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions; ordering sampling containers

Principal Specialist, Environmental Client Services (2004)

Responsibilities included performing project management; advising clients on testing; providing price quotes; monitoring turnaround time; auditing sample entries; answering client questions; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions; ordering sampling containers

Principal Specialist Group Leader, Environmental Client Services (2006)

Responsibilities include performing project management; advising clients on testing; providing price quotes; monitoring turnaround time; auditing sample entries; answering client questions; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions; ordering sampling containers

Rachel L. Kreamer, B.S., Manager, Environmental Client Services

Education:

B.S. Biology, Eastern Mennonite College (1980)

Continuing Education:

Financial Accounting, Penn State (2005)
Behavioral Science in Business, Penn State (2006)
Price and Markets, Penn State (2006)

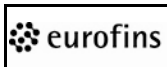
Professional Experience:

With Lancaster Laboratories since 1987

Client Services Specialist, Environmental Client Services (1990)
Environmental Project Manager, Environmental Client Services (1994)
Coordinator, Environmental Client Services (1996)
Group Leader, Environmental Client Services (1996)

Responsibilities included supervising personnel; training; revising and updating SOPs; monitoring turnaround time

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Manager, Environmental Client Services (2005)
 Responsibilities included supervising personnel; training; revising and updating SOPs; monitoring turnaround time
 Manager, Pharmaceutical Client Services (2005)
 Responsibilities included supervising personnel; revising and updating SOPs; training
 Director, Professional Scientific Staffing – VA (2007)
 Responsibilities included managing all aspects of the PSS group in VA
 Director, Bay Area Service Center (2008)
 Responsibilities included managing all aspects of the Bay Area Service Center
 Manager, Environmental Client Services and Bay Area Service Center (2009)
 Responsibilities include managing all aspects of the environmental client services group and Bay Area Service Center

Awards, Citations, Honorary Societies & Publications:

Senior Leadership Group Achievement Award (1996)

M. Susan Kreider, Senior Specialist, Data Deliverables

Continuing Education:

Chemistry and Psychology courses, F&M College

Professional Experience:

General Cigar Co., R&D Center, Laboratory Technician (1963-1966)
 Responsibilities included testing tobacco products; smoke analysis; nicotine and tar analysis; preparing samples for gas chromatography
 Company F. Weaver, Inc., Laboratory Technician (1966-1967)
 Responsibilities included performing microbiological testing of food products, both raw materials and finished products; training factory employees in sterile food handling
 Microbiological Associates, Inc., Stock Line/Sterile Technician (1968-1969)
 Responsibilities included performing cancer research; dissection of animal and human tissue for cell line production; freezing of live cells; all phases of sterile lab work
 Warner Lambert Co., Assistant Microbiologist/Organic Chemistry Technician (1970-1975)
 Responsibilities included performing microbiological and chemical testing of raw material and finished products
 Julia Winifred & Co. (Jacks III), Sales Clerk (1982-1983)
 Responsibilities included retail sales; preparing windows and displays in store
 With Lancaster Laboratories since 1983
 Laboratory Technician, ExpressLAB (1983)
 Responsibilities included performing sample prep and analyses
 Senior Technician, ExpressLAB (1986)
 Responsibilities included performing sample prep and analyses
 Chemist, ExpressLAB (1988)
 Responsibilities included performing sample prep and analyses
 Specialist, Pesticide Residue Analysis (1998)
 Responsibilities included performing sample prep and analyses
 Specialist, EPH/Misc. GC (2003)
 Responsibilities included performing sample prep and analyses
 Specialist, Data Deliverables (2005)
 Responsibilities included validating and sending data deliverables
 Senior Specialist, Data Deliverables (2006)
 Responsibilities include validating and sending data deliverables

Robert M. Large, B.S., Director, Environmental Client Services/Inside Business Development/Sample Administration/Data Deliverables/Sample Support/Bay Area Service Center

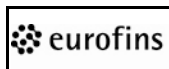
Education:

B.S. Zoology, Pennsylvania State University (1973)

Continuing Education:

Chromatography/Mass Spectral Interpretation, Finnigan MAT Institute (1981)
 Foundations of Management, Gilbert Associates (1982)
 M.B.A. Program, St. Joseph's University (1984-1987)
 How to Market Professional Services, ACIL (1990)

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Professional Experience:

Gilbert Associates, Inc., Program Manager (1977-1984)
 Spotts, Stevens, & McCoy, Director of Client Services (1984-1990)
 With Lancaster Laboratories since 1990
 Marketing Specialist, Environmental Client Services (1990)
 Group Leader, Environmental Client Services (1994)
 Manager, Environmental Client Services (1995)
 Responsibilities included: supervise personnel; project management; various office tasks; interpret QC implications to data quality; and advise clients on testing. Set up and managed the Bay Area Service Center in Richmond, CA (2001). Manage Environmental Sample Administration (2002). Manage Inside Business Development (2003).
 Director, Environmental Client Services/Business Development/Sample Administration/Bay Area Service Center (2005)
 Responsibilities include: supervise personnel; project management; various office tasks; interpret QC implications to data quality; and advise clients on testing. Set up and managed the Bay Area Service Center in Richmond, CA (2001). Manage Environmental Sample Administration (2002). Manage Inside Business Development (2003). Assisted setting up Professional Scientific Staffing (PSS) for a major biotech client (2004). Manage Data Deliverables and Sample Support (2010).

Kerri E. Legerlotz, Senior Chemist, GC/MS Volatiles

Education:

B.S. Chemistry, Houghton College (2005)

Professional Experience:

Pfizer, Chemist (2005-2006)
 Responsibilities included performing raw material, finished product, and stability testing; wet chemistry, pH, viscosity, IR, Karl Fischer, specific gravity
 With Lancaster Laboratories since 2006
 Chemist, GC/MS Volatiles (2006)
 Responsibilities included testing for volatile compounds using GC/MS by purge and trap; preparing working standards from neat compounds
 Senior Chemist, GC/MS Volatiles (2013)
 Responsibilities include analyzing water and soil samples by purge and trap GC/MS; generating and reviewing raw data; performing maintenance on GC/MS, purge and traps, and various autosamplers; troubleshooting problems on GC/MS, purge and traps, and autosamplers; formulating and diluting analytical reference materials

Parker D. Lindstrom, B.S., Senior Chemist, Metals

Education:

B.S. Chemical Oceanography, Millersville University (2002)

Continuing Education:

Comprehensive Gas Chromatography Seminar, RESTEK (2002)
 Comprehensive GC/MS Seminar, RESTEK (2002)
 Statistics at Lancaster Laboratories, LLU (2005)
 24-hour HAZWOPER, LLU (2006)

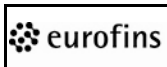
Professional Experience:

Fred Fiorentino, Assistant Laborer (1997-2002)
 Responsibilities included roofing, painting, general construction, clean-up, installation of windows, doors, stairs, decking
 Dr. Kerper, Office Assistant (2000-2002)
 Responsibilities included filing, cataloging children's books
 Millersville University IMC/IMS, Media/Education Assistant (2000-2002)
 Responsibilities included assisting teachers in creating media for the classroom, editing video and audio projects
 With Lancaster Laboratories since 2002
 Associate Chemist/Senior Chemist, GC/MS Volatiles (2002)
 Responsibilities included running purge and trap and GC/MS to analyze samples and QC for VOCs; performing purge and trap and GC/MS maintenance
 Senior Chemist, Metals (2006)
 Responsibilities included running ICP/MS; verifying samples; performing maintenance; prepping samples; general troubleshooting for metals department; installation, maintenance and operation of CVAF low level Mercury; providing general computer help to Computer Services department
 Senior Chemist Metrology, Metals (2009)
 Responsibilities include helping the instrument (Metrology) group maintain and qualify HPLCs, GCs, and other pharmaceutical instruments; helping with other qualifications as needed (hoods, storage units, etc); for a short time in 2009 verifying data in Water Quality department

Memberships and Appointments:

Emergency Response Team (Spill Team), Lancaster Laboratories (2006)

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Jason M. Long, B.S., Senior Chemist, GC/MS Volatiles

Education:

B.S. Chemistry, Shippensburg University (2004)

Professional Experience:

EA Engineering Science & Technology, Lab Tech (2004)

Responsibilities included setting up and running tests in toxicology lab; cleaning glassware used in performing tests; titrating for alkalinity and pH of water samples

With Lancaster Laboratories since 2004

Chemist, GC/MS Volatiles (2004)

Responsibilities included analyzing water and soil samples by purge and trap GC/MS; generating and reviewing raw data; performing maintenance on GC/MS, purge and traps, and various autosamplers

Senior Chemist, GC/MS Volatiles (2007)

Responsibilities include analyzing water and soil samples by purge and trap GC/MS; generating and reviewing raw data; performing maintenance on GC/MS, purge and traps, and various autosamplers; troubleshooting problems on GC/MS, purge and traps, and autosamplers

Lyssa M. Longenecker, B.S., Senior Specialist, Environmental Client Services

Education:

B.S. Biology, Millersville University of PA (2010)

Professional Experience:

With Eurofins Lancaster Laboratories since 2011

Specialist, Environmental Client Services (2011)

Responsibilities included serving as the primary laboratory contact to clients; communicating technical information to the client in a comprehensible manner; deciphering the clients' testing needs; conveying the clients' requirements to the laboratory; ensuring clients' requirements and needs are met

Senior Specialist, Environmental Client Services (2014)

Responsibilities include serving as the primary laboratory contact to clients; communicating technical information to the client in a comprehensible manner; deciphering the clients' testing needs; conveying the clients' requirements to the laboratory; ensuring clients' requirements and needs are met

Dorothy M. Love, B.S., Manager, Environmental Quality Assurance

Education:

B.S. Environmental Health, Indiana University of Pennsylvania (1981)

Professional Experience:

Sun Transport, Inc., Safety Assistant (1980-1981)

Texas A & M University, Research Assistant (1982-1984)

Texas Water Commission, Chemist (1984-1986)

GHR Analytical, Chemist (1986-1987)

Clean Harbors, Inc., Senior Chemist (1987-1989)

With Eurofins Lancaster Laboratories since 1989

Senior Specialist (1989)

Senior QA Specialist (1998) Coordinator (2000)

Principal Specialist/Coordinator, Quality Assurance (2003)

Responsibilities included supervising personnel; training other QA staff; revised and updated analytical methods; monitored laboratory activities and corrective action for quality issues; performed internal audits; worked with external auditors; reviewed lab data and procedures; enforced regulatory compliance requirements; reviewed/wrote client/lab Quality Assurance Project Plans (QAPP)

Principal Specialist Group Leader, Quality Assurance (2005)

Responsibilities included supervising personnel; training other QA staff; revised and updated analytical methods; monitored laboratory activities and corrective action for quality issues; performed internal audits; worked with external auditors; reviewed lab data and procedures; enforced regulatory compliance requirements; reviewed/wrote client/lab Quality Assurance Project Plans (QAPP)

Manager, Environmental Quality Assurance (2013)

Responsibilities include supervising the Environmental QA department; monitoring regulatory activities; reviewing procedures and data; interacting with clients and agencies; performing regulatory and client document review; enforcing regulatory compliance; quality improvement; staff training; QA policy development and maintenance

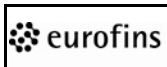
Memberships and Appointments:

Society of Women Environmental Professionals (SWEP (2007-present)

TNI Quality Systems Committee (2009-present)

NJ Environmental Laboratory Advisory Committee (2012-present)

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Natalie R. Luciano, B.A., Senior Specialist, Environmental Client Services

Education:

B.A. Biology, Bridgewater College (2006)

Continuing Education:

Safe Drinking Water Regulations Revisions, PaAAEL & PA DEP (2010)

PA Regulatory Update Bureau of Safe Drinking Water, PaAAEL (2013)

PA DEP Regulatory Update, PA DEP (2013)

Professional Experience:

With Eurofins Lancaster Laboratories since 2007

Specialist, Environmental Client Services (2007)

Responsibilities included performing project management; serving as the primary contact for external clients; communicating client requirements to laboratory areas; auditing entries and reviewing sample data

Senior Specialist, Environmental Client Services (2013)

Responsibilities include performing project management; serving as the primary contact for external clients; communicating client requirements to laboratory areas; auditing entries and reviewing sample data

Duane A. Luckenbill, B.S., Vice President, Eurofins Lancaster Laboratories Environmental

Education:

B.S. Chemistry, Clarion University of PA (1989)

Continuing Education:

Introduction to Mass Spectral Interpretation, Hewlett-Packard (1995)

Technical Training, OI Analytical (1995)

Professional Experience:

ATEC Associates, Inc., GC/MS Analyst (1989)

With Eurofins Lancaster Laboratories since 1989

Chemist (1991)

Chemist/Coordinator (1993)

Group Leader (1997)

Manager (2001)

Responsibilities included client satisfaction, safety and quality systems administration, and all aspects of financial, personnel, and operations management of the GC/MS Volatiles and GC/MS Semivolatiles groups

Director, Environmental Sciences (2005)

Responsibilities included client satisfaction, safety and quality systems administration, and all aspects of financial, personnel, and operations management of the GC/MS Volatiles, GC/MS Semivolatiles, Volatiles in Air, Organic Extraction, Leachate Preparation, Field Sampling, Pesticide Residue Analysis, Volatiles by GC, and EPH/Miscellaneous GC groups

Vice President, Eurofins Lancaster Laboratories Environmental (2013)

Responsibilities include all aspects of financial, personnel, and operations management of all Technical areas, Environmental Quality and Compliance, Computer Application/Development, and Environmental Support Services while continually focusing on client satisfaction, safety, and quality systems administration; collaborating with other Eurofins US environmental companies to expand national testing capabilities and grow market share in the US

Awards, Citations, Honorary Societies & Publications:

Undergraduate Award in Analytical Chemistry, American Chemical Society (1988)

Department of Chemistry Competitive Award, Clarion University (1988-1989)

Outstanding Senior Chemistry Award, American Institute of Chemists Foundation (1989)

Senior College Award for Chemistry, Society for Analytical Chemists of Pittsburgh (1989)

One publication on mass spectrometry

Nicole L. Maljovec, M.S., Principal Specialist Group Leader, Environmental Client Services

Education:

B.S. Chemistry, St. Bonaventure University (2004)

M.S. Adolescence Education, D'Youville College (2005)

Professional Experience:

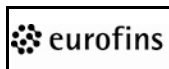
CYTEC Industries, Industrial Hygiene Internship (2003-2004)

Responsibilities included performing air monitoring and sampling; complying with OSHA standards; assisting R/D lab with the identification of unknown chemicals and wastes

Niagara Wheatfield, Environmental Science Teacher (2005-2006)

Responsibilities included teaching chemistry, chemistry lab, and environmental science; developing special education plans to assist students with learning disabilities

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With Lancaster Laboratories since 2006

Specialist, Environmental Client Services (2006)

Responsibilities included performing project management; advising clients on testing; providing price quotes; monitoring turnaround time; auditing sample entries; answering client questions; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions; ordering sampling containers

Senior Specialist Group Leader, Environmental Client Services (2007)

Responsibilities included performing project management; advising clients on testing; providing price quotes; monitoring turnaround time; auditing sample entries; answering client questions; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions; ordering sampling containers; managing a team of client service representatives and administrative assistants, training of new employees, setting up and delegating new projects, serving as primary project manager for several large clients and consultants

Principal Specialist Group Leader, Environmental Client Services (2012)

Responsibilities include serving as the primary contact or back-up with the laboratory for a number of assigned clients requiring specialized testing or complex projects; understanding and communicating technical information and client requirements to laboratory personnel, helping to ensure that requirements are met; leading broad-based complex projects to a satisfactory conclusion according to client technical and schedule requirements; developing strong relationships with major accounts resulting in additional sales; advising and training other members of the department; serving as a technical resource both internally and externally; proactively assisting Outside Business Development with client visits, presentations, and internal audits for assigned clients; participating on PPI teams

Melissa McDermott, B.A., Principal Specialist, Environmental Business Development

Education:

B.A. Biology, Millersville University (1992)

Elementary Education Certification, PA (May 2009)

Middle School Science Certification, PA (July 2009)

Continuing Education:

Gas Chromatography Principles and Practices (1995)

Conflict Resolution and Confrontation Skills Seminar (1996)

Coaching Skills for Supervisors Seminar (1996)

Waste Testing and Quality Assurance Symposium (1996)

Entry Level Management (1997)

How to Deliver Exceptional Customer Service Seminar (1997)

Statistics at Lancaster Laboratories (2006)

Professional Experience:

With Eurofins Lancaster Laboratories since 1992

Chemist, EPH/Misc. GC (1993)

Responsibilities included performing analysis of environmental samples for metals by AA flame and cold vapor generation; assembling client data packages

Chemist Coordinator, EPH/Misc. GC (1996)

Responsibilities included coordinating rush work; communicating with client service representatives regarding sample status; answering client questions; generating employee job plans; conducting employee evaluations

Senior Chemist, EPH/Misc. GC (1997)

Responsibilities included performing analysis of environmental samples for DRO and interpretive TPH analyses; verifying analyses performed by other analysts; preparing standards; revising departmental SOPs; method development; reviewing data packages

Senior Specialist, Environmental Client Services (1997)

Responsibilities included auditing sample entry; answering client questions; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions and providing sampling containers

Senior Chemist, EPH/Misc. GC (2002)

Responsibilities included reviewing and approving data; writing departmental methods; reviewing and approving data packages; acting as technical resource within department; answering client questions; monitoring and performing QA metrics

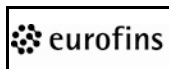
Senior Specialist, Environmental Client Services (2007)

Responsibilities included acting as technical resource between client services and laboratories; scheduling sample submissions and providing sampling containers; communicating client requirements to lab areas

Senior Chemist, EPH/Misc. GC (2009)

Responsibilities included reviewing and approving data; writing departmental methods; reviewing and approving data packages; acting as technical resource within department; answering client questions; monitoring and performing QA metrics

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Senior Chemist Group Leader, Pesticides (2011)

Responsibilities included performing routine and non routine instrumental analyses of QC and clients' samples for pesticides, PCBs, herbicides, and other related compounds in accordance with departmental methods and standard operating procedures (SOPs); assisting in implementing special client requests; identifying and offering solutions to correct instrument problems and causes of QC problems; reviewing data for accuracy and completeness (for both routine and non routine analyses, reports, or data packages); serving as a technical resource for the department; performing both technical and personnel aspects of group operations; performing work within the department or other areas as required; acting as a technical resource, trainer, and troubleshooter to specific department; making recommendations for operational and/or technical improvements; communicating effectively within the group; coaching and developing direct reports; planning and monitoring workflow

Principal Specialist, Environmental Business Development (2014)

Responsibilities include using company literature, verbal discussions, formal written quotes, proposals, tours, and audits to independently secure new business consistent with operational capabilities and business plan goals; collaborating efforts and activities with those of Outside Sales account managers as needed; focusing on proposal writing for major national accounts; attending face-to-face sales meetings with selected national accounts as needed and maintaining responsibility for their maintenance and growth

Roy R. Mellott Jr., B.S., Senior Chemist Group Leader, GC/MS Volatiles

Education:

B.S. Biology, Millersville University (1993)

Continuing Education:

Hazardous Waste Disposal, LLU (1996)

GC: Principles & Practices, LLU (1997)

GC/MS: Applications/Troubleshooting Seminar, ECS/MDL Systems, Inc. (1999)

Introduction to Interpretation of Mass Spectra, LLU (2005)

Interpretation of Mass Spectra, Intermediate, LLU (2005)

Role of the Leader 1 – Giving Recognition, LLU (2007)

Role of the Leader 2 – Clarifying Performance Expectations, LLU (2007)

Role of the Leader 3 – Developing Others, LLU (2007)

Role of the Leader 4 – Providing Constructive Feedback, LLU (2007)

PPI Team Training, LLU (2010)

PPI Facilitator Workshop, LLU (2010)

Targeted Selection, LLU (2010)

Role of the Leader Building Team Pride and Purpose, LLU (2011)

Role of the Leader Resolving Conflicts with Your Peers, LLU (2011)

Professional Experience:

With Eurofins Lancaster Laboratories since 1995

Senior Lab Tech I, GC/MS Volatiles (1995)

Responsibilities included requisitioning samples; performing sample storage, prescreening, discard, hazardous waste disposal; tracking down missing samples by various means

Chemist/Auditor, GC/MS Volatiles (1996)

Responsibilities included performing analysis of waters, soils, and other matrices for VOCs via various analytical methods; evaluation of analytical data; calibrating and trouble shooting various GC/MS equipment; evaluation/review of analyst-generated data; corresponding with analysts about possible trends (whether analyst- or system-related) in generated data; evaluation/review of corrections of problems with generated data

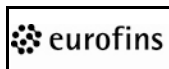
Senior Chemist, GC/MS Volatiles (2002)

Responsibilities included performing analysis of waters, soils, and other matrices for VOCs via various analytical methods; evaluation of analytical data; setting up, calibrating, and trouble shooting various GC/MS equipment; evaluation/review of analyst-generated data; corresponding with analysts about possible trends (whether analyst- or system-related) in generated data; evaluation/review of corrections of problems with generated data; updating/correcting SOPs and laboratory and analytical procedures; preparation, tracking and documentation of analytical standards used in the laboratory; training of new employees to the department

Senior Chemist Group Leader, GC/MS Volatiles (2005)

Responsibilities include performing analysis of waters, soils, and other matrices for VOCs via various analytical methods; evaluation of analytical data; setting up, calibrating, and trouble shooting various GC/MS equipment; evaluation/review of analyst-generated data; corresponding with analysts about possible trends (whether analyst- or system-related) in generated data; evaluation/review of corrections of problems with generated data; updating/correcting SOPs and laboratory and analytical procedures; preparation, tracking and documentation of analytical standards used in the laboratory; training of new employees to the department

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Memberships & Appointments:

Nature Conservancy (1998-present)
Eurofins Lancaster Laboratories
Ethics Committee (1999-2003)
Lancaster Herpetological Society
Treasurer (2005-present)
HabitatMT (2011-present)

Jessica L. Miller, B.S., Senior Chemist, Pesticide Residue Analysis

Education:

B.S. Chemistry, Cedar Crest College (2011)

Continuing Education:

Gas Chromatography Principles and Practice (2011)

Professional Experience:

With Eurofins Lancaster Laboratories since 2011

Chemist, Pesticide Residue Analysis (2011)

Responsibilities included performing pesticide residue analysis; prescreening samples; calibrating, reviewing, and uploading data

Senior Chemist, Pesticide Residue Analysis (2014)

Responsibilities include performing pesticide residue analysis; prescreening samples; calibrating, reviewing, and uploading data

Memberships and Appointments:

Psi Chi
Member (2009)
Gamma Sigma Epsilon
Member (2011)

Megan A. Moeller, B.S., Senior Specialist, Environmental Client Services

Education:

B.S. Environmental Science, University of Delaware (1999)

Professional Experience:

With Lancaster Laboratories since 1999

Sample Administration/Client Service Specialist, Environmental Client Services (2003)

Responsibilities included interpretation and entry of incoming samples. Route samples to the correct locations. Assist Client Service representatives with auditing, reviewing reports, and reviewing invoices.

Specialist, Environmental Client Services (2004-2006)

Responsibilities included managing projects, prepare quotations, audit sample entries, answer client questions, communicate client requirements to lab areas, schedule sample submissions, and provide sample containers.

Senior Specialist, Environmental Client Services (2006)

Responsibilities include managing projects, prepare quotations, audit sample entries, answer client questions, communicate client requirements to lab areas, schedule sample submissions, and provide sample containers.

Chad A. Moline, B.S., Senior Chemist, GC/MS Semivolatiles

Education:

B.S. Environmental Studies, Slippery Rock University (1998)
Teaching Certification, Secondary Education, Millersville University (2003)

Professional Experience:

Centre Analytical Laboratories, Lab Technician (1999-2000)

Responsibilities included running various wet chemistry analyses

Lancaster Laboratories, Chemist/Senior Chemist (2000-2005)

Responsibilities included maintaining GC/MS instrumentation

Warwick School District, Science Teacher (2005-2006)

Responsibilities included teaching chemistry and physics to 8th grade students

Conestoga Valley School District, Science Teacher (2006-2007)

Responsibilities included teaching chemistry and earth science to 8th grade students

With Eurofins Lancaster Laboratories since 2007

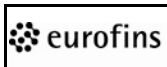
Senior Chemist Group Leader, GC/MS Semivolatiles (2007)

Responsibilities included monitoring workflow; meeting client turnaround times

Senior Chemist (2012)

Responsibilities include maintaining and operating GC/MS instrumentation

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Jeffrey S. Moyer, B.S., Senior Specialist Group Leader, Sample Bottles

Education:

B.S. Environmental Resource Management, Penn State University (1977)

Professional Experience:

Joseph A. Kodak, Carpenter's Helper (1977-1978)

Responsibilities included performing construction

BP Oil, Inc., Operations Supervisor (1978-1979)

Responsibilities included working on special projects in the regional operations office

Koch Hydrocarbon Company, Terminal Manager (1979-1997)

Responsibilities included managing the operation of a 24 hr/day, 365 day/year propane storage facility; coordinating inventory storage, product quality control, maintenance, safety, and personnel staffing and training; additional responsibilities included facility upgrades and expansion projects

With Lancaster Laboratories since 1997

Specialist, Environmental Sample Administration (1997)

Responsibilities included entering environmental samples for analysis; coordinating projects with client services; updating standard forms; filing client bottle orders; tracking change forms and forwarding updated info to SA department; tracking short hold/rush list; processing gold forms

Specialist, Environmental Client Services (1999)

Responsibilities included acting as technical resource for clients and SA entry; preparing quotes for clients; preparing bottle orders; scheduling sample pickups; auditing acknowledgements and client paperwork; troubleshooting client problems; updating standard forms; processing bottle orders, lab reports, acknowledgements, and COCs; handling reprint requests; preparing SDG reports

Senior Specialist Group Leader, Sample Bottles (2004)

Responsibilities include managing bottles department; coordinating projects with client services; updating bottle code and preservation sheets; updating SOPs; working with purchasing to ensure inventory levels are adequate; backing up transportation coordination

Jennifer L. Moyer, B.S., Senior Specialist, Metals

Education:

B.S. Chemistry, Lock Haven University (2000)

Professional Experience:

Lock Haven University, Lab Tech (1996-1998)

Responsibilities included setting up labs; stocking and setting up stock rooms; helping professors with projects

Croda Inc., Process Development Chemist (1998-2000)

Responsibilities included developing and improving procedures on existing products

With Lancaster Laboratories since 2000

Chemist, Metals (2000)

Responsibilities included running and maintaining ICP instruments

Chemist, Metals (2002)

Responsibilities included running and maintaining Graphite Furnace Atomic Absorption instruments

Group Leader/Specialist, Metals (2003)

Responsibilities included overseeing Graphite Furnace Atomic Absorption and Mercury analysts

Senior Specialist, Metals (2007)

Responsibilities include verifying ICP, GFAA, Mercury, and ICP-MS

Kathrine K. Muramatsu, B.S., Senior Chemist Group Leader, GC/MS Volatiles

Education:

B.S. Chemistry, University of Colorado (2005)

Continuing Education:

Forensic Science and DNA Testing Certification (2006)

24-Hour Emergency Response (HAZWOPER), Lancaster Laboratories (2009)

American Heart Association (AHA)/American Red Cross certified, Lancaster Laboratories (2009)

Professional Experience:

With Eurofins Lancaster Laboratories since 2007

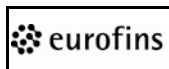
Chemist, Analytical Chemistry, Professional Scientific Staffing – CO (2007)

Responsibilities included ensuring compliance with cGMPs; performing analysis of system water, clean in place (CIP) samples, clean out of place (COP) samples, and other sample types; methods used were total organic carbon (TOC), pH, conductivity, Limulus Amebocyte Lysate (LAL), and UV spectroscopy

Chemist, GC/MS Volatiles (2007)

Responsibilities included analyzing environmental samples of various sample matrices using purge and trap GC/MS; generating and reviewing raw data; performing instrument maintenance as needed

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Chemist Group Leader, GC/MS Volatiles (2009)

Responsibilities included supervising and mentoring personnel; coordinating daily workload through prioritizing and scheduling; processing monthly metrics for the department; verifying sample data; analyzing environmental samples of various sample matrices using purge and trap GC/MS; generating and reviewing raw data; performing instrument maintenance as needed

Senior Chemist Group Leader, GC/MS Volatiles (2014)

Responsibilities include supervising and mentoring personnel; coordinating daily workload through prioritizing and scheduling; processing monthly metrics for the department; verifying sample data; analyzing environmental samples of various sample matrices using purge and trap GC/MS; generating and reviewing raw data; performing instrument maintenance as needed

Awards, Citations, Honorary Societies, and Publications

Dean's List (2002)

Colorado Scholars (2002-2005)

Superlative Service Award (2010)

Two publications in the Journal of Organic Chemistry

Memberships and Appointments:

American Chemical Society

Charles J. Neslund, B.S., Technical Director, Volatiles in Air and Specialty Services Group, Eurofins Lancaster Laboratories Environmental

Education:

B.S. Chemistry, University of Pittsburgh (1982)

Continuing Education:

Graduate studies in organic chemistry, University of Pittsburgh (1983)

Professional Experience:

Lancaster Laboratories (1984-1996)

Chemist (1986)

Group Leader (1987)

Chemist (1991)

OI Analytical, Sales Representative (1996)

With Eurofins Lancaster Laboratories since 1997

Group Leader, GC/MS Semivolatiles (1997)

Responsibilities included supervising personnel; scheduling lab work; managing laboratory operations and financial resources; project management; data interpretation; reviewing and approving data; developing and evaluating new methods; consulting with clients regarding testing needs; revising and updating SOPs and analytical methods

Manager, GC/MS Semivolatiles and Volatiles in Air (2005)

Responsibilities included supervising personnel; scheduling lab work; managing laboratory operations and financial resources; project management; data interpretation; reviewing and approving data; developing and evaluating new methods; consulting with clients regarding testing needs; revising and updating SOPs and analytical methods

Manager, Volatiles in Air and Specialty Services Group (2007)

Responsibilities included supervising personnel; scheduling lab work; managing laboratory operations and financial resources; project management; data interpretation; reviewing and approving data; developing and evaluating new methods; consulting with clients regarding testing needs; revising and updating SOPs and analytical methods; marketing specialty services capabilities; conducting technical presentations

Technical Director, Volatiles in Air and Specialty Services Group, Eurofins Lancaster Laboratories Environmental (2014)

Responsibilities include leading departments in accordance with vision, values, and strategic goals of company; overseeing and facilitating efficient operations and systems, sound business practices, consistent client service, and motivated staff

Awards, Citations, Honorary Societies & Publications:

Dawson-Grundmann Innovation Award (1995)

Memberships & Appointments:

American Chemical Society (ACS)

Chromatography Forum of the Delaware Valley (CFDV)

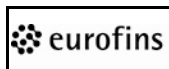
Past member of Executive Committee of the Chromatography Forum of the Delaware Valley

Air & Waste Management Association (A&WMA)

Society of Environmental Toxicology and Chemistry (SETAC)

Sediment Management Workgroup (SMWG)

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Deborah A. Neslund, Senior Specialist, Environmental Sample Administration

Professional Experience:

Lancaster General Hospital, Phlebotomist (1976-1977)
Fairfax Hospital, LPN (1978)
Lancaster General Hospital, Phlebotomist/EKG Technician (1980-1986)
With Eurofins Lancaster Laboratories since 1986

- Senior Specialist Coordinator, Environmental Sample Administration (1986)
Responsibilities included supervising personnel; directed flow of samples to include prioritization to meet hold times and standards set for rush and other samples; developed and improved systems for efficiency within SA; represented SA in communications with Technical Groups, Client Services, and other support areas; logged-in samples
- Senior Specialist Group Leader, Environmental Sample Administration (2005)
Responsibilities included supervising personnel; directed flow of samples to include prioritization to meet hold times and standards set for rush and other samples; developed and improved systems for efficiency within SA; represented SA in communications with Technical Groups, Client Services, and other support areas; logged-in samples
- Senior Specialist (2013)
Responsibilities include directing flow of samples to include prioritization to meet hold times and standards set for rush and other samples; developing and improving systems for efficiency within SA; representing SA in communications with Technical Groups, Client Services, and other support areas; logging-in samples

Ryan V. Nolt, B.S., Manager, GC/MS Volatiles

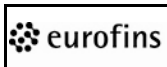
Education:

B.S. Chemistry, Millersville University (1997)

Professional Experience:

With Eurofins Lancaster Laboratories since 1996

- Clerk II, Sample Support (1996)
Responsibilities included performing ASRS operations, preserving incoming samples, homogenizing samples, packing bottle orders, and performing sample discard
- Senior Technician, ExpressLAB (1997)
Responsibilities included performing sample dilutions, preparing standards, prepping samples, and setting up new instruments
- Chemist, GC/MS Volatiles (1998)
Responsibilities included performing purge and trap and GC/MS maintenance; tuning and calibrating GC/MS system; analyzing samples; reviewing, working up, and assembling all supporting data; and preparing new standards
- Senior Chemist Coordinator, GC/MS Volatiles (2000)
Responsibilities included performing routine and non-routine laboratory analysis; diagnosing and solving technical problems; implementing improvements to maximize quality; maintaining and troubleshooting instruments; writing and revising SOPs; validating new methods and equipment; assigning new work to instrument groups and monitoring productivity; training new analysts
- Principal Chemist Group Leader, GC/MS Volatiles (2005)
Responsibilities included performing routine and non-routine laboratory analysis; diagnosing and solving technical problems; implementing improvements to maximize quality; maintaining and troubleshooting instruments; writing and revising SOPs; validating new methods and equipment; assigning new work to instrument groups and monitoring productivity; training new analysts
- Manager, GC/MS Volatiles (2014)
Responsibilities include performing a variety of technical and administrative tasks to develop, evaluate, and supervise staff; planning and monitoring work flow; designing, implementing, and utilizing departmental operations systems; promoting safety; remaining current on technical developments in the area of GC/MS volatiles; communicating with clients; maintaining a strong commitment to quality

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Anneliese H. Owen, M.B.A., Manager, Environmental Sample Administration

Education:

B.S. Molecular and Cell Biology, Pennsylvania State University (1986)
M.B.A. Pennsylvania State University (1993)

Professional Experience:

With Lancaster Laboratories since 1986

Coordinator (1987)

Client Services Specialist (1988)

Business Development Specialist (1990)

Group Leader, Environmental Sample Administration (1992)

Responsibilities included: supervise personnel; manage laboratory operations and financial resources; sample interpretation and entry; and monitor corrective action for quality issues.

Manager, Environmental Sample Administration (2005)

Responsibilities include: supervise personnel; manage laboratory operations and financial resources; sample interpretation and entry; and monitor corrective action for quality issues.

Linda C. Pape, B.A., Senior Chemist, GC/MS Volatiles

Education:

B.A. Business Administration, Milsaps College (1985)

Professional Experience:

Rite Aid Pharmacy, Store Manager (1985-1989)

Responsibilities included being responsible for overall maintenance and security of merchandise, store, and property; ordering and display of all merchandise; auditing daily cash and inventory reports; scheduling employees; payroll accounting; training of new and prospective personnel

With Lancaster Laboratories since 1993

Chemist, Volatiles by GC (1993)

Responsibilities included analyzing client-submitted samples and their associated quality control samples by purge-and-trap gas chromatography; reviewing and uploading the corresponding data in an efficient manner with a high degree of accuracy and quality; evaluating current organizational and analytical systems; suggesting and implementing necessary corrective action to ensure the above can be performed in alignment with client and/or regulatory requirements; initiating and leading technical projects to a timely, accurate, and efficient conclusion while meeting client and/or regulatory requirements with a high degree of quality

Chemist, Water Quality (2000)

In addition to responsibilities listed above performed CN distillation, PO₄ digestion, and phenol distillation during a 3-month time frame

Senior Chemist, Volatiles by GC (2007)

Responsibilities included analyzing client-submitted samples and their associated quality control samples by purge-and-trap gas chromatography; reviewing and uploading the corresponding data in an efficient manner with a high degree of accuracy and quality; performing final review (verification) of data for clients (adding appropriate comments as necessary); evaluating current organizational and analytical systems; suggesting and implementing necessary corrective action to ensure the above can be performed in alignment with client and/or regulatory requirements; initiating and leading technical projects to a timely, accurate, and efficient conclusion while meeting client and/or regulatory requirements with a high degree of quality; training new employees in Volatiles by GC soils

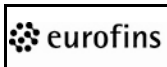
Senior Chemist, Volatiles by GC/MS (2008)

Responsibilities included analyzing client-submitted samples and their associated quality control samples by purge-and-trap gas chromatography/mass spectrometry; reviewing and uploading the corresponding data in an efficient manner with a high degree of accuracy and quality; performing final review (verification) of data for clients (adding appropriate comments as necessary); evaluating current organizational and analytical systems; suggesting and implementing necessary corrective action to ensure the above can be performed in alignment with client and/or regulatory requirements; initiating and leading technical projects to a timely, accurate, and efficient conclusion while meeting client and/or regulatory requirements with a high degree of quality; training new employees

Senior Chemist, GC/MS Volatiles (2009)

Responsibilities include analyzing client-submitted samples and their associated quality control samples; reviewing and uploading the corresponding data in an efficient manner with a high degree of accuracy and quality; performing final review (verification) of data for clients (adding appropriate comments as necessary); evaluating current organizational and analytical systems; suggesting and implementing necessary corrective action to ensure the above can be performed in alignment with client and/or regulatory requirements; initiating and leading technical projects to a timely, accurate, and efficient conclusion while meeting client and/or regulatory requirements with a high degree of quality; training new employees

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Cassandra L. Pelto, B.S., Project Manager, Fort Collins Service Center

Education:

B.S. Biology, University of Central Florida (2008)

Professional Experience:

Environmental Research and Design, Laboratory Technician (2005-2008)

Responsibilities included performing following tests: Color, pH, Alkalinity, Spec. Conductivity, Turbidity, Metals Digestion, TN/TP Digestion, Chloride, Fluoride and Hardness

Environmental Research and Design, Microbiologist/Assistant Laboratory Manager (2008-2010)

Responsibilities included performing tests and QC on Fecal Coliform, E. Coli, and Total Coliform by MF and MTF (MPN); assisted Lab Manager with data entry, QC checks and inspections

Environmental Research and Design, Laboratory Manager (2010-2014)

Responsibilities included personnel Training, Liaison for Inspections, QC Review, Data Entry, Sample receiving, Client Project Management, Inorganic Analysis: Metals, Nutrients, Oil and Grease, Hardness, etc.

With Eurofins Lancaster Laboratories since 2014

Project Manager, Fort Collins Service Center (2014)

Responsibilities include serving as the primary contact for a number of assigned clients; understanding technical information and communicating client requirements to laboratory personnel, helping to ensure that requirements are met; managing large/complex projects according to client technical and schedule requirements; developing strong relationships with major accounts resulting in additional sales; training subordinates; delegating routine tasks; resolving issues when problems arise; participating in departmental process improvement

Memberships and Appointments:

Florida Society of Environmental Analysts

Member (2010-2014)

James H. Place, B.S., Senior Chemist, Pesticide Residue Analysis

Education:

B.S. Physical Science, York College of Pennsylvania (1997)

Professional Experience:

AMZ Corporation, Laboratory Technician (1998-2000)

Responsibilities included performing analysis and maintenance of chemical compositions pertaining to electroplating baths

Nichia America Co., Laboratory Technician (2000-2001)

Responsibilities included performing analysis of phosphorus for composition of pigments; performing sample screening and AA analysis

AMZ Corporation, Laboratory Technician (2001-2003)

Responsibilities included performing analysis and maintenance of chemical compositions pertaining to electroplating baths; conducting inventory and ordering chemicals

With Lancaster Laboratories since 2003

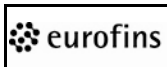
Chemist, Pesticide Residue Analysis (2003)

Responsibilities include performing routine and non-routine instrumental analyses of QC and clients' samples for pesticides, PCBs, herbicides, and other related compounds in accordance with departmental methods and SOPs; achieving quality results within the time-frame expected by our clients with minimal daily supervision; maintaining the GCs or HPLCs used for routine analyses; identifying and correcting common instrument or QC problems

Senior Chemist, Pesticide Residue Analysis (2008)

Responsibilities include performing routine and non-routine instrumental analyses of QC and clients' samples for pesticides, PCBs, herbicides, and other related compounds in accordance with departmental methods and SOPs; assisting in implementing special client requests; identifying and offering solutions to correct instrument problems and causes of QC problems; reviewing data for accuracy and completeness (for both routine and non-routine analyses, reports, or data packages); serving as a technical resource for the department

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Christine M. Ratcliff, B.S., Principal Specialist, Volatiles in Air

Education:

B.S. Chemistry, Shippensburg University (1988)

Continuing Education:

Mass Spectral Interpretation, Finnigan MAT Institute (1990)

Professional Experience:

With Lancaster Laboratories since 1988

Chemist (1991)

Coordinator (1994)

Group Leader (1996)

Senior Chemist/Coordinator (1997)

Senior Chemist (2002)

Responsibilities included reviewing and approving data; revising and updating SOPs and analytical methods; reviewing lab data

Senior Specialist, GC/MS Semivolatiles (2005)

Responsibilities included reviewing and approving data; revising and updating SOPs and analytical methods; reviewing lab data

Principal Specialist, GC/MS Semivolatiles (2009)

Responsibilities included reviewing and approving data; revising and updating SOPs and analytical methods; reviewing lab data; performing technical audit of GC/MS semivolatiles data in a timely manner

Principal Specialist, Volatiles in Air (2009)

Responsibilities include reviewing and approving data; revising and updating SOPs and analytical methods; reviewing lab data; performing technical audit of Volatiles in Air, GC/MS semivolatiles, and GC/MS volatiles data in a timely manner

Principal Specialist, Volatiles in Air (2009)

Responsibilities include reviewing and approving data; revising and updating SOPs and analytical methods; reviewing lab data; performing technical audit of Volatiles in Air, GC/MS semivolatiles, GC/MS volatiles, and dioxans and furans data in a timely manner

Mark A. Ratcliff, B.A., Senior Specialist, GC/MS Semivolatiles

Education:

B.A. Physics, Franklin & Marshall College (1988)

Continuing Education:

Finnegan Mass Spectral Interpretation Course (1991)

Professional Experience:

With Lancaster Laboratories since 1989

Chemist (1992)

Senior Chemist (1996)

Responsibilities included: perform GC/MS semivolatiles testing; operate GC/MS instruments; data interpretation; calibrating and repairing instruments; prepare standards; revise and update SOPs; and train other analysts.

Senior Specialist, GC/MS Semivolatiles (2005)

Responsibilities include: perform GC/MS semivolatiles testing; operate GC/MS instruments; data interpretation; calibrating and repairing instruments; prepare standards; revise and update SOPs; and train other analysts.

Barbara F. Reedy, B.S., Senior Specialist, Environmental Quality Assurance

Education:

B.S. Environmental Biology, Millersville University (1993)

Continuing Education:

Environmental GC Analysis Seminar, Restek (2001)

The Internet Audit A Quality Tool, PaAAEL (2001)

Advanced Gas Chromatography Mass Spectroscopy Seminar, PaAAEL (2002)

LC/MS/MS System Seminar, Applied Biosystems (2006)

Introduction to Root Cause Analysis, Patton Professional (2007)

When to Initiate Corrective Action, Patton Professional (2007)

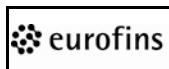
Practical Process Improvement Training in the role of Team Member (2008)

GC Pesticide/PCB's Analysis Training Seminar (2008)

NY/PAAEL Annual Meeting - Internal & Electronic Audits: Satisfying Regulatory Requirements, Corrective and Preventive Actions, Ethics and Data Integrity Training (2009)

Environmental Laboratory Assessment Basic Assessor Training – TNI Standard 2009 (2012)

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Professional Experience:

Department of Environmental Resources, Division of Rivers and Wetlands, Scientific Intern (1993)
Responsibilities included reviewing wetland permits applications; inspecting and photographing wetland mitigation sites; determining hydrology, soil type, and the consistency of the mitigation with the approved project plans; researching records of the sites

With Eurofins Lancaster Laboratories since 1993
Associate Chemist/Chemist, Volatiles by GC (1993)
Responsibilities included calibrating Capillary, VOA, BTEX, and FID instruments; performing routine maintenance; interpreting, reviewing, and uploading data

Senior Chemist, Volatiles by GC (1999)
Responsibilities included being primary verifier for the majority of data for Volatiles by GC for the ELCD/PID and FID for both waters and soils; signing of analytical reports; generating statistically determined QC windows; training new analysts to review and upload data into the LIMS

Senior Specialist, Environmental Quality Assurance (2001)
Responsibilities include ensuring quality of data being produced in the laboratories by performing data review, auditing laboratories, and reviewing written procedures; ensuring laboratory adherence to government regulations and client requirements; reviewing client and government documents for requirements outside our usual laboratory practices; setup and testing new analysis in the laboratory sample management system as required by the departments; maintaining documentation of agency certifications

Memberships & Appointments:

Pennsylvania Association of Accredited Laboratories (2013-present)

Beth A. Rich, Senior Specialist, Safety

Professional Experience:

With Eurofins Lancaster Laboratories since 1998
Senior Administrator, Human Resources (1998)
Responsibilities included entering and maintaining employee information in system; photocopying, filing, maintaining personnel files; tracking mid-year and annual job plan completion; following up on exit interviews and other HR admin and support

Specialist, Human Resources (2005)
Responsibilities included maintaining a high level of human resource generalist knowledge to support all personnel in the HR department and to serve all employees

Senior Specialist, Human Resources (2010)
Responsibilities included maintaining a high level of human resource generalist knowledge to support all personnel in the HR department and to serve all employees

Senior Specialist, Safety (2013)
Responsibilities include managing worker's compensation and return to work programs; coordinating annual health screenings, flu shots, and blood bank donations; setting up new site worker's compensation systems as needed; filing incident reports and tracking recordable incidents; coordinating special medical programs as needed

John R. Riggs, Jr., B.S., Senior Specialist Group Leader, Environmental Software Development

Education:

B.S. Professional Studies (Computer Science/Mathematic), Misericordia University (1994)

Continuing Education:

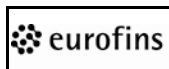
Masters Business Administration, Elizabethtown College (Expected graduation date: 2015)

Professional Experience:

Nissin Foods, Inc., Distribution Supervisor/IT Engineer (1994-1998)
Responsibilities included acting as a liaison between local and corporate management teams; supervised the activities of multiple teams of material handlers engaged in receiving, storing, and shipping finished goods; ensured the accuracy of orders and inventory to meet customer demand; maintained documentation and prepared reports which reflected the effectiveness and efficiency of department activities; Implemented warehouse safety procedures and hold regular safety meetings; established and recommended changes to policies to improve the organization; supported and maintained Novell servers and backups; administered user accounts and email; configured new desktop machines and maintained existing work stations

AVAR, Project Manager/Lead Developer (1998-2014)
Responsibilities included directing the planning, design, production and management of applications and data centers; lead a development team in creating software applications to provide business solutions; acted as a point of contact for vendors, business units, and Information Technology partners during integration of projects, administering schedules and communicating risks; conducted meetings, helping to facilitate communication and maximize productivity; coordinated the work of multiple teams to support applications for data management systems; oversaw creation and maintenance of all unit and system testing plans; supervised the generation of documentation and technical guides for end users; prepared and deliver end-user training

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With Eurofins Lancaster Laboratories since 2014

Senior Specialist Group Leader, Environmental Software Development (2014)

Responsibilities include providing technical support for maintenance of installed software applications and assisting with the development, installation, and maintenance of new applications for general use; assisting in development, implementation, and maintenance of software intended to improve the quality and efficiency of work performed

Heidi L. Roberts, B.S., Senior Chemist, Organic Extraction

Education:

B.S. Environmental Science/Biology, Kutztown University (1996)

Continuing Education:

P.E. Spectroscopy Seminar, Perkin Elmer (1998)

Statistics, LLU (1999)

Pharm. Calc. Class, LLU (1999)

LLI Leadership Training (2000)

Practical Process Improvement Team Member Training (2008)

Practical Process Improvement Facilitator Training (2010)

Professional Experience:

M.J. Reider Associates, Lab Technician (1996-1997)

Responsibilities included organics prep/method development for HEM/various wet chemistry analyses.

With Lancaster Laboratories since 1997

Chemist, Metals (1998)

Responsibilities included performing metals analyses, maintenance of instruments, verification of analyses, analyzed GMP samples, administered quad studies, MDL studies, IDL studies.

Coordinator, Metals (1999)

Responsibilities included coordination of GFAA/FAA/Hg group, verification of analyses, instrument maintenance and operation, updating of SOPs, training records, quad studies, MDLs, and IDLs, performed GMP analyses.

Coordinator/Specialist, Environmental Client Services (2001)

Responsibilities included supervising Commercial Account Team and administrators, handle miscellaneous and homeowner calls, prepare bottle orders, audit sample paperwork, monitor sample progress, and handle client concerns.

Group Leader/Senior Specialist, Environmental Client Services (2005)

Responsibilities included supervising Account Management Team and administrator, work with team members on continual process improvement, manage several large client accounts, prepare bottle orders, audit sample paperwork, monitor sample progress, and handle client concerns.

Senior Chemist, Organic Extraction (2007)

Responsibilities include performing non-routine extractions, scheduling prep work, verification of prepped batches, processing MOS reports, managing projects for tobacco analyses, point person for project rollouts.

Awards, Citations, Honorary Societies, and Publications:

Senior Leadership Group Award, Lancaster Laboratories (2001, 2005, 2007)

Superlative Service Award, Lancaster Laboratories (2004, 2010)

Memberships and Appointments:

Ethics Committee, Lancaster Laboratories (1998)

MOS Process Improvement Team, Lancaster Laboratories (2005)

Nicholas R. Rossi, M.S., Senior Chemist, EPH/Misc. GC

Education:

B.S. Biology, Messiah College (2005)

M.S. Environmental Pollution Control, Penn State Harrisburg (2011)

Professional Experience:

Vermont Agency of Agriculture, Laboratory Technician/Sample Collector (2004-2005)

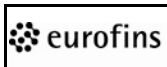
Responsibilities included collecting water samples from agricultural sites and extracting samples in the lab

With Eurofins Lancaster Laboratories since 2005

Chemist, GC/MS Volatiles (2005)

Responsibilities included organizing batches of samples, sample preparation, analyzing soil and water samples for volatile organic compounds using purge and trap GC-MS, instrument maintenance, and performing a level II audit on data prior to verification; processing plan improvement (PPI) team to reduce the amount of errors in the prescreen department; evaluating the process, implementing changes, and tracking results

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Chemist, EPH/Misc. GC (2011)

Responsibilities included analyzing routine and non-routine samples and their associated quality control samples by gas chromatography; reviewing and reporting the corresponding data; maintaining, optimizing, and calibrating equipment (functions are to be performed in an efficient manner with a high degree of accuracy and quality); assisting in organization of related departmental work and in sample preparation (as required) to consistently meet client turnaround time requirements

Senior Chemist, EPH/Misc. GC (2013)

Responsibilities include performing routine and non-routine instrumental analyses of QC and clients' samples for total petroleum hydrocarbons, diesel range organics, and other miscellaneous organic compounds in accordance with departmental methods and SOPs; assisting in implementing special client requests; identifying and offering solutions to correct instrument problems and causes for QC problems; reviewing data for accuracy and completeness for routine and non-routine analyses, reports, or data packages; serving as a technical resource for the department

Memberships and Appointments:

American Chemical Society (2010)

Pennsylvania Department of Environmental Professionals (2011)

Robin C. Runkle, B.S., Senior Specialist, GC/MS Volatiles

Education:

B.S. Chemistry, State University of New York at Oneonta (1988)

Continuing Education:

Introduction to Mass Spectral Interpretation, Finnigan Mat (1991)

Gas Chromatography: Practical Theory and Applications for LL (1993)

HP5890 GC Troubleshooting and Maintenance, Hewlett-Packard (1993)

Technical Training, OI Analytical (1995)

Professional Experience:

With Lancaster Laboratories since 1989

Senior Chemist (1993)

Responsibilities included: sample preparation; perform GC/MS volatile testing; operate GC/MS instruments; data interpretation; review and approve data; developing and evaluating new methods; calibrating and repairing instruments; prepare standards; reagent preparation; revise and update SOPs and analytical methods; order supplies; train other analysts; and prepare and test trip blank water.

Senior Specialist, GC/MS Volatiles (2005)

Responsibilities include: data review and verification, review and sign reports, respond to and work on client inquiries and ATF requests.

Stephanie A. Selis, B.S.E., Senior Chemist, GC/MS Volatiles

Education:

B.S.E. Biology, Chemistry Minor, Millersville University (1996)

Professional Experience:

Access I, Access II, PC Focus (1997)

Emergency Evacuation Coordinator (1998)

Gas Chromatography Principles and Practices, Lancaster Laboratories University (1998)

GC/MS Theories and Applications, MDL Systems (1999)

Statistics, Lancaster Laboratories University (2000)

Enlightened Leadership: Getting to the Heart of Change, Lancaster Laboratories University (2000)

Building Relationship Versatility: Social Styles at Work, Lancaster Laboratories University (2000)

Leadership at Lancaster Laboratories, Lancaster Laboratories University (2000)

Introduction to Interpretation of Mass Spectra, Lancaster Laboratories University (2005)

Professional Experience:

With Lancaster Laboratories since 1996

Chemist (1996)

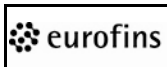
Senior Chemist, Volatiles by GC (2000)

Responsibilities included performing sample analysis, troubleshooting, and maintenance; calibrating the system; establishing QC windows for soil analysis; writing SOPs; performing data entry; preparing standards; performing sample verification; training analysts

Senior Chemist, GC/MS Volatiles (2005)

Responsibilities include performing sample analysis; auditing maintenance notebooks; performing troubleshooting, maintenance, and system calibration; preparing standards; performing sample verification; training analysts

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Richard A. Shober, B.S., Principal Chemist, Pesticide Residue Analysis

Education:

B.S. Chemistry, Muhlenberg College (1984)

Continuing Education:

Inductively Coupled Plasma Spectroscopy, Allied Analytical (1985)
ACS Short Course, Analytical Chemistry of Contaminants in Surface and Groundwater (1986)
Gas Chromatography: Practical Theory & Application, Lancaster Laboratories (1994)
Mass Spectral Interpretation, Hewlett-Packard (1995)
Comprehensive HPLC, RESTEK (2010)

Professional Experience:

With Lancaster Laboratories since 1984

Principal Chemist, Pesticide Residue Analysis (1999)

Responsibilities include performing pesticide residue testing; operating gas chromatography instruments; interpreting data; repairing instruments; developing new methods for and operating LC/MS/MS; developing and maintaining computer systems/programs for lab use

Awards, Citations, Honorary Societies & Publications:

Poster paper on computer applications for analytical chemistry
Poster paper on tobacco specific nitrosamine analysis

Biographical Listings:

Who's Who in Environmental Science

Susan B. Shorter, B.S. CTFL, Principal Specialist, Environmental Software Development

Education:

B.S. Chemistry and Mathematics, Cedar Crest College (1986)
ISTQB Software Testing – Foundations Certification, Certificate #05-CTFL-00172-USA (2005)

Continuing Education:

Introduction to DOS, HACC-Lancaster Campus (09/18/1992)
How to Handle People with Tact and Skill, HACC (06/14/1993)
Challenges Facing Drinking Water Laboratories: ICR, Methods, Quality, and Certification, EPA and Western Michigan University (08/30-31/1994)
How to Evaluate Data from a QA/QC Perspective, EPA (07/07/1997)
Systematic Software Testing, Software Quality Engineering (June 2004)
Software Testing Foundations, Software Quality Engineering (May 2005)

Professional Experience:

With Eurofins Lancaster Laboratories since 1988

Associate Chemist (1988)

Responsibilities included setting up ICP, maintaining ICP, reviewing data from the instrument, reviewing daily oos sheets

Chemist I, Coordinator added 10/1991 (1990)

Responsibilities included setting up ICP, maintaining ICP, reviewing data from the instrument, reviewing daily oos sheets, plus verifying sample analyses, training new employees, maintaining instrumental SOPs

Specialist, Quality Assurance (1991)

Responsibilities included QA coordination for various environmental analytical departments, reviewing data packages, submitting blind and PT samples to ESD, maintaining state certifications, GLP, working with state, agency, and client auditors, technical resource for SDWA

Senior Specialist (previously known as Specialist II), Quality Assurance (1993)

Responsibilities included QA coordination for various environmental analytical departments, reviewing data packages, submitting blind and PT samples to ESD, maintaining state certifications, GLP, working with state, agency, and client auditors, technical resource for SDWA, document review, QAPP generation

Senior Chemist, GC/MS Volatiles (1999)

Responsibilities included auditing GC/MS volatile data, performing QA tasks (filing SOPs, maintaining training records, etc.), auditing MDLs and Quad studies

Senior Specialist, Computer Applications Development (2002)

Responsibilities included writing and executing Test Plans for software quality support; completing documentation as required by policies and procedures for software validation

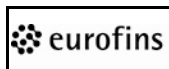
Senior Specialist, Computer Systems (2007)

Responsibilities included writing and executing Test Plans for software quality support; completing documentation as required by policies and procedures for software validation

Principal Specialist, Environmental Software Development (2013)

Responsibilities include writing and executing Test Plans for software quality support; completing documentation as required by policies and procedures for software validation

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Memberships & Appointments:

Society of Applied Spectroscopy (1990-1993)
Pennsylvania Association Accredited Environmental Laboratories (PA AAEL) (1992-2004)
Director (1998-2003)
Secretary/Treasurer (1998-2003)

Jeffrey B. Smith, B.A., Senior Chemist Group Leader, Volatiles in Air

Education:

B.A. Biology, University of Delaware (1991)

Professional Experience:

Roy F. Weston, Inc., Chemist (1991-1997)
Merck, Chemist (1997-2000)
With Lancaster Laboratories since 2001
Senior Chemist, GC/MS Semivolatiles (2001)
Responsibilities included performing GC/MS analysis of semivolatile organics
Senior Chemist Group Leader, Volatiles in Air (2005)
Responsibilities include tracking of all incoming work and scheduling analysts; tracking all incoming summa orders and assigning to analyst; main CSR contact for group; instrument troubleshooting and maintenance; auditing and certifying data as needed

Michele J. Smith, B.S., Senior Specialist, Specialty Services Group

Education:

B.S. Chemistry, St. Mary's College, Notre Dame, Indiana (1998)
22 credits master's study with Penn State University (2000-2002)

Continuing Education:

Gas Chromatography Principles and Practices, Lancaster Laboratories University (1999)
Statistics, Lancaster Laboratories University (2000)

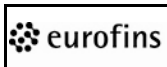
Professional Experience:

St. Mary's College, Laboratory Teaching Assistant (1996-1998)
Responsibilities included: assisted professor in the laboratory—responsible for experiment demonstrations, answered student's questions, and graded lab reports.
With Lancaster Laboratories since 1998
Chemist (1998)
Responsibilities included: maintain GC/MS instrumentation, tune and calibrate GC/MS, analyze samples by GC/MS, review and assemble all supporting GC/MS data, review daily QC outliers.
Senior Chemist (2001)
Responsibilities included: maintain GC/MS instrumentation, tune and calibrate GC/MS, analyze samples by GC/MS, review and assemble all supporting GC/MS data, perform technical audit of GC/MS and HPLC, sign analysis reports, track samples to meet turn around time.
Senior Chemist Coordinator (2004)
Responsibilities included: maintain GC/MS instrumentation, tune and calibrate GC/MS, analyze samples by GC/MS, review and assemble all supporting GC/MS data, perform technical audit of GC/MS and HPLC, sign analysis reports, track samples to meet turn around time.
Senior Specialist Group Leader, GC/MS Semivolatiles (2005)
Responsibilities included: review and assemble GC/MS data, perform technical audit of GC/MS and HPLC, sign analysis reports, schedule and track samples to meet turn around time.
Senior Specialist, Environmental Client Services (2008)
Responsibilities included auditing sample paperwork; setting up standard forms; generating bottle orders; preparing quotes
Senior Specialist, Specialty Services Group (2011)
Responsibilities include maintaining instrumentation; tuning and calibrating instrument daily; analyzing quality control and client samples; reviewing and assembling data in an efficient manner with a high degree of quality; evaluating current organizational and analytical systems; diagnosing complex problems and offering solutions with a high degree of independence; suggesting and implementing improvements to maximize quality and productivity; acting as technical resource for internal problems and projects; assisting in "brainstorming" client problems and projects; training new employees in all aspects of instrumentation; researching new and emerging technologies

Memberships and Appointments:

American Chemical Society (1998-2002)

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Tara M. Spaide, Senior Specialist, Environmental Client Services

Continuing Education:

Algebra and Analytical Geometry, Pennsylvania State University (1993)
Chemistry, Pennsylvania State University (1993)

Professional Experience:

With Lancaster Laboratories since 1986

Senior Specialist Coordinator, Organic Extraction (1997)

Responsibilities included supervising personnel; scheduling lab work; managing laboratory operations; reviewing and approving data; and revising and updating analytical methods

Senior Chemist Coordinator, Organic Extraction (2003)

Responsibilities included supervising personnel; scheduling lab work; managing laboratory operations; reviewing and approving data; and revising and updating analytical methods

Senior Chemist Group Leader, Organic Extraction (2005)

Responsibilities included supervising personnel; scheduling lab work; managing laboratory operations; reviewing and approving data; and revising and updating analytical methods

Senior Specialist, Environmental Client Services (2007)

Responsibilities include auditing sample paperwork; setting up standard forms; generating bottle orders; preparing quotes

Chelsea B. Stong, B.S., Senior Chemist, GC/MS Volatiles

Education:

B.S. Biology, Eastern University (2007)

Professional Experience:

With Lancaster Laboratories since 2006

Laboratory Technician, GC/MS Volatiles (2006)

Responsibilities included scanning samples into LIMS; prepping samples for analysis

Chemist, GC/MS Volatiles (2007)

Responsibilities included analyzing water and soil samples using a GC/MS; prepping samples for analysis; working up raw data

Senior Chemist, GC/MS Volatiles (2012)

Responsibilities include maintaining GC/MS instrumentation; tuning and calibrating instrument daily; analyzing quality control and client samples; reviewing and assembling data in an efficient manner with a high degree of quality; evaluating current organizational and analytical systems; suggesting and implementing the necessary corrective action to ensure the above can be performed in alignment with client an/or regulatory requirements; performing all duties with minimal supervision; working on special assignments; diagnosing complex problems and offering solutions with a high degree of independence; assisting in "brainstorming" client problems and projects; completing assigned projects on time; researching new and emerging technologies; producing written and oral reports on research activities

Andrew J. Strebel, Principal Chemist, GC/MS Semivolatiles

Continuing Education:

Advanced Aquarius Programmers Course, Hewlett-Packard (1989)

Environmental Applications of GC/MS, Indiana University (1989)

Environmental GC-MS (DOS) Operation, Hewlett-Packard (1995)

Unix Module 1, Albright College (1995)

Unix Module 2, Albright College (1995)

Unix Shell Scripts, Albright College (1995)

Unix AWK Programming, Albright College (1995)

Target Training, Thru-Put Systems, Inc. (1995)

Report Writer Training, Thru-Put Systems, Inc. (1998)

HP-UX System Administration for HP 9000s, Hewlett Packard (1998)

HP-UX Troubleshooting for HP 9000s, Hewlett Packard (1998)

GC/MS Training Course, MDL Systems (1999)

LC/MS/MS 101 Training Course, Basic Mass Spec Solutions, Inc. (2001)

Professional Experience:

With Lancaster Laboratories since 1986

Technical Specialist (1991)

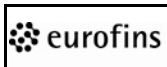
Chemist (1994)

Senior Chemist (1997)

Principal Chemist, GC/MS Semivolatiles (2001)

Responsibilities include: perform routine semivolatile testing; operate GC/MS semivolatile instruments; data interpretation; review and approve data; developing and evaluating new methods; calibrating and repairing instruments; prepare standards; revise and update SOPs and analytical methods; train other analysts; develop and maintain computer systems/programs for lab use; and computer validation testing.

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Robert Strocko, Jr., B.S., Manager, Metals and Microbiology

Education:

B.S. Biology, York College of Pennsylvania (1988)

Continuing Education:

Thermo Jarrel I ASA ICP Course, Thermo Jarrell ASA (1993)

Professional Experience:

Springettsbury Waste Water Treatment Facility, Chemistry Technician (1986-1988)

Responsibilities included running NPDES tests on wastewater, % solids, NH₄, pH, BOD, suspended solids, coliform, dissolved solids, temperature, and Hexa-Chrome testing

Penn Dairies, Laboratory Technician (1988-1989)

Responsibilities included testing raw milk for coliform bacteria for acceptance; performing milk-fat percent solids on milk products; calculating sugar content in sweetened milk

Pennsylvania Department of Environmental Resources, Chemistry Technician (1989-1992)

Responsibilities included receiving samples; logging data for analysis to computer; handling field sampling questions; operating flame AA; shipping cooler to field samples

With Eurofins Lancaster Laboratories since 1992

Chemist, Metals (1992)

Responsibilities included setting up, pouring, and running samples on ICP; reviewing and verifying ICP data; performing instrument maintenance; calculating IDLs, MDLs, and linear ranges; writing SOPs

Chemist/Coordinator, Metals (1996)

Responsibilities included overseeing prep room personnel and work flow; scheduling work flow through prep room; writing job plans and job reviews; ordering standards and reagents; overchecking notebooks

Manager, Metals (1998)

Responsibilities include overseeing technical areas in ICP, low-level mercury, ICP-MS, and mercury; writing SOPs, ICARs, etc.; writing job plans and job reviews; handling technical questions for clients/client services; verifying ICP/ICP-MS/Hg data

Manager, Metals Analysis and Microbiology (2013)

Responsibilities included overseeing technical areas in ICP, low-level mercury, ICP-MS, and mercury; writing SOPs, ICARs, etc.; writing job plans and job reviews; handling technical questions for clients/client services; verifying ICP/ICP-MS/Hg data

Manager, Metals Analysis and Microbiology (2014)

Responsibilities include included overseeing technical areas in ICP, low-level mercury, ICP-MS, and mercury; writing SOPs, ICARs, etc.; writing job plans and job reviews; handling technical questions for clients/client services; verifying ICP/ICP-MS/Hg data; overseeing technical area in Microbiology; tests include Colilert (presence/absence), Colilert (Q-tray), Heterotrophic Plate Count (HPC), Fecal Coliform by Membrane Filtration, Yeast and Mold, Hydrocarbon degraders; overseeing writing of SOPs, responding to ICARs; writing job plans and job reviews; handling technical questions for clients/client services; verifying data

Christiane S. Sweigart, B.S., Senior Specialist, Environmental Quality Assurance

Education:

B.S. Science, Elizabethtown College (1985)

Medical/Technology Degree, St. Joseph School of Medical Technology (1985)

Continuing Education:

The Principles of Gas Chromatography (1993)

Statistics Course (1993)

Creative Training Techniques Conference (1997)

SEDD/ADR Implementation Workshop (2008)

ERPTOOLSX (Environmental Resources Planning Tools) (2010)

PPI (Practical Process Improvement) - Facilitator Training (2011)

Professional Experience:

With Eurofins Lancaster Laboratories since 1985

Chemist, GC/MS (1985)

Responsibilities included GC/MS operation targeting VOA and BNA compounds, instrument maintenance, sample handling, and data handling (interpretation and documentation)

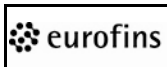
Chemist, GC/VOA (1986)

Responsibilities included GC operation targeting both aromatic and halogenated compounds, FID operation, instrument maintenance, sample handling, and data handling (interpretation and documentation); training others on FID methods, development of training/reference manual for FID, development of internal Operating Manual, standard documentation, definition and maintenance of statistically defined windows, and temporary coordinator in Department 4025

Chemist Coordinator, GC/VOA (1993)

Responsibilities included coordination of sample analysis and data management; job plans and feedback for several personnel; communication both internal and external, and data handling (interpretation and documentation; and combination of existing department with another (personnel, instrumentation, and sample volume)

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Senior Specialist, Human Resources (1997)
Responsibilities included recruiting, training, and professional development
Senior Specialist, Electronic Data Deliverables (2001)
Responsibilities included EDD generation, EDD content review, and communication (internal and external)
Senior Specialist, Environmental Quality Assurance (2013)
Responsibilities include ensuring quality of operations and data being produced in the laboratories; ensuring laboratory adherence to government regulations and client requirements; independently performing complex work and special projects in addition to routine and non-routine duties

Awards, Citations, Honorary Societies & Publications:

Recognition for the implementation of a revamped New Hire Orientation (1999)
Recognition for the development and presentation of the Ethic's Refresher (2001)

Memberships & Appointments:

LCAHRM (1997-2001)

Lawrence M. Taylor, B.S., Senior Specialist, GC/MS Volatiles

Education:

B.S. Chemistry, Shippensburg University (1989)

Continuing Education:

QA Report Operator Training Course, Finnigan Mat Institute (1990)
Technical Training, OI Analytical (1995)
Mass Spectral Interpretation Course, Hewlett-Packard (1995)
Archon Training Course, PTS (1997)

Professional Experience:

With Lancaster Laboratories since 1989
Senior Chemist (1992)
Responsibilities included GC/MS volatile data interpretation; review and approve data; verify sample results, and sign reports.
Senior Specialist, GC/MS Volatiles (2005)
Responsibilities include GC/MS volatile data interpretation; review and approve data; verify sample results, and sign reports.

Valerie L. Tomayko, B.S., Principal Specialist, Pesticide Residue Analysis

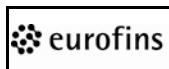
Education:

A.S. Chemical Engineering Technology, Pennsylvania State University (1977)
B.S. Human Resource Management, Geneva College (1993)

Professional Experience:

Hercules Inc., Laboratory Technician (1977-1983)
Antech Ltd., Associate Chemist, (1985-1989)
Quanterra (formerly Wadsworth/Alert), Chemist, (1989-1997)
UEC (United States Steel Engineering Consultants), Chemist (1997)
With Lancaster Laboratories since 1997
Senior Chemist, Pesticide Residue Analysis (1997)
Responsibilities included: data interpretation; review and approve data; review data packages; and generate statistical QC limits for Pesticide Residue Analysis and Extractable Petroleum Hydrocarbons/MBC GC and Nitrosamines departments.
Senior Chemist Coordinator, Pesticide Residue Analysis (2001)
Responsibilities included: Monitor turnaround time and status of samples and packages; coordinate work flow; track employees' progress; assist in implementing procedures/protocols for meeting QA requirements, data package requirements, and special client or project-specific requests. In addition to data interpretation; review and approve data; review data packages; and generate statistical QC limits for Pesticide Residue Analysis and Extractable Petroleum Hydrocarbons/MBC GC and Nitrosamines departments.
Senior Specialist Group Leader, Pesticide Residue Analysis (2005)
Responsibilities included: Monitor turnaround time and status of samples and packages; coordinate work flow; track employees' progress; assist in implementing procedures/protocols for meeting QA requirements, data package requirements, and special client or project-specific requests. In addition to data interpretation; review and approve data; review data packages; and generate statistical QC limits for Pesticide Residue Analysis and Extractable Petroleum Hydrocarbons/MBC GC and Nitrosamines departments.
Senior Specialist Group Leader, Volatiles by GC (2006)
Responsibilities included: Monitor turnaround time and status of samples; coordinate work flow; track employees' progress; assist in implementing procedures/protocols for meeting QA requirements, data package requirements, and special client or project-specific requests. In addition to data interpretation; review and approve data; review data packages; and generate statistical QC limits for GC Volatile analysis.

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Principal Specialist, Pesticide Residue Analysis (2011)

Responsibilities include reviewing laboratory data for technical compliance to methods, SOPs, client protocols, and regulatory agency requirements; overchecking and verifying data from the analysts performing instrumental analyses, including QC and clients' samples for pesticides, PCBs, herbicides, and other related compounds; reviewing data for accuracy and completeness (for routine and non-routine analyses, analytical reports, and/or data packages); assisting in implementing special client requests that impact data processing and reporting; identifying and offering solutions to correct problems related to data processing and reporting; serving as a technical resource for the department with regard to QA/QC procedures and issues

Luz C. Torres, B.S., Senior Specialist Group Leader, Data Deliverables

Education:

B.S. Secretarial Sciences, Catholic University of Puerto Rico (1982)

Continuing Education:

English as a Second Language, Spanish American Civic Association (1988)

Computer Literacy, Spanish American Civic Association (1989)

Professional Experience:

Dr. Jose Moro, Pediatrician, Administrative Secretary (1976-1986)

Responsibilities included customer service, answering phone, collecting payment, billing medical insurance, dictation, transcription, writing letters, filing, archiving, account receivables, ordering supplies.

With Lancaster Laboratories since 1988

Laboratory Assistant, Water Quality (1988)

Responsibilities included washing glassware, assisting technical staff by performing Odor and TDS analyses.

Clerk II, Data Deliverables (1991)

Responsibilities included data package assembly, tracking/preparing/sending QC summary reports, processing and sending data packages, generating and sending Lotus Text file disks, and DP content review.

Administrator I, II, III, Data Deliverables (1992)

Responsibilities included DP assembly, DP content review, review of analytical data, DP processing and sending, training new hires and current staff learning new tasks, DP corrections follow up.

Specialist Coordinator, Data Deliverables (1996)

Responsibilities included technical data review, package correction and problems investigation, Package TAT monitoring, oversee data package assembly, content review, and data package processing, documentation of departmental procedures, maintenance of database, interviewing, supervision of personnel

Senior Specialist Coordinator, Data Deliverables (2003)

Responsibilities included QA review, interviewing, supervision of personnel including writing job plan and performance evaluation, package correction and problems investigation, package TAT monitoring, documentation of departmental procedures, training new hires and cross-training employee from other areas, maintenance of method summary database, oversee data package assembly, content review, and data package processing.

Senior Specialist Group Leader, Data Deliverables (2005)

Responsibilities include QA review, interviewing, supervision of personnel including writing job plan and performance evaluation, package correction and problems investigation, package TAT monitoring, documentation of departmental procedures, training new hires and cross-training employee from other areas, maintenance of method summary database, oversee data package review and data package processing.

Timothy J. Trees, A.A.S., Principal Chemist, Specialty Services Group

Education:

Certificate, N.Y.S. Water/Wastewater Treatment Operations, Columbia Greene Community College (1985)

A.A.S. Environmental Control of Hazardous Waste/Water Quality, Ulster County Community College (1988)

Continuing Education:

Water Treatment Operations, NYS License Board (1984)

Wastewater Treatment Operations, NYS License Board (1986)

Varian AA Course (1992)

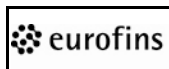
Service Operations Process Optimization, Pennsylvania State University (1992)

Hitachi GFAA Workshop, Hitachi, CT (1994)

24-hour HAZWOPER (spill response) (1995)

Atomic Spectroscopy Workshop, Perkin-Elmer (1997)

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Professional Experience:

York Wastewater Management (1985-1986)

Rider Engineering (1986-1988)

With Eurofins Lancaster Laboratories since 1988

Senior Technician, Metals (1988)

Responsibilities included: operation, maintenance, and sample preparation of mercury cold vapor and hydride generation instrumentation for the determination of mercury, arsenic, and selenium; data entry; troubleshooting instruments; repair of instrumentations' electronic system.

Chemist I, Metals (1990)

Responsibilities included: operation and maintenance of graphite furnace instrumentation; verification of mercury cold vapor and hydride generation data; coaching and training of personnel in the operation of mercury and hydride instrumentation; troubleshooting and repair of instrumentations' mechanical and electronic system.

Chemist I/Coordinator, Metals (1992)

Responsibilities included: operation and maintenance of graphite furnace instrumentation; ICP operation; verification of mercury cold vapor and hydride generation data; coaching and training of personnel in the operation of mercury, hydride, and graphite furnace instrumentation; troubleshooting and repair of instrumentations' mechanical and electronic system; systems operation optimization to increase production; scheduling of personnel for department operation; job plan and review with employees.

Chemist II/Coordinator, Metals (1993)

Responsibilities included: coaching and training of personnel in the operation of mercury, hydride, and graphite furnace instrumentation; assist clients with data interpretation and process improvement; ICP operation; verification of graphite furnace, mercury cold vapor, and hydride generation data; data package review; troubleshooting and repair of instrumentations' mechanical and electronic systems; system operations optimization to increase production; scheduling of personnel for department operation; job plan and review with employees.

Senior Chemist/Coordinator, Metals (1994)

Responsibilities included: operation, maintenance, repair, and troubleshooting of department graphite furnaces; flame atomic absorption, mercury cold vapor, hydride generation, and Inductively Coupled Plasma Instrumentation as well as computer systems used in the operation with these instruments; data qualification, interpretation, and verification of department workload; assist clients with interpretation of data, cause and effect; coaching and training of department personnel in areas of sample preparation, instrument setup, maintenance, and analysis using these instruments; job plan, review, and evaluation with employees; ordering of supplies; maintained operation of Metals Atomic Absorption for the department; method development for both environmental and pharmaceutical divisions for graphite furnace and ICP work; Set up and maintain, all SOPs and documentation for computer systems and instrumentation to comply with GMP regulations; data package review for metals analysis; review and verification of ICP data as needed.

Principal Chemist/Coordinator, Metals (1996)

Responsibilities included: operation, maintenance, repair, and troubleshooting of department graphite furnaces; flame atomic absorption, mercury cold vapor, hydride generation, and Inductively Coupled Plasma Instrumentation as well as computer systems used in the operation with these instruments; data qualification, interpretation, and verification of department workload; assist clients with interpretation of data, cause and effect; coaching and training of department personnel in areas of sample preparation, instrument setup, maintenance, and analysis using these instruments; job plan, review, and evaluation with employees; ordering of supplies; maintained operation of Metals Atomic Absorption for the department; method development for both environmental and pharmaceutical divisions for graphite furnace and ICP work; Set up and maintain, all SOPs and documentation for computer systems and instrumentation to comply with GMP regulations; data package review for metals analysis; review and verification of ICP data as needed.

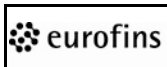
Senior Chemist, GC/MS Semivolatiles (1998)

Responsibilities included: operation, maintenance, and troubleshooting of GC/MS instrumentation; HP5890, 6890 GC, 5971, 5972, 5973 Mass Spec; review and data interpretation of various analyses including but not limited to, 8270C, Appendix IX, 625, CLP 3/90, and 2/88; standards preparation for various methods; data interpretation and data package assembly of batch data; evaluation and review of system procedures.

Principal Chemist, GC/MS Semivolatiles (2001)

Responsibilities included: operation, maintenance, and troubleshooting of GC/MS instrumentation; HP5890, 6890 GC, 5971, 5972, 5973 Mass Spec; method development, research, and development of GC/MS procedures; review and data interpretation of various analyses including but not limited to 8270C, Appendix IX, 625, CLP 3/90 and 2/88; standards preparation for various methods; data interpretation and data package assembly of batch data; evaluation and review of system procedures; analysis and troubleshooting of HPLC and analysis of PAHs; coaching and training of analysts to assist with troubleshooting; working in Pharmaceutical Method Development and Validation, operating LC/MS, LC/MS/MS, and GC/MS instrumentation, and performing instrument qualifications since June 2003

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Principal Chemist, Flexible Staffing (2006)

Responsibilities included working in GC/MS Volatiles in Air department; operation, maintenance, and troubleshooting GC/MS instrumentation; HP5890, 6890 GC, 5971, 5972, 5973 Mass Spec; method development, research, and development of GC/MS procedures; review and data interpretation of various analyses including but not limited to TO-15 and TO-14; standards preparation for various methods; data interpretation and data package assembly of batch data; evaluation and review of system procedures; ability to operate a variety of instrumentation and data systems

Principal Chemist, GC/MS Semivolatiles (2007)

Responsibilities included operating, performing maintenance on, and troubleshooting GC/MS instrumentation; HP5890, 6890 GC, 5971, 5972, 5973, 5975 Mass Spec; setting up and performing method development of Thermo Fisher TRACE GC and DSQ II MS; performing method development using both EI and CI mode of analysis; method development, research, and development of GC/MS procedures; review and data interpretation of various analyses including, but not limited to, 8270C, Appendix IX, 625, CLP 3/90 and 2/88; standards preparation for various methods; data interpretation and data package assembly of batch data; evaluation and review of system procedures; analysis and troubleshooting of HPLC and analysis of PAHs; coaching and training of analysts to assist with troubleshooting; Including working in GC/MS Volatiles in Air department; operation, maintenance, and troubleshooting GC/MS instrumentation; HP5890, 6890 GC, 5971, 5972, 5973 Mass Spec; method development, research, and development of GC/MS procedures; review and data interpretation of various analyses including but not limited to TO-15 and TO-14; standards preparation for various methods; data interpretation and data package assembly of batch data; evaluation and review of system procedures; ability to operate a variety of instrumentation and data systems

Principal Chemist, Specialty Services Group (2011)

Responsibilities include acting as technical resource within the environmental division; developing and validating analytical protocols; troubleshooting and solving analytical chemistry problems; optimizing instrument configuration and performance; evaluating and interpreting analytical results; writing SOPs; assisting in responding to and eliminating ICARs, assisting in optimizing procedures in prep lab; communicating effectively within department; performing routine work as required. Maintain and operation of Thermo Fisher Scientific TSQ Quantum XLS MS/MS as well as TSQ8000 MS/MS with a Trace 1310 GC; developing methods utilizing GC triple Quad technology in a variety of matrices; utilizing various extraction technologies such as QuEChERS (Quick, Easy, Cheap, Effective, Rugged, and Safe) to effectively extract and cleanup sample matrices

Holly L. Trego, M.S., Manager, Computer Applications Development

Education:

B.S. Computer Science, Millersville University (1998)
M.S. Computer Science, Pennsylvania State University (2004)

Professional Experience:

Millersville University (1994-1998)

Computer Programmer

Responsibilities included organizing meetings with staff of Academic Advising and students; maintained statistics on students grades in the Undeclared program using SAS; created reports in Cobol to report on the statistics; organized summer orientation for the Undeclared program.

Internet Programmer

Responsibilities included creating and maintaining various interactive web pages to allow students to view information; developed web site for students to vote on what classes departments should offer.

With Lancaster Laboratories since 1996

Senior Specialist, Computer Applications Development (1996)

Responsibilities included write Visual Basic code to general client reports; design Powerbuilder System with customized macros which processes analytical data; develop data acquisition software with SQL*Loader.

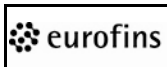
Senior Specialist/Group Leader, Computer Applications Development (2005)

Responsibilities included managing environmental application development projects, maintenance of existing applications.

Manager, Computer Applications Development (2007)

Responsibilities include managing environmental application development projects, maintenance of existing applications.

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Dennis Urban, M.S., Principal Specialist, Training

Education:

B.A. Chemistry, Millersville University (1972)
M.S. Chemistry, St. Joseph's University (1976)
M.S. Applied Statistics, Villanova University (1998)

Continuing Education:

Waters HPLC Training Course, Techniques, Instrument Maintenance, and Service, Waters Associates (1979)
Technicon Autoanalyzer Techniques, Technicon (1982)
Fundamentals of Gas Chromatography, Perkin-Elmer Corporation
FTIR Spectrometry, Theory, Techniques, and Application, Analect Instruments (1983)
FTIR Spectrometry, Pittsburgh Conference (1985)
Infrared Spectroscopy II: Instrumentation, Polymer Spectra, Sample Handling, and Computer Assisted Spectroscopy, Bowdoin College (1985)
Infrared Spectroscopy I: Interpretation of Spectra, Bowdoin College (1986)
Theoretical and Applied Statistics, RCA (1987)
Purge and Trap Training Course: Theory, Operation, and Maintenance, Tekmar Company (1990)
Chemometrics for Chemists, Spectros Associates (1993)
Statistically Sound Procedures for Calculating MDLs and PQLs from Calibration Data, Pittsburgh Conference (1995)
Design and Analysis of Experiments, Institute for Professional Education (1996)
Experimental Design for Productivity & Quality in R & D, ACS Shore Course (1998)

Professional Experience:

RCA, Chemistry and Physics Laboratory, Associate Engineering Technician (1972-1977)
Wyeth Labs, Analytical Quality Control Laboratory, Control Analyst (1977-1979)
Responsibilities included performing the necessary chemical and physical testing of all raw materials used in the manufacturing facility; techniques used were GC, IR, UV/VIS, AA, and wet chemical methods
Wyeth Labs, Drug in Feed Group, Chemist (1979-1980)
Responsibilities included developing and validating HPLC methods for analyzing the drug content in various animal feed matrices used in toxicology studies; conducted stability studies of drug in feed mixtures
RCA, Member, Technical Staff (1980-1987)
Responsibilities included method development and analytical support and troubleshooting to the manufacturing particle size analysis, and classical wet chemical methods
With Eurofins Lancaster Laboratories since 1987
Principal Chemist (1997)
Responsibilities included methods development and validation; instrument maintenance, troubleshooting and repair; and analyst training
Principal Specialist, Training (2000)
Responsibilities include developing, designing, and presenting in-house technical training programs, consulting with laboratory personnel and management on the proper use of appropriate statistical procedures and in the interpretation of statistical results

Memberships & Appointments:

American Chemical Society
American Statistical Association

Nicole M. Veety, B.S., Senior Chemist Group Leader, Instrumental Water Quality

Education:

AA Psychology, Harrisburg Area Community College (1997)
B.S. Psychobiology, Lebanon Valley College (2000)

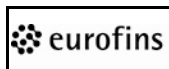
Professional Experience:

With Eurofins Lancaster Laboratories since 2000
Senior Technician, Instrumental Water Quality (2000)
Responsibilities included various prep analyses, data entry, TOC and TOX analyses.
Chemist, Instrumental Water Quality (2003)
Responsibilities included performing various analyses, verification, and review and revise SOPs.
Senior Chemist, Instrumental Water Quality (2006)
Responsibilities include performing various analyses, method development, verification, and review and revise SOPs.
Senior Chemist Group Leader, Instrumental Water Quality (2009)
Responsibilities include performing various analyses, method development, verification, and review and revise SOPs; acting as a technical resource, trainer, and troubleshooter; making recommendations for operational and/or technical improvements; coaching and developing direct reports; planning and monitoring workflow.

Awards, Citations, Honorary Societies, and Publications:

Phi Theta Kappa National Honor Society (Alpha Nu Omega) (1996-2000)

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Robert Todd Vincent, B.S., Principal Chemist, Organic Extraction

Education:

B.S. Chemistry, West Virginia Wesleyan College (2001)

Professional Experience:

With Lancaster Laboratories since 2001

Chemist, EPH/Misc. GC (2001)

Responsibilities included analyzing samples; performing equipment repair; GC method development

Chemist, Organic Extraction (2005)

Responsibilities included performing method development; equipment repair

Senior Chemist, Organic Extraction (2007)

Responsibilities included performing method development; equipment repair; vendor relations; technology evaluation

Principal Chemist, Organic Extraction (2011)

Responsibilities include performing high level, difficult preps (with minimal supervision or guidance) following standard operating procedures (SOPs); self train in new techniques; entering information into computer; training new or existing employees in extraction techniques or use of equipment; using knowledge to actively improve current processes; developing, enhancing, and validating new extraction methods; keeping work area clean and organized; preparing spikes; repairing equipment; updating departmental SOPs and training manual; disposing of wastes in approved manner; assisting in incident prevention and remediation when necessary

Harry D. Ward, Ph.D., Principal Specialist Group Leader, Training

Education:

B.S. Chemistry, Muhlenberg College (1980)

Ph.D. Organic Chemistry, University of Delaware (1985)

Professional Experience:

Armstrong World Industries, Inc., Research Scientist (1985-2003)

Responsibilities included performing research and development related to flooring

With Eurofins Lancaster Laboratories since 2003

Senior Chemist, Pharmaceutical Product Testing (2003)

Responsibilities included performing pharmaceutical product testing

Senior Chemist, Method Development & Validation (2005)

Responsibilities included performing pharmaceutical method development and validation

Senior Training Specialist, Human Resources (2006)

Responsibilities included design and delivery of core and elective technical training

Principal Training Specialist, Human Resources (2008)

Responsibilities included design and delivery of core and elective technical training

Principal Specialist Group Leader, Training (2011)

Responsibilities include managing the resources of the technical training group; designing and delivering core and elective technical training

Barbara J. Weaver, M.S., CIH, Principal Specialist, Training and Development, Human Resources

Education:

B.S. Chemistry, Elizabethtown College (1971)

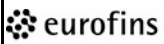
M.S. Analytical Chemistry, Illinois Institute of Technology (2001)

Certifications:

CIH - American Board of Industrial Hygiene - Certified in the comprehensive practice of industrial hygiene (1983),

Certification #2719

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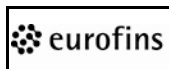
Continuing Education:

Business Law, Elizabethtown College (1979)
 NIOSH Course #553 "Industrial Hygiene Sampling, Decision Making, Monitoring and Record Keeping, Sampling Strategies" (1979)
 Industrial Toxicology, 5-Day Workshop, Thomas Jefferson University (1980)
 Special Topics: Environmental Analytical Chemistry, Graduate Work, Villanova University (1981)
 "Comprehensive Industrial Hygiene Review", University of Cincinnati, NIOSH Education Resource Center (1983)
 Environmental Health, Graduate Work, West Chester University (1985)
 Chemical Hygiene - The OSHA Laboratory Standard, NEAIIA PDC (1990)
 Health and Safety Management for Hazardous Waste Professionals, AIHA PDC #11 (1990)
 Financial Accounting, Penn State (1990)
 NIOSH Course #582 "Sample and Analysis of Airborne Asbestos Dust", NIOSH Education Resource Center, Cincinnati (1992)
 Survey of Management, Penn State University (1993)
 Laboratory Safety and Health, American Chemical Society (1994)
 24-hour HAZWOPER (spill response) and Refreshers (1995-present)
 Health, Safety, and Environmental Auditing, Johns Hopkins (1995)
 Managing Ionizing Radiation Programs for Industrial Hygienists, AIHA (1996)
 Radiation Safety Officer Training, Radiation Safety Associates, MA (1997)
 Presenting Data and Information, Edward R. Tufte, Graphic Press LLC (2005)
 IATA/FIATA Dangerous Goods, IATA (2007)
 GC/MS Training Seminar, Restek (2008)
 IATA Dangerous Goods Refresher Training, DGI (2009)
 Exposure Assessment Strategies and Statistics, 4.6 CEUs, AIHA (2009)
 Practical Process Improvement, Training in the Role of Facilitator (2010)
 DOT (49CFR) Shipper Course, DGI (2011)
 8-hr HAZWOPER refresher (2011)
 IATA Acceptance Training, all inclusive (2011)

Professional Experience:

Warner Lambert, Inc., Quality Control Chemist (1970-1973)
 Responsibilities included performing USP/NF and client-specific raw materials and product testing; conducting specific project assignments such as documentation of product-specific alcohol denaturing at supplier's site; pre-market new product quality control testing; serving on panels for testing fragrance and color
 Hershey Medical Center, Junior Research Technician (1973-1974)
 Responsibilities included developing rubidium-crystal FID-GC (nitrogen sensitive) methods for the low level detection of barbiturates in solution and in blood extracts; performing analysis of blood and spiked blood from rat and monkey; performing analysis of a specific liver enzyme; using preparative fix-angle ultracentrifuge in sample preparation; developing electron microscopy photographs for liver cell mitochondria study
 Elizabethtown College, Laboratory Instructor (1977-1978)
 Responsibilities included preparing materials for freshman chemistry laboratories; providing basic laboratory instruction for freshmen; conducting research on the separation of linoleic and linolenic acids (omega-3 and omega-6 fatty acids in olive oil) using spinning band distillation; testing flame-retardant cellulose insulation to determine the flame-retardant formulation for industrial client
 With Lancaster Laboratories since 1978
 Chemist, Air Quality/Industrial Hygiene (1978)
 Responsibilities included performing air and miscellaneous chemical analysis using gas chromatography, colorimetric analysis, UV-Vis, spectrophotometry, fiber-counting using phase contrast microscopy, and infrared analysis
 Program Manager, Air Quality/Industrial Hygiene (1978)
 Responsibilities for the Air Quality and Miscellaneous Chemistry Group included conducting NIOSH, OSHA, and EPA air sampling and analysis; industrial hygiene (air quality and employee exposure in the workplace) consulting services; responsibilities for laboratory work included method development for analysis of pharmaceutical active compounds in air; method development for the FID-GC analysis of cholesterol and fatty acid profiles; infra-red and gas chromatography methods; forensic sample analysis and expert witness testimony; USP/NF testing, some ASTM testing, analytical microscopy using phase contrast, fluorescence and light microscopy; preparing and/or submitting PAT and QA test samples and blanks for analysis; business development, technical writing, proposal, pricing and quote development, and client services for QA/IH; managing the industrial hygiene field sampling/consultation and industrial hygiene/miscellaneous chemistry (client special projects) lab group; maintaining DEA registration; serving as laboratory director for the AIHA analytical laboratory certification for more than 10 years
 Marketing and Technical Services Specialist, Business Development (1987)
 Responsibilities included inside and external business development including client visits and trade shows; serving as client services/account representative for air quality, foods, and pharmaceutical sciences; creating and tracking quotes and responses to requests for bids and proposals; continued to serve as laboratory director for the AIHA analytical laboratory certification

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Principal Specialist reporting to Vice President, Environmental and Pharmaceutical Sciences (1987)

Responsibilities included technical writing, special projects, and performing Graphite Furnace Atomic Absorption for Pb and Cu in water; pesticides data entry verification; coordinating, developing, and providing technical and EHS training; providing technical support to the EHS staff; serving as interim EHS officer and the EHS liaison with our parent company; serving as Lancaster Radiation Safety Officer during the period in which Lancaster held a site NRC license; serving as a permanent member of the safety committee representing EHS training

Principal Specialist, Training & Development, Human Resources (1991)

Responsibilities include coordinating, developing, and providing technical training and environmental health and safety (EHS) training; soliciting and managing grants for training programs; providing coordination for the external and continuing education programs; providing technical support for the EHS staff and continuing to represent EHS training on the safety committee

Awards, Citations, Honorary Societies & Publications:

1 publication on microscopy

1 publication on NMR and Copper-histidine

Book Review - Review of *Guidelines for Laboratory Design: Health and Safety Aspect*, **The Synergist** March 2002

Acknowledged in two EPA publications: Pb-Based Paint Laboratory Operations Guidelines: Analysis of Pb in Paint, Dust and Soil (EPA 747-R-92-006 May 1993) and Environmental Management Guide for Small Laboratories (EPA 233-B-98-001 July 1998)

Biographical Listings: *Who's Who in the East*, under Barbara J. Felty; *Who's Who in the Safety Profession*

Memberships and Appointments:

American Board of Industrial Hygiene (1984-present)

American Industrial Hygiene Association (AIHA) (1980-present)

Sampling and Laboratory Analysis Committee (2001-present)

Communication and Training Methods Committee (2006-present)

AIHA - Central Pennsylvania Section, Charter Member (1981-present)

Treasurer (1981-1984, 2008-present), President-elect (1985-1986, 2002-2005), President (1986-1987, 2005-2006),

Secretary (2007-2008), Membership Director (1988-1993), Director (2000-2002)

American Chemical Society (1985-present)

Chemical Health and Safety Section, Membership Committee (1992-1993)

Lancaster County Industrial Safety Council (Director 1988-1990)

Leadership Lancaster (1995)

Mentor (1999-2002), Marketing Committee (1999-2000)

Johns Hopkins NIOSH Education Resource Center Continuing Education Advisory Committee (1996-2006)

Penn State University-Lancaster Center Advisory Committee (2002-2006)

Chromatography Forum, Delaware Valley (2002-present/lifetime member)

Timothy S. Weaver, B.A., Senior Specialist, Environmental Software Development

Education:

B.A. Mathematics, Franklin & Marshall College (1996)

Professional Experience:

With Eurofins Lancaster Laboratories since 1996

Computer Specialist, Volatiles by GC (1996)

Responsibilities included programming, maintenance, and updates

Computer Specialist, Environmental Sciences (1997)

Responsibilities included disk format programming initially, followed by pesticides system and database maintenance and programming

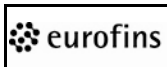
Specialist, Computer Applications Development (2002)

Responsibilities included pesticides system and database maintenance and programming; invoice print server maintenance; LLENS program administration

Senior Specialist, Environmental Software Development (2008)

Responsibilities include pesticides system and database maintenance and programming; invoice print server maintenance; LLENS program administration

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Heather E. Williams, B.S., Senior Chemist, EPH/Miscellaneous GC

Education:

B.S. Forensic and Investigative Science, West Virginia University (2004)

Continuing Education:

Principles of Gas Chromatography, LLU (2007)

Professional Experience:

With Lancaster Laboratories since 2006

Chemist, EPH/Miscellaneous GC (2006)

Responsibilities included analyzing routine samples and their associated QC by gas chromatography for extractable petroleum products such as DRO, TPH, and other related materials; reviewing, calculating, and reporting the corresponding data and results; maintaining, optimizing, and calibrating Gas Chromatographs in an efficient and accurate manner; assisting in organization of department work, track samples, and prepare samples and standards to consistently meet turn around time requirements

Senior Chemist, EPH/Miscellaneous GC (2008)

Responsibilities include analyzing routine samples and their associated QC by gas chromatography for extractable petroleum products such as DRO, TPH and other related materials; reviewing, interpreting, calculating, and reporting the corresponding data and results; maintaining, optimizing, and calibrating Gas Chromatographs in an efficient and accurate manner; assisting in organization of department work, tracking samples; preparing samples and standards to consistently meet turn around time requirements; verifying sample data; corresponding with client service representatives regarding client inquiries and providing answers and solutions when problems arise; SOP writing and revising as new methods are developed; assisting with new instrument installation and set-up; participating in practical process improvements as a member of a team

Bret M. Winey, B.S., Senior Specialist, Environmental Software Development

Education:

B.S. Computer Science, Millersville University (2005)

Professional Experience:

Penn State University, College of Medicine, Programmer/Analyst (2009-2011)

Responsibilities included developing systems responsible for collecting and analyzing medical research data

Weidenhammer Systems Corp., Programmer/Analyst (2011-2012)

Responsibilities included maintaining and implementing functionality on clients' websites, using specification gathered directly from the respective client

Donegal Mutual Insurance Company, Inc., Programmer (2012-2013)

Responsibilities included maintaining existing web presentation and provide aid during transition to new website design

With Eurofins Lancaster Laboratories since 2013

Senior Specialist, Environmental Software Development (2013)

Responsibilities include providing technical support for maintenance of installed software applications and assisting with the development, installation, and maintenance of new applications for general use; assisting in development, implementation, and maintenance of software intended to improve the quality and efficiency of work performed

Donald E. Wyand, B.S., Director, Environmental Business Development/Sales

Education:

B.S. Chemistry, Lebanon Valley College (1989)

Continuing Education:

Graduate Chemistry, Villanova University

Professional Experience:

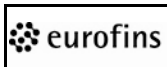
With Lancaster Laboratories since 1989

Client Services Specialist (1990)

Business Development Specialist (1993)

Principal Specialist/Account Manager (1995)

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Principal Specialist/Sales (1998) Principal Specialist/Coordinator/Sales, Environmental Sciences (2001)

Responsibilities included: National Account Manager; project management; evaluating new methods; consult with clients regarding testing needs; develop long-term, mutually beneficial relationships with new and existing clients by maximizing our clients' efficiency and effectiveness in managing analytical projects; present relevant market information to senior management and technical operations staff to develop new services for our clients; organize and manage National Account teams; prepare, organize, and manage project planning for target accounts; present Lancaster Labs' capabilities through formal presentations, personal account visits, and marketing campaigns; develop and maintain marketing programs within assigned geographic territory; maintain and communicate knowledge of regulatory issues, analytical methodology, and industry requirements to new and existing clients; prepare proposals and quotations; advise clients on testing; communicate client requirements to lab areas; perform technical presentation to inform our clients of new environmental regulations; and lead client teams to offer analytical solutions to client problems.

Principal Specialist/Group Leader/Sales (2005)

Responsibilities included: National Account Manager; project management; evaluating new methods; consult with clients regarding testing needs; develop long-term, mutually beneficial relationships with new and existing clients by maximizing our clients' efficiency and effectiveness in managing analytical projects; present relevant market information to senior management and technical operations staff to develop new services for our clients; organize and manage National Account teams; prepare, organize, and manage project planning for target accounts; present Lancaster Labs' capabilities through formal presentations, personal account visits, and marketing campaigns; develop and maintain marketing programs within assigned geographic territory; maintain and communicate knowledge of regulatory issues, analytical methodology, and industry requirements to new and existing clients; prepare proposals and quotations; advise clients on testing; communicate client requirements to lab areas; perform technical presentation to inform our clients of new environmental regulations; and lead client teams to offer analytical solutions to client problems.

Director, Environmental Business Development/Sales (2006)

Responsibilities include: National Account Manager; project management; evaluating new methods; consult with clients regarding testing needs; develop long-term, mutually beneficial relationships with new and existing clients by maximizing our clients' efficiency and effectiveness in managing analytical projects; present relevant market information to senior management and technical operations staff to develop new services for our clients; organize and manage National Account teams; prepare, organize, and manage project planning for target accounts; present Lancaster Labs' capabilities through formal presentations, personal account visits, and marketing campaigns; develop and maintain marketing programs within assigned geographic territory; maintain and communicate knowledge of regulatory issues, analytical methodology, and industry requirements to new and existing clients; prepare proposals and quotations; advise clients on testing; communicate client requirements to lab areas; perform technical presentation to inform our clients of new environmental regulations; and lead client teams to offer analytical solutions to client problems.

Memberships & Appointments:

American Chemical Society
Society of American Military Engineers
Society of Environmental Toxicology and Chemistry

Meng Yu, M.S., Principal Chemist, Specialty Services Group

Education:

B.S. Chemical Engineering, Zhejiang University of Technology (1986)
Post Graduate, Biogeography and Environmental Assessment, University of Saarland (1995)
M.S. Chemistry, Catholic University of Leuven (1999)

Professional Experience:

Setsco Service Ltd, Executive Chemist (1999-2002)

Responsibilities performing EPA and USDA method development and validation for water, soil, food, and pharmaceutical materials using USP, BP, and AOAC methods; performing pesticide residue analysis using all kinds of GC

Cantest Ltd, Research Chemist (2002-2008)

Responsibilities included performing bioanalytical and food safety method development and validation; performing pesticide and drug residue method validation as per USDA, EPA, CFIA methods; UPLCMSMS, LCMSMS, LCMS and GCMS operation and maintenance

Pharmanet Inc. HSP Laboratory, Research Scientist (2008-2010)

Responsibilities included performing bioanalytical method development and validation for plasma, urine, tissue, etc.; performing LCMSMS operation, tuning, and maintenance

With Lancaster Laboratories since 2010

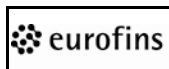
Principal Chemist, Specialty Services Group (2010)

Responsibilities include developing and validating new testing methods; operating and maintaining LCMSMS instruments; performing sample analyses

Memberships and Appointments:

ASMS (2010)

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Michael A. Ziegler, B.S., Senior Chemist, Volatiles in Air

Education:

B.S. Molecular Biology, Clarion University of PA (2002)

Professional Experience:

With Eurofins Lancaster Laboratories since 2006

Chemist, GC/MS Volatiles (2006)

Responsibilities included maintaining GC/MS instrumentation; tuning and calibrating instrument daily; analyzing quality control and client samples; reviewing and assembling data in an efficient manner with a high degree of quality; evaluating current organizational and analytical systems; suggesting and implementing the necessary corrective action to ensure the above can be performed in alignment with client and/or regulatory requirements; performing all duties with minimal supervision

Chemist, Volatiles in Air (2010)

Responsibilities included maintaining GC and/or GC/MS instrumentation and calibrating GC and/or GC/MS instrument daily; analyzing quality control and client samples; reviewing and assembling data in an efficient manner with a high degree of quality to meet client requirements; performing various Airlab duties associated with sample prep and sample flow (these include, but are not limited to, sample retrieval and entry, Nitrogen tank replacement, summa can cleaning, summa/FC requests, and sample pressurization/prescreen)

Senior Chemist, Volatiles in Air (2014)

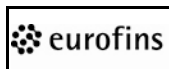
Responsibilities include maintaining GC and/or GC/MS instrumentation and calibrating GC and/or GC/MS instrument daily; analyzing quality control and client samples; reviewing and assembling data in an efficient manner with a high degree of quality to meet client requirements; performing various Airlab duties associated with sample prep and sample flow (these include, but are not limited to, sample retrieval and entry, Nitrogen tank replacement, summa can cleaning, summa/FC requests, and sample pressurization/prescreen)

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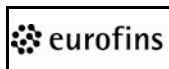
Eurofins Document Reference	1-P-QM-GDL-9015382	Revision	4
Effective Date	Aug 8, 2014	Status	Effective
Historical/Local Document Number	DOD - Environmental Quality Policy Manual Appendix E		
Local Document Level	Level 1		
Local Document Type	POL - Policy		
Local Document Category	ES - Environmental Sciences		

Prepared by	Kathryn Brungard
Reviewed and Approved by	Duane Luckenbill;Review;Tuesday, July 29, 2014 11:10:44 AM EDT Robert Strocko;Review;Wednesday, July 30, 2014 1:00:17 PM EDT Dorothy Love;Approval;Wednesday, July 30, 2014 2:21:13 PM EDT

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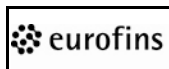
Document Title	Document ID	Historical Document ID	Document Owner
Level 1			
Organizational Charts Personnel to Sign Reports	1-P-QM-GDL-9015380	DOD - Environmental Quality Policy Manual Appendix C	4052 - Environmental Quality Assurance
Personnel Qualifications and Responsibilities	1-P-QM-GDL-9015381	DOD - Environmental Quality Policy Manual Appendix D	4052 - Environmental Quality Assurance
SOPs and Analytical Methods	1-P-QM-GDL-9015382	DOD - Environmental Quality Policy Manual Appendix E	4052 - Environmental Quality Assurance
Instrument and Equipment List	1-P-QM-GDL-9015383	DOD - Environmental Quality Policy Manual Appendix F	4052 - Environmental Quality Assurance
Preventative Maintenance Schedules	1-P-QM-GDL-9015384	DOD - Environmental Quality Policy Manual Appendix G	4052 - Environmental Quality Assurance
Calibration Schedules	1-P-QM-GDL-9015385	DOD - Environmental Quality Policy Manual Appendix H	4052 - Environmental Quality Assurance
NELAP Scope of Testing	1-P-QM-GDL-9015386	DOD - Environmental Quality Policy Manual Appendix I	4052 - Environmental Quality Assurance
Quality Control Types, Frequency, and Corrective Action	1-P-QM-GDL-9015387	DOD - Environmental Quality Policy Manual Appendix J	4052 - Environmental Quality Assurance
Microbiological Testing	1-P-QM-GDL-9015388	DOD - Environmental Quality Policy Manual Appendix K	4052 - Environmental Quality Assurance
Manual Integration	1-P-QM-GDL-9017675	Policy 0001	4052 - Environmental Quality Assurance
Laboratory Ethics and Data Integrity Policy	1-P-QM-GDL-9017679	Policy 0007	4052 - Environmental Quality Assurance
Chemical Hygiene Plan	1-P-QM-GDL-9015198	Chemical Hygiene Plan	6098 - Safety
Preparedness, Prevention, and Contingency Plan	1-P-QM-GDL-9017681	Policy 0010	6098 - Safety
Exposure Control Plan for Bloodborne Pathogens	1-P-QM-GDL-9017682	Policy 0011	6098 - Safety
Level 2			
Balance, Syringe, Pipette Verification	1-P-QM-QMA-9015389	DOD - LOM-SOP-ES-235	4052 - Environmental Quality Assurance
Bay Area Service Center Dangerous Goods Shipping Procedure	1-P-QM-QMA-9017337	LOM-SOP-ES-237	50 - Bay Area Service Center
Change Control Procedures for ELLE	1-P-QM-QMA-9028515	N/A	4052 - Environmental Quality Assurance
Chromatography Integration and Documentation	1-P-QM-QMA-9017333	LOM-SOP-ES-232	4052 - Environmental Quality Assurance
Chromatography Integration and Documentation for OH VAP	1-P-QM-QMA-9022815	LOM-SOP-ES-232 (OH VAP)	4052 - Environmental Quality Assurance
Communicating Maximum Contaminant Level (MCL) Exceedances	1-P-QM-QMA-9017330	LOM-SOP-ES-227	4039 - Environmental Client Services and Inside Business Development
Compliance with Environmental GLP Regulations	1-P-QM-QMA-9022322	LOM-SOP-LAB-204 and LOM-SOP-LAB-224	4052 - Environmental Quality Assurance
Data Entry, Verification and Reporting	1-P-QM-QMA-9017322	LOM-SOP-ES-218	4052 - Environmental Quality Assurance

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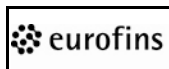
Document Title	Document ID	Historical Document ID	Document Owner
Level 2 (continued)			
Demonstrations of Capability	1-P-QM-QMA-9015390	DOD - LOM-SOP-ES-238	4052 - Environmental Quality Assurance
Determining Method Detection Limits and Limits of Quantitation	1-P-QM-QMA-9017309	LOM-SOP-ES-203	4052 - Environmental Quality Assurance
Documentation for the Parallax Analysis Definition Function	1-P-QM-QMA-9017323	LOM-SOP-ES-219	4052 - Environmental Quality Assurance
Environmental Project Cycle	1-P-QM-QMA-9017338	LOM-SOP-ES-239	4052 - Environmental Quality Assurance
Establishing Control Limits	1-P-QM-QMA-9017313	LOM-SOP-ES-207	4052 - Environmental Quality Assurance
Forensic Laboratory Services	1-P-QM-QMA-9017307	LOM-SOP-ES-201	4052 - Environmental Quality Assurance
Guidelines for Analytical Decision Making in Environmental Testing	1-P-QM-QMA-9021833	LOM-SOP-LAB-226	4052 - Environmental Quality Assurance
Guidelines for Writing Technical Reports	1-P-QM-QMA-9017308	LOM-SOP-ES-202	4052 - Environmental Quality Assurance
Handling of Client Technical Complaints (Investigations and Response)	1-P-QM-QMA-9017332	LOM-SOP-ES-231	4052 - Environmental Quality Assurance
HP-UX Target 3.5 Data System Accounts and Electronic Signature Security	1-P-QM-QMA-9017336	LOM-SOP-ES-236	4052 - Environmental Quality Assurance
Instrument and Equipment Maintenance and Calibration	1-P-QM-QMA-9017325	LOM-SOP-ES-222	4052 - Environmental Quality Assurance
Investigation and Corrective Action of Noncompliant Data	1-P-QM-QMA-9017315	LOM-SOP-ES-209	4052 - Environmental Quality Assurance
Investigation and Corrective Action Reporting for Laboratory Problems	1-P-QM-QMA-9017331	LOM-SOP-ES-230	4052 - Environmental Quality Assurance
Laboratory Notebooks, Logbooks, and Documentation for Environmental Testing	1-P-QM-QMA-9021767	LOM-SOP-LAB-220	4052 - Environmental Quality Assurance
Laboratory Sample Analysis Record (LSAR) Documentation	1-P-QM-QMA-9017318	LOM-SOP-ES-212	4052 - Environmental Quality Assurance
Legal Chain-of-Custody Documentation	1-P-QM-QMA-9017335	LOM-SOP-ES-234	4052 - Environmental Quality Assurance
Missed Holding Time Reports	1-P-QM-QMA-9017326	LOM-SOP-ES-223	4052 - Environmental Quality Assurance
Monitoring of the Volatile Organics Analysis (VOA) Storage Areas for Contamination	1-P-QM-QMA-9017311	LOM-SOP-ES-205	4052 - Environmental Quality Assurance
Monitoring Temperatures in Refrigerators, Freezers, Incubators, and Ovens Using the Andover System	1-P-QM-QMA-9017316	LOM-SOP-ES-210	4052 - Environmental Quality Assurance
Monitoring Temperatures in Refrigerators, Freezers, Incubators, and Ovens Using the ETM	1-P-QM-QMA-9021509	N/A	4052 - Environmental Quality Assurance
Obtaining a Representative Environmental Solid Sample Aliquot	1-P-QM-QMA-9017334	LOM-SOP-ES-233	4052 - Environmental Quality Assurance
Procurement of Environmental Laboratory Supplies	1-P-QM-QMA-9021705	LOM-SOP-LAB-218	4052 - Environmental Quality Assurance
Proficiency Test Samples	1-P-QM-QMA-9017321	LOM-SOP-ES-216	4052 - Environmental Quality Assurance
Quarantine Soils Procedures	1-P-QM-QMA-9017317	LOM-SOP-ES-211	4052 - Environmental Quality Assurance
Reagents and Standards	1-P-QM-QMA-9017328	LOM-SOP-ES-225	4052 - Environmental Quality Assurance

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Document Title	Document ID	Historical Document ID	Department Owner
Level 2 (continued)			
Sample Requisition	1-P-QM-QMA-9017312	LOM-SOP-ES-206	4052 - Environmental Quality Assurance
Subcontracting Analytical Testing	1-P-QM-QMA-9017310	LOM-SOP-ES-204	4052 - Environmental Quality Assurance
Thermometer Use and Calibration	1-P-QM-QMA-9017314	LOM-SOP-ES-208	4052 - Environmental Quality Assurance
Validation and Authorization of Analytical Methods	1-P-QM-QMA-9017329	LOM-SOP-ES-226	4052 - Environmental Quality Assurance
Automated External Defibrillator (AED) Program	1-P-QM-QMA-9017350	LOM-SOP-HS-215	6098 - Safety
Biosafety Manual	1-P-QM-QMA-9024252	N/A	6098 - Safety
Disposal of Regulated Medical Waste	1-P-QM-QMA-9017349	LOM-SOP-HS-214	6098 - Safety
Emergency Evacuation Plan	1-P-QM-QMA-9017343	LOM-SOP-HS-208	6098 - Safety
Environmental Hazardous Sample Communication Procedure	1-P-QM-QMA-9017346	LOM-SOP-HS-211	6098 - Safety
Environmental, Health, and Safety (EHS) Assessments	1-P-QM-QMA-9017344	LOM-SOP-HS-209	6098 - Safety
Fall Protection Plan	1-P-QM-QMA-9017354	LOM-SOP-HS-221	6098 - Safety
Fleet Safety Plan	1-P-QM-QMA-9021826	N/A	6098 - Safety
Hot Work Permit Program	1-P-QM-QMA-9017345	LOM-SOP-HS-210	6098 - Safety
Incident Response Plan	1-P-QM-QMA-9017347	LOM-SOP-HS-212	6098 - Safety
Inspection of Facility Emergency Equipment	1-P-QM-QMA-9017353	LOM-SOP-HS-220	6098 - Safety
Lockout/Tagout	1-P-QM-QMA-9017342	LOM-SOP-HS-207	6098 - Safety
Management of Hazardous Wastes in the Laboratory	1-P-QM-QMA-9017352	LOM-SOP-HS-219	6098 - Safety
Pharmaceutical Sample Handling	1-P-QM-QMA-9017351	LOM-SOP-HS-218	6098 - Safety
Radiation Safety Program	1-P-QM-QMA-9017348	LOM-SOP-HS-213	6098 - Safety
Reporting Work Related Incidents	1-P-QM-QMA-9017340	LOM-SOP-HS-203	6098 - Safety
Respiratory Protection Program	1-P-QM-QMA-9017341	LOM-SOP-HS-204	6098 - Safety
Safety Glasses	1-P-QM-QMA-9017339	LOM-SOP-HS-202	6098 - Safety
Spill Prevention, Control, and Countermeasure Plan	1-P-QM-QMA-9017355	LOM-SOP-HS-222	6098 - Safety
Building Security	1-P-QM-QMA-9017366	LOM-SOP-LAB-212	6043 - Physical Services
Data and Record Storage, Security, Retention, Archival, and Disposal	1-P-QM-QMA-9017358	LOM-SOP-LAB-203	6047 - Office Services
Document Control	1-P-QM-QMA-9017357	LOM-SOP-LAB-202	6047 - Office Services

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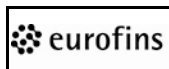
Document Title	Document ID	Historical Document ID	Department Owner
Level 2 (continued)			
E-Mail System	1-P-QM-QMA-9017360	LOM-SOP-LAB-205	9013 - Information Technology
Employee Training Program	1-P-QM-QMA-9017379	LOM-SOP-LAB-231	6047 - Office Services
Environmental Health and Safety Training	1-P-QM-QMA-9017378	LOM-SOP-LAB-230	6054 - Training
EtQ System User Account Maintenance	1-P-QM-QMA-9017380	LOM-SOP-LAB-232	6047 - Office Services
Eurofins North America E-Mail and Archiving	1-P-QM-QMA-9020074	NA	9013 - Information Technology
Facilities Operation Manual	1-P-QM-QMA-9017374	LOM-SOP-LAB-223	6043 - Physical Services
Facility Change Control Procedure	1-P-QM-QMA-9017364	LOM-SOP-LAB-209	6043 - Physical Services
Insect and Rodent Control	1-P-QM-QMA-9017367	LOM-SOP-LAB-213	6043 - Physical Services
Laboratory Housekeeping and Cleaning	1-P-QM-QMA-9017373	LOM-SOP-LAB-221	6043 - Physical Services
Position Qualification Descriptions (PQDs) and Essential Job Functions (EJFs)	1-P-QM-QMA-9017376	LOM-SOP-LAB-225	6056 - Recruiting
Review of Legal Matters	1-P-QM-QMA-9017371	LOM-SOP-LAB-219	20 - Bio/Pharmaceutical Sciences
Review of Legal Matters	1-P-QM-QMA-9017371	LOM-SOP-LAB-219	40 - Environmental Sciences
Use and Maintenance of Reagent Water Supply	1-P-QM-QMA-9017368	LOM-SOP-LAB-214	4052 - Environmental Quality Assurance
Utilizing the Services and Support of the Computer Systems Group	1-P-QM-QMA-9017362	LOM-SOP-LAB-207	9013 - Information Technology
Windows Network and Computer Accounts	1-P-QM-QMA-9017361	LOM-SOP-LAB-206	9013 - Information Technology
Writing and Reviewing Lancaster Laboratories Policies and Operating Procedures	1-P-QM-QMA-9017356	LOM-SOP-LAB-201	6047 - Office Services
Level 3 – Environmental Microbiology			
Quanti-Tray X Sealer	1-P-QM-PRO-9017534	OMC-PM-078	3002 - Environmental Microbiology
Quality Control/Quality Assurance Procedure for Environmental Microbiology	1-P-QM-PRO-9018209	SOP-PM-041	3002 - Environmental Microbiology
2% Brilliant Green Bile Broth (for Coliform Test Dept. 02)	1-P-QM-WI -9018027	SOP-PM-001, Media 400	3002 - Environmental Microbiology
EC Medium – for Dept. 02	1-P-QM-WI -9018028	SOP-PM-001, Media 401	3002 - Environmental Microbiology
Free Chlorine Residual Data Records (Optional Total Chlorine Reading)	1-P-QM-WI -9011681	Analysis 0308	3002 - Environmental Microbiology
Heterotrophic Plate Count Testing for Environmental Solid and Liquid Samples Pour Plate Method SM 9215B-1994	1-P-QM-WI -9011658	Analysis 0307, 4196, 12833	3002 - Environmental Microbiology
Hydrocarbon Degrading Plate Count Study Waters and Solids	1-P-QM-WI -9013997	Analysis 6157, 6158	3002 - Environmental Microbiology
Lauryl Sulfate Tryptose Broth (1x LST) Single Strength – for Dept. 02	1-P-QM-WI -9018025	SOP-PM-001, Media 398	3002 - Environmental Microbiology
Lauryl Sulfate Tryptose Double Strength (2x LST) – for Dept. 02	1-P-QM-WI -9018026	SOP-PM-001, Media 399	3002 - Environmental Microbiology

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Level 3 – Environmental Microbiology (continued)			
M-FC (for Dept. 02)	1-P-QM-WI -9018024	SOP-PM-001, Media 397	3002 - Environmental Microbiology
Modification DPD Free Chlorine Residual In Water (Presence/Absence)	1-P-QM-WI -9011686	Analysis 0416	3002 - Environmental Microbiology
Modification Fecal Coliform by Membrane Filtration	1-P-QM-WI -9011598	Analysis 0199, 11028	3002 - Environmental Microbiology
MS/Agar Noble Base (for HC degrading PC study)	1-P-QM-WI -9018021	SOP-PM-001, Media 390	3002 - Environmental Microbiology
MS/Agar Noble Medium (for HC degrading PC study for Dept. 02)	1-P-QM-WI -9018022	SOP-PM-001, Media 391	3002 - Environmental Microbiology
Total Coliform and E. coli Analysis Potable Water (Presence/Absence), 6477 Swimming Pool Samples, 6479 Potable Water (Quantitative), 8161	1-P-QM-WI -9014018	Analysis 6477, 6479, 8161	3002 - Environmental Microbiology
Tryptic Soy Broth (TSB) for Dept. 02 Sterility Checks	1-P-QM-WI -9018035	SOP-PM-001, Media 409	3002 - Environmental Microbiology
Tryptic Soy Broth (TSB)—for Dept. 02	1-P-QM-WI -9018023	SOP-PM-001, Media 396	3002 - Environmental Microbiology
Level 3 – Environmental Sciences			
Glassware Cleaning	1-P-QM-PRO-9015465	DOD - SOP-MS-001	4021 - GC/MS Volatiles
Preparation and Testing of Trip Blanks for GC/MS Volatile Analyses	1-P-QM-PRO-9015466	DOD - SOP-MS-002	4021 - GC/MS Volatiles
GC/MS Instrumentation Maintenance	1-P-QM-PRO-9015467	DOD - SOP-MS-004	4021 - GC/MS Volatiles
Preservation and Residual Chloride Checks of Samples for GC/MS Volatile Water Analysis	1-P-QM-PRO-9015468	DOD - SOP-MS-005	4021 - GC/MS Volatiles
GC/MS Volatile Standards Traceability	1-P-QM-PRO-9015469	DOD - SOP-MS-006	4021 - GC/MS Volatiles
Preparation and Analysis of Cleaning Blanks for GC and GC/MS Volatiles	1-P-QM-PRO-9015470	DOD - SOP-MS-007	4021 - GC/MS Volatiles
GC/MS Volatiles Audit Process	1-P-QM-PRO-9015471	DOD - SOP-MS-012	4021 - GC/MS Volatiles
Preparation and Testing of Storage Blanks for GC/MS Volatile Analysis	1-P-QM-PRO-9015473	DOD - SOP-MS-015	4021 - GC/MS Volatiles
Use of 40-mL Vials for Volatile Organic Analyses	1-P-QM-PRO-9015474	DOD - SOP-MS-016	4021 - GC/MS Volatiles
Level II Review of GS/MS Volatiles	1-P-QM-PRO-9017810	SOP-MS-017	4021 - GC/MS Volatiles
Volatile Compounds in Aqueous and Solid Samples by SW-846 8260B for OH VAP	1-P-QM-WI -9012739	Analysis 10237, 10335 OH VAP	4021 - GC/MS Volatiles
Volatile Organics Tentatively Identified Compound Method (Interpretive)	1-P-QM-WI -9012746	Analysis 0882, 0884, 12027	4021 - GC/MS Volatiles
Determination of Volatile Target Compounds and Gasoline Range Organics (GRO) by GC/MS in Soils and Solids by Method 8260B	1-P-QM-WI -9012764	Analysis 10237, 10607, 10949, 10950, 10951	4021 - GC/MS Volatiles
The Determination of 1,2,3- Trichloropropane by Gas Chromatography/ Mass Spectrometry (GC/MS) using Isotope Dilution and Selective Ion Monitoring (SIM)	1-P-QM-WI -9012867	Analysis 11017	4021 - GC/MS Volatiles
Targeted Library Search by GC/MS	1-P-QM-WI -9013053	Analysis 11660	4021 - GC/MS Volatiles
Determination of Volatile Target Compounds and Gasoline Range Organics (GRO) by GC/MS in Soils and Solids by Method 8260C	1-P-QM-WI -9013077	Analysis 11995	4021 - GC/MS Volatiles
Determination of Volatile Target Compounds and Gasoline Range Organics (GRO) by Capillary Column Gas Chromatography/Mass Spectrometry (GC/MS) in Waters and Wastewaters by Method 8260C	1-P-QM-WI -9013078	Analysis 11996, 11997, 13130	4021 - GC/MS Volatiles

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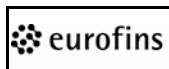
Document Title	Document ID	Historical Document ID	Department Owner
Level 3 – Environmental Sciences (continued)			
The Determination of Vinyl Chloride, Trichloroethene and Tetrachloroethene by Gas Chromatography /Mass Spectrometry (GC/MS) using Selective Ion Monitoring (SIM)	1-P-QM-WI -9013082	Analysis 12030	4021 - GC/MS Volatiles
The Determination of Vinyl Chloride and Carbon Disulfide by Gas Chromatography/Mass Spectrometry (GC/MS) using Selective Ion Monitoring (SIM)	1-P-QM-WI -9013992	Analysis 6008	4021 - GC/MS Volatiles
The Determination of Ethylene Oxide and Crotonaldehyde by Gas Chromatography/Mass Spectrometry (GC/MS) in Water and Soil by SW-846 Method 8260B	1-P-QM-WI -9014003	Analysis 6372, 6377	4021 - GC/MS Volatiles
Preparation of Oil Samples	1-P-QM-WI -9015068	Analysis DOD - 0373	4021 - GC/MS Volatiles
The Determination of 1,4-Dioxane by Gas Chromatography/Mass Spectrometry (GC/MS) using Isotope Dilution and Selective Ion Monitoring (SIM)	1-P-QM-WI -9015075	Analysis DOD - 0527, 10326	4021 - GC/MS Volatiles
Volatile Organics Tentatively Identified Compound Method	1-P-QM-WI -9015084	Analysis DOD - 0890, 0880, 12028	4021 - GC/MS Volatiles
Waters for Volatile Organic Compounds by Purge and Trap Gas Chromatography/Mass Spectrometry using EPA Method 624	1-P-QM-WI -9015097	Analysis DOD - 10371	4021 - GC/MS Volatiles
Determination of Volatile Target Compounds by Capillary Column Gas Chromatography/Mass Spectrometry (GC/MS) in Waters and Wastewaters by Method 6200B	1-P-QM-WI -9015099	Analysis 10460	4021 - GC/MS Volatiles
The Determination of Volatile Organic Compounds in Wastewater by Isotope Dilution and Gas Chromatography/Mass Spectrometry (GC/MS)	1-P-QM-WI -9015136	Analysis 2394, 2417	4021 - GC/MS Volatiles
Determination of Volatile Target Compounds and Gasoline Range Organics (GRO) by Capillary Column Gas Chromatography/Mass Spectrometry (GC/MS) in Waters and Wastewaters by Method 8260B	1-P-QM-WI -9015141	Analysis DOD - 2898, 10335, 10903, 10904, 10905, 10943, 10945	4021 - GC/MS Volatiles
Toxicity Characteristic Leachate Procedure (TCLP); Analysis of Zero Headspace Extractions (ZHE) of Solid Waste, Soils, and other Matrices for Volatile Target Compounds by Gas Chromatography/Mass Spectrometry (GC/MS): Capillary Column Technique	1-P-QM-WI -9015142	Analysis DOD - 3636	4021 - GC/MS Volatiles
Waters for Purgeable Organic Compounds by Capillary Column Gas Chromatography Mass Spectrometry	1-P-QM-WI -9015143	Analysis DOD - 3648	4021 - GC/MS Volatiles
Low Concentration Waters for Volatile Organic Analysis	1-P-QM-WI -9015153	Analysis DOD - 4914	4021 - GC/MS Volatiles
Fixed-Volume Hand-Held	1-P-QM-PRO-9015403	DOD - MC-IO-003	4022 - Metals
Bottletop Dispensers	1-P-QM-PRO-9015404	DOD - MC-IO-019	4022 - Metals
Glassware Cleaning	1-P-QM-PRO-9015463	DOD - SOP-IO-013	4022 - Metals
Metals Use of the LLENS System	1-P-QM-PRO-9015464	DOD - SOP-IO-036	4022 - Metals
Mercury in Aqueous and Solid Samples by SW-846 Method 7470A (Aqueous) and 7471A (Solid) for OH VAP	1-P-QM-WI -9011649	Analysis 0259, 0159 OH VAP	4022 - Metals
Maintenance and Calibration of HACH Model 2100N Laboratory Turbidimeter	1-P-QM-PRO-9017427	MC-IO-017	4022 - Metals
Mercury in Aqueous and Solid Samples by SW-846 Method 7470A (Aqueous) and 7471A (Solid) for OH VAP	1-P-QM-WI -9011649	Analysis 0259, 0159 OH VAP	4022 - Metals

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Sample Preparation of Soil, Sediment, and Sludge for Total Mercury Analysis by Atomic Absorption Cold Vapor Technique	1-P-QM-WI -9012710	Analysis 0494	4022 - Metals
Langelier Index in Water	1-P-QM-WI -9012744	Analysis 0576	4022 - Metals
Mercury by Cold Vapor Atomic Fluorescence Spectrometry using EPA Method 1631 Revision E	1-P-QM-WI -9013144	Analysis 1573, 1574	4022 - Metals
Preparation of Soil, Sediment, and Sludge for Analysis of Metals by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES)	1-P-QM-WI -9013404	Analysis 1849	4022 - Metals
Client Specific - 3030 C. Treatment for Acid-Extractable Metals for North Carolina Groundwater Samples	1-P-QM-WI -9013465	Analysis 2812, 10651, 11988, 11989	4022 - Metals
Dilute/Run and AVS/SEM Sample Handling for Metals	1-P-QM-WI -9013476	Analysis 4792	4022 - Metals
Digestion of Non-Aqueous Samples by SW-846 Method 3050B for OH VAP	1-P-QM-WI -9013983	Analysis 5708, 10637, 11026, 11027 OH VAP	4022 - Metals
Sample Preparation of Sediments, Sludges, and Soils for Analysis of Metals by Inductively Coupled Plasma Atomic Emission Spectrometry (5708)	1-P-QM-WI -9013984	Analysis 5708II	4022 - Metals
Digestion of Solid Samples by SW-846 Method 7471A - OH VAP	1-P-QM-WI -9013985	Analysis 5711 OH VAP	4022 - Metals
Digestion of Aqueous Samples by SW-846 Method 7470A for OH VAP	1-P-QM-WI -9013986	Analysis 5713 OH VAP	4022 - Metals
Sample Preparation of Potable Water, Groundwater, Surface Water, and Wastewater for Analysis of Total Recoverable Metals by ICP (5716)	1-P-QM-WI -9013987	Analysis 5716	4022 - Metals
Undigested Sample Preparation of Potable Water for Analysis of Total Recoverable Metals by Inductively Coupled Plasma Mass Spectrometry [ICP-MS]	1-P-QM-WI -9013994	Analysis 6051, 5281	4022 - Metals
Sample Preparation of Wastewater for Analysis of Total Recoverable Metals by Inductively Coupled Mass Spectrometer (ICP-MS)	1-P-QM-WI -9013995	Analysis 6052	4022 - Metals
Sample Preparation of Potable Water, Groundwater, Surface Water, and Wastewater for Analysis of Total Recoverable Metals by ICPMS (7050)	1-P-QM-WI -9014042	Analysis 7050	4022 - Metals
Mercury in Aqueous, Solid and Tissue Samples by Cold Vapor AA	1-P-QM-WI -9015067	Analysis DOD - 0259, 0159	4022 - Metals
Digestion of Aqueous Samples by SW-846 Method 7470A, EPA 254.1, CLP2.1, CLP4.0 and CLP 5.2.	1-P-QM-WI -9015082	Analysis DOD - 0821, 5713, 5714	4022 - Metals
Sample Preparation of Oils for Analysis of Metals by Inductively Coupled Plasma Spectroscopy	1-P-QM-WI -9015091	Analysis DOD - 1015, 11355	4022 - Metals
Sample Preparation of Waters for Analysis of Total Recoverable Metals by Inductively Coupled Plasma Optical Emission Spectrometry	1-P-QM-WI -9015133	Analysis DOD - 1848, 5720, 10635	4022 - Metals
Sample Preparation of Wastewater and Leachates for Analysis of Total Metals by Inductively Coupled Plasma Atomic Emission Spectrometry	1-P-QM-WI -9015159	Analysis DOD - 5705, 10636	4022 - Metals
Sample Prep of Sediments, Sludges, Soils, and Fish Tissue for Analysis of Metals by ICP and ICP-MS	1-P-QM-WI -9015160	Analysis DOD - 5708, 10637	4022 - Metals

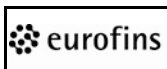
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Sample Preparation of Soil, Sediment, Sludge, Oils, and Fish Tissue for Total Mercury Analysis by Atomic Absorption Cold Vapor Technique	1-P-QM-WI -9015161	Analysis DOD - 5711, 10638	4022 - Metals
Sample Preparation of Leachates and Other Wastewater for Analysis of Total Metals by Inductively Coupled Plasma-Mass Spectrometer (ICP-MS)	1-P-QM-WI -9015165	Analysis DOD - 6050, 10639	4022 - Metals
Metals by Inductively Coupled Plasma Atomic Emissions Spectroscopy for SW-846 Methods 6010A/B/C (aqueous, solid, tissue), CLP 2.1(water/solid/tissue), CLP 4.0(water/solid/tissue), CLP 5.2 (water/solid/tissue) and EPA 200.7(aqueous)	1-P-QM-WI -9018442	Analysis 6966, 1643, 6935, 7914, 6946, 6947, 1650, 6949, 6952, 6951, 6953, 1654, 1662, 1656, 1657, 6958, 6960, 1667, 6961, 10145, 6955, 6944, 6936, 6969, 7968, ...	4022 - Metals
Metals by Inductively Coupled Plasma Mass Spectrometry for SW-846 Methods 6020/6020A (aqueous, solid, tissue), CLP 5.2 (aqueous, solid, tissue) and EPA 200.8 (aqueous)	1-P-QM-WI -9018443	Analysis 6142, 6123, 6125, 10801, 6126, 6127, 6129, 6128, 6132, 6131, 6133, 6134, 6140, 6136, 6137, 6138, 6143, 6139, 6135, 6124, 6141, 6146, 6144, 6147, 6145, ...	4022 - Metals
Trace Metals in Aqueous and Non-Aqueous Samples by Method SW-846 6020 for OH VAP	1-P-QM-WI -9022820	6127, 6027, 6131, 6031, 6137, 6037, 6139, 6039, 6133, 6033, 6125, 6142, 6042, 6128, 6028, 6124, 6024, 6126, 6026, 6145, 6045, 6135, 6035 OH VAP	4022 - Metals
Digestion of Aqueous Samples by SW846 Method 3020A/3010A Modified for Analysis by ICP/MS for OH VAP	1-P-QM-WI -9022821	6050 OH VAP	4022 - Metals
Trace Metals in Aqueous and Non-Aqueous Samples by Method SW-846 6010B for OH VAP	1-P-QM-WI -9022822	7066, 6966, 1743, 1643, 7035, 6935, 7046, 6946, 7047, 6947, 1750, 1650, 7049, 6949, 7052, 6952, 7051, 6951, 7053, 6953, 1754, 1654, 1762, 1662, 7058, 6958, 1767, 1667, 7061, 6961, 7055, 6955, 7044, 6944, 7036, 6936, 7022, 6925, 7071, 6971, 7072,... OH VAP	4022 - Metals
Digestion of Aqueous Samples by SW-846 3005A for ICP Analysis – OH VAP	1-P-QM-WI -9024237	Analysis 1848 OH VAP	4022 - Metals
Digestion of Aqueous Samples by SW-846 3010A for ICP Analysis – OH VAP	1-P-QM-WI -9024239	Analysis 5705 OH VAP	4022 - Metals
Pesticide Extract Cleanup Using Gel Permeation Chromatography	1-P-QM-PRO-9015407	DOD - MC-OE-004	4024 - Pesticide Residue Analysis
QC Data Acceptability and Corrective Action	1-P-QM-PRO-9015493	DOD - SOP-PP-002	4024 - Pesticide Residue Analysis
Interpretation of Chromatographic Data	1-P-QM-PRO-9015494	DOD - SOP-PP-011	4024 - Pesticide Residue Analysis
Preventative and Corrective GC Maintenance	1-P-QM-PRO-9015495	DOD - SOP-PP-013	4024 - Pesticide Residue Analysis
Monitoring QC Data Acceptance Limits	1-P-QM-PRO-9015496	DOD - SOP-PP-025	4024 - Pesticide Residue Analysis
Preventative and Corrective HPLC Maintenance for the Pesticide Residue Analysis Department	1-P-QM-PRO-9015497	DOD - SOP-PP-029	4024 - Pesticide Residue Analysis
Setting Up Single Component Initial Calibrations	1-P-QM-PRO-9015498	DOD - SOP-PP-031	4024 - Pesticide Residue Analysis
Using "Datalog" Software for Data Acquisition of Multicomponent Pesticides/PCBs	1-P-QM-PRO-9015499	DOD - SOP-PP-032	4024 - Pesticide Residue Analysis

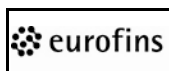
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Using "Datalog" Software for Single-component Data Acquisition	1-P-QM-PRO-9015500	DOD - SOP-PP-033	4024 - Pesticide Residue Analysis
Common Equations Used During Chromatographic Analyses	1-P-QM-PRO-9015501	DOD - SOP-PP-040	4024 - Pesticide Residue Analysis
Standards Traceability and Monitoring	1-P-QM-PRO-9018220	SOP-PP-003	4024 - Pesticide Residue Analysis
Standards Preparation, Coding, and Storage	1-P-QM-PRO-9018222	SOP-PP-021	4024 - Pesticide Residue Analysis
Data Audit Procedure for Department 4024	1-P-QM-PRO-9018224	SOP-PP-023	4024 - Pesticide Residue Analysis
Uploading Data to the LIMS	1-P-QM-PRO-9018225	SOP-PP-027	4024 - Pesticide Residue Analysis
Setting Retention Time Windows	1-P-QM-PRO-9018226	SOP-PP-035	4024 - Pesticide Residue Analysis
Creating Calibration Timed Events in Chrom Perfect	1-P-QM-PRO-9018227	SOP-PP-036	4024 - Pesticide Residue Analysis
Setting Up Analysis Numbers in the Departmental Database	1-P-QM-PRO-9018228	SOP-PP-037	4024 - Pesticide Residue Analysis
Prescreening Water and Soil Samples for Pesticides and PCBs	1-P-QM-PRO-9018229	SOP-PP-041	4024 - Pesticide Residue Analysis
Micromass Quattro Micro Tandem Mass Spectrometer with a Waters 2795 HPLC System (LC/MS/MS)	1-P-QM-PRO-9018230	SOP-PP-042	4024 - Pesticide Residue Analysis
PCBs in Oil by SW-846 Method 8082	1-P-QM-WI -9011597	Analysis 0174	4024 - Pesticide Residue Analysis
Medium Level Sonic Probe Extraction Procedure for the Determination of Pesticides and PCBs in a Solid Matrix	1-P-QM-WI -9012745	Analysis 0819M, 11144	4024 - Pesticide Residue Analysis
Liquid/Liquid Extraction Procedure for the Determination of Organophosphorous Pesticides in a Wastewater Matrix	1-P-QM-WI -9012765	Analysis 10240	4024 - Pesticide Residue Analysis
Determination of Picric Acid in Soil Samples by HPLC with UV	1-P-QM-WI -9012797	Analysis 10709	4024 - Pesticide Residue Analysis
Soxhlet Extraction Procedure for the Determination of Polychlorinated Biphenyls (PCBs) in a Solid Matrix	1-P-QM-WI -9013065	Analysis 11696	4024 - Pesticide Residue Analysis
Analysis of Low Level Polychlorinated Biphenyls (PCBs) in Aqueous Samples using Gas Chromatography with Electron Capture Detection (GC-ECD)	1-P-QM-WI -9013081	Analysis 12013	4024 - Pesticide Residue Analysis
Passive In-Situ Chemical Extraction Sampler (PISCES) Procedure for the Determination of Polychlorinated Biphenyls (PCBs)	1-P-QM-WI -9013121	Analysis 12801	4024 - Pesticide Residue Analysis
N-Methylcarbamates by Method 531.1 in Groundwater and Drinking Water using High Performance Liquid Chromatography (HPLC)	1-P-QM-WI -9013126	Analysis 1340	4024 - Pesticide Residue Analysis
N-Methylcarbamate Pesticides by Method 8318 / 8318A in Solids	1-P-QM-WI -9013139	Analysis 1509, 10597	4024 - Pesticide Residue Analysis
Extraction Procedure for the Determination of Carbamate and Urea Pesticides in a Soil or Solid Waste Matrix	1-P-QM-WI -9013140	Analysis 1510, 11143	4024 - Pesticide Residue Analysis
Analysis of Acephate and Methamidophos by 8141A in Aqueous and Solid Samples	1-P-QM-WI -9013395	Analysis 1782, 1785	4024 - Pesticide Residue Analysis
Chlorinated Acids in Water Using GC-ECD by Method 515.1	1-P-QM-WI -9013405	Analysis 1864	4024 - Pesticide Residue Analysis
Analysis of Aqueous Samples for Chlorinated Pesticides and PCBs by Gas Chromatography with an Electron Capture Detector	1-P-QM-WI -9013406	Analysis 1869	4024 - Pesticide Residue Analysis

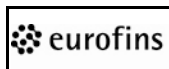
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Analysis of Aqueous Samples for Nitrogen- and Phosphorus-Containing Pesticides by Gas Chromatography with a Nitrogen-Phosphorus Detector	1-P-QM-WI -9013407	Analysis 1870	4024 - Pesticide Residue Analysis
Analysis of Captan and Captafol by Gas Chromatography with Electron Capture Detection of Waters and Solids Method 8081A	1-P-QM-WI -9013435	Analysis 2257, 2253	4024 - Pesticide Residue Analysis
Picric Acid in Water by Method 8015B Using HPLC with UV Detection	1-P-QM-WI -9013439	Analysis 2265	4024 - Pesticide Residue Analysis
Analysis of Formaldehyde and other Aldehydes in Aqueous and Solid Samples by High Performance Liquid Chromatography (HPLC) Method 8315A	1-P-QM-WI -9013471	Analysis 4144, 4173, 8044, 8045	4024 - Pesticide Residue Analysis
Extraction of Chlorinated Herbicides in a Soil Matrix	1-P-QM-WI -9013472	Analysis 4181	4024 - Pesticide Residue Analysis
Soxhlet Extraction Procedure for the Determination of Pesticides in a Solid Matrix	1-P-QM-WI -9013991	Analysis 6006SOX	4024 - Pesticide Residue Analysis
Separatory Funnel Extraction Procedure for the Determination of Chlorinated Pesticides; Nitrogen and Phosphorus Containing Pesticides; and PCBs in a Drinking Water Matrix	1-P-QM-WI -9014001	Analysis 6368, 11127	4024 - Pesticide Residue Analysis
Extraction of Chlorinated Acids and Herbicides in Drinking Water by Method 515.1	1-P-QM-WI -9014002	Analysis 6369	4024 - Pesticide Residue Analysis
Analysis of Pesticides and Polychlorinated Biphenyls (PCBs) in Aqueous Samples by Method 608	1-P-QM-WI -9014174	Analysis 7572	4024 - Pesticide Residue Analysis
Microextraction of 1,2-Dibromoethane (EDB), 1,2-Dibromo-3-chloropropane (DBCP), and 1,2,3-Trichloropropane (TCP), in Water	1-P-QM-WI -9014309	Analysis 7786	4024 - Pesticide Residue Analysis
Organic Acids in Water by HPLC/UV Method 8015B/D	1-P-QM-WI -9015063	Analysis 8843, 12737	4024 - Pesticide Residue Analysis
Analysis of Pesticides in Aqueous Samples using GC-ECD	1-P-QM-WI -9015066	Analysis DOD - 0177, 0950, 0180, 1954	4024 - Pesticide Residue Analysis
Waste Dilution Procedure for the Determination of PCBs in Oil	1-P-QM-WI -9015077	Analysis DOD - 0815	4024 - Pesticide Residue Analysis
Extraction of Chlorinated Herbicides in a Water Matrix by SW-846 8151A	1-P-QM-WI -9015078	Analysis DOD - 0816, 11110, 11111	4024 - Pesticide Residue Analysis
Separatory Funnel Extraction Procedure for the Determination of Pesticides and PCBs in a Wastewater Matrix	1-P-QM-WI -9015079	Analysis DOD - 0817, 6654, 10241, 11112, 11113, 11114, 11116, 11117, 11118, 11119, 11120, 11121, 11123, 11126, 11960	4024 - Pesticide Residue Analysis
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Analysis of Pesticides by 8081B in Solid Samples using GC-ECD	1-P-QM-WI -9015108	Analysis DOD - 10590	4024 - Pesticide Residue Analysis
Analysis of Polychlorinated Biphenyls (PCBs) by 8082A in Aqueous Samples using GC-ECD	1-P-QM-WI -9015109	Analysis DOD - 10591	4024 - Pesticide Residue Analysis
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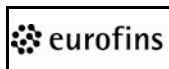
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Semivolatile Run/Injection Log Generation	1-P-QM-PRO-9015456	DOD - SOP-EX-019	4026 - GC/MS Semivolatiles
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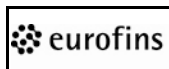
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Separatory Funnel Extraction Procedure for the Determination of Base-Neutrals and Acid Extractables in a Wastewater Matrix by SW-846 Method 3510C	1-P-QM-WI -9015076	Analysis DOD - 0813, 11010, 11015, 10464, 10467, 10476	4026 - GC/MS Semivolatiles
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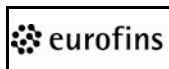
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Nitrite Nitrogen in Water and Wastewater (Colorimetric, Automated)	1-P-QM-WI -9011634	Analysis 0219, 5991	4027 - Instrumental Water Quality
Nitrate Nitrogen in Water and Wastewater (Colorimetric, Automated Cadmium Reduction)	1-P-QM-WI -9011635	Analysis 0220, 7882, 5992	4027 - Instrumental Water Quality
Determination of Inorganic Anions by Ion Chromatography	1-P-QM-WI -9011637	Analysis 0224, 0228, 0332, 0368, 1504, 1505, 1506, 7322, 7332, 7333, 7334, 7335, 7336, 7337, 7338	4027 - Instrumental Water Quality
Determination of Total and Soluble Phosphorus in Water, Wastewater, and Soils (Colorimetric,	1-P-QM-WI -9011640	Analysis 0227, 0345, 1546, 5893, 5894	4027 - Instrumental Water Quality

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Ascorbic Acid, Automated)			
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Determination of Total and Amenable Cyanide in Water, Wastewater, and Soils, Free Cyanide in Water and Wastewater, Reactive Cyanide of Solids, and Weak Acid Dissociable Cyanide in Waters and Soils	1-P-QM-WI -9011646	Analysis 0237, 1123, 1549, 5895, 5898, 8255, 0241, 4814, 0961, 0957, 0959	4027 - Instrumental Water Quality
Determination of Total Organic Carbon, Dissolved Organic Carbon, and Inorganic Carbon in Water and Wastewater	1-P-QM-WI -9011651	Analysis 0273, 6090, 7547	4027 - Instrumental Water Quality
Determination of Total Organic Carbon in Water and Wastewater (Quadruplicate Studies)	1-P-QM-WI -9011682	Analysis 0354	4027 - Instrumental Water Quality
Determination of Nitrocellulose in Water and Soil	1-P-QM-WI -9011683	Analysis 0370, 0371, 1105, 1106	4027 - Instrumental Water Quality
Automated Determination of Phenols in Water, Wastewater, and Soils By Automated Flow Analyzer EPA 420.4, EPA 420.2, SW-846, 9066	1-P-QM-WI -9011690	Analysis 0434, 2393, 5912	4027 - Instrumental Water Quality
Phenol Distillation (as Preparation for Analysis on the Flow Analyzer)	1-P-QM-WI -9011693	Analysis 0491, 5911, 8123	4027 - Instrumental Water Quality
Total and Amenable Cyanide Distillation (As Preparation for Analysis on the Automatic Flow Analyzer)	1-P-QM-WI -9011694	Analysis 0492, 1548, 5896, 5897, 8256, 0956, 0958	4027 - Instrumental Water Quality
Total Cyanide Analysis by Massachusetts Contingency Plan (MCP)	1-P-QM-WI -9012873	Analysis 11151	4027 - Instrumental Water Quality
Determination of Total and Available Cyanide in Water using Amperometric Detection by ASTM D 7511-09e2 and Method OIA-1677-09	1-P-QM-WI -9013123	Analysis 12823, 12941, 12999	4027 - Instrumental Water Quality
Reagent Water Extraction (as Preparation for Analysis on the Ion Chromatograph or Autoanalyzer)	1-P-QM-WI -9013127	Analysis 1352, 10129	4027 - Instrumental Water Quality
Total Kjeldahl Nitrogen Digestion of Water and Wastewater (A Preparation for Analysis 0217)	1-P-QM-WI -9013136	Analysis 1460	4027 - Instrumental Water Quality
Total Kjeldahl Nitrogen Digestion of Solids and Soils (a preparation for Analysis #1511)	1-P-QM-WI -9013138	Analysis 1465	4027 - Instrumental Water Quality
Determination of Total Carbon in Water and Wastewater	1-P-QM-WI -9013142	Analysis 1550	4027 - Instrumental Water Quality
Determination of TOC and TC in Solids and Sludges by Combustion	1-P-QM-WI -9013418	Analysis 2079, 0383, 6623, 10065, 11356, 11763	4027 - Instrumental Water Quality
Moisture by Sartorius Moisture Analyzer/Moisture by Mettler Toledo HB43 SM20 2540 G and SOW OLM03.2	1-P-QM-WI -9013422	Analysis 2111, 2118, 2121, 2353	4027 - Instrumental Water Quality
Determination of Hexavalent Chromium by Ion Chromatography in Solids and Waters SW-846 7199 and EPA 218.6	1-P-QM-WI -9013989	Analysis 5892, 6467	4027 - Instrumental Water Quality
Determination of Perchlorate by Ion Chromatography	1-P-QM-WI -9013993	Analysis 6019, 10130, 10147	4027 - Instrumental Water Quality
Weak Acid Dissociable Cyanide Distillation (as Preparation for Analysis on the Flow Analyzer)	1-P-QM-WI -9014171	Analysis 7528, 0960	4027 - Instrumental Water Quality
Digestion of Total and Soluble Phosphorus in Water, Wastewater, and Soils EPA 361.1, SM20 4500 P B, and SM20 4500 P E	1-P-QM-WI -9014675	Analysis 8261, 8262, 8263, 8264, 8895	4027 - Instrumental Water Quality
Client Specific - Determination of Inorganic Anions by Ion Chromatography (Department of Defense)	1-P-QM-WI -9015115	Analysis DOD - 10697, 10698, 10699, 10700, 10701, 10702, 10703	4027 - Instrumental Water Quality
Client Specific - Determination of Total Cyanide in Water, Wastewater, and Soils (Department of Defense) SW-846 9012B, SW-846 9012A	1-P-QM-WI -9015116	Analysis DOD - 10704, 10705	4027 - Instrumental Water Quality
Client Specific - Total Cyanide Distillation (Department of Defense)	1-P-QM-WI -9015117	Analysis DOD - 10706, 10707	4027 - Instrumental Water Quality
Hexavalent Chromium (Cr VI) in Aqueous and Non-aqueous Samples by Method SW-846	1-P-QM-WI -9022443	Analysis 5892, 6467 OH VAP	4027 - Instrumental Water Quality

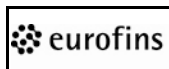
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7199 for OH VAP			
pH Meters and Probes	1-P-QM-PRO-9015415	DOD - MC-TL-001	4028 - Leachate Preparation
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Calibration of the Leachate Tumblers	1-P-QM-PRO-9015416	DOD - MC-TL-002	4028 - Leachate Preparation
Glassware Cleaning for Leachate Extractions	1-P-QM-PRO-9015525	DOD - SOP-TL-001	4028 - Leachate Preparation
Leachate Blank Evaluations	1-P-QM-PRO-9015526	DOD - SOP-TL-002	4028 - Leachate Preparation
Subsampling and Preservation of Leachates	1-P-QM-PRO-9015527	DOD - SOP-TL-003	4028 - Leachate Preparation
Manually Pressurized Zero Headspace Extractor (ZHE)	1-P-QM-PRO-9015528	DOD - SOP-TL-004	4028 - Leachate Preparation
Procedure for Calculating and Reporting Weighted Average Results for TCLP Extracts	1-P-QM-PRO-9015529	DOD - SOP-TL-005	4028 - Leachate Preparation
Shake Extraction of Solid Waste with Water ASTM Method #D3987-85	1-P-QM-WI -9015074	Analysis DOD - 0447	4028 - Leachate Preparation
Toxicity Characteristic Leaching Procedure TCLP Zero Headspace Leachates, Method 1311	1-P-QM-WI -9015085	Analysis DOD - 0946, 2573, 0075	4028 - Leachate Preparation
Toxicity Characteristic Leaching Procedure TCLP Nonvolatile Leachates	1-P-QM-WI -9015086	Analysis DOD - 0947, 1339	4028 - Leachate Preparation
Waste Extraction Test Leaching Procedure for Volatile and Non-volatile Analytes	1-P-QM-WI -9015129	Analysis DOD - 1435, 1436	4028 - Leachate Preparation
Synthetic Precipitation Leaching Procedure (SPLP) for Nonvolatile Leachates	1-P-QM-WI -9015130	Analysis DOD - 1567	4028 - Leachate Preparation
Food and Tissue Preparation	1-P-QM-WI -9015137	Analysis DOD - 2487	4028 - Leachate Preparation
Cation Exchange Capacity of Soils (Sodium Acetate) by Method 9081	1-P-QM-WI -9015138	Analysis DOD - 2595	4028 - Leachate Preparation
Synthetic Precipitation Leaching Procedure (SPLP) Zero Headspace Leachates	1-P-QM-WI -9015194	Analysis DOD - 8792, 1339	4028 - Leachate Preparation
Spectronic Genesys 2 Spectrophotometer	1-P-QM-PRO-9015417	DOD - MC-WQ-002	4029 - Water Quality
Accumet Model AB30 pH/Ion/Conductivity Meter	1-P-QM-PRO-9015419	DOD - MC-WQ-004	4029 - Water Quality
Equipment Incubators and Refrigerators	1-P-QM-PRO-9015420	DOD - MC-WQ-006	4029 - Water Quality
pH Probes and Meters	1-P-QM-PRO-9015421	DOD - MC-WQ-007	4029 - Water Quality
Equipment Muffle Furnaces and Ovens	1-P-QM-PRO-9015422	DOD - MC-WQ-009	4029 - Water Quality
Calibration of Hach 2100AN Turbidimeter	1-P-QM-PRO-9015423	DOD - MC-WQ-010	4029 - Water Quality
Maintenance of Desiccators	1-P-QM-PRO-9015424	DOD - MC-WQ-012	4029 - Water Quality
Fixed Volume Hand-Held Pipettes	1-P-QM-PRO-9015425	DOD - MC-WQ-013	4029 - Water Quality
Adjustable Volume Handheld Pipettes	1-P-QM-PRO-9015426	DOD - MC-WQ-014	4029 - Water Quality
Hach DR 2800 Spectrophotometer	1-P-QM-PRO-9015427	DOD - MC-WQ-017	4029 - Water Quality
Orion 960 Autotitration System	1-P-QM-PRO-9015428	DOD - MC-WQ-022	4029 - Water Quality
YSI Model 5100 Dissolved Oxygen Meter	1-P-QM-PRO-9015429	DOD - MC-WQ-023	4029 - Water Quality
Maintenance of Hot Plates	1-P-QM-PRO-9015430	DOD - MC-WQ-024	4029 - Water Quality
Standardization of 0.02 and 0.1 Normal Sulfuric Acid	1-P-QM-PRO-9015530	DOD - SOP-WQ-002	4029 - Water Quality
Standardization of 0.02 Normal Sodium Hydroxide	1-P-QM-PRO-9015531	DOD - SOP-WQ-005	4029 - Water Quality
Water Quality Washroom Procedures	1-P-QM-PRO-9015532	DOD - SOP-WQ-006	4029 - Water Quality
Instructions for Collecting Data on the LLENS System	1-P-QM-PRO-9015533	DOD - SOP-WQ-014	4029 - Water Quality
Chemical Review	1-P-QM-PRO-9015534	DOD - SOP-WQ-016	4029 - Water Quality
Quality Control Data for Wet Chemistry	1-P-QM-PRO-9015535	DOD - SOP-WQ-017	4029 - Water Quality
Total Solids by 2540 B-1997, EPA 160.3 or 2540 G-1997	1-P-QM-WI -9011623	Analysis 0203	4029 - Water Quality
Total Fixed Solids Total Volatile Solids by 2540	1-P-QM-WI -9011624	Analysis 0204, 0205	4029 - Water Quality

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E-1997, 160.4 or 2540 G-1997			
Total Suspended Solids by 2540 D-1997 or EPA 160.2	1-P-QM-WI -9011625	Analysis 0206	4029 - Water Quality
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Fixed Suspended Solids (Gravimetric) (#207) Volatile Suspended Solids (Gravimetric) (#208) by SM 2540 E - 1997	1-P-QM-WI -9011626	Analysis 0207, 0208	4029 - Water Quality
Total Dissolved Solids (Calculation)	1-P-QM-WI -9011627	Analysis 0209	4029 - Water Quality
Fixed Dissolved Solids (Calculation)	1-P-QM-WI -9011628	Analysis 0210	4029 - Water Quality
Volatile Dissolved Solids (Calculation)	1-P-QM-WI -9011629	Analysis 0211	4029 - Water Quality
Total Dissolved Solids in Waters (Gravimetric) by 2540 C-1997 or EPA 160.1	1-P-QM-WI -9011630	Analysis 0212	4029 - Water Quality
Settleable Solids by 2540 F-1997, or EPA 160.5	1-P-QM-WI -9011631	Analysis 0215	4029 - Water Quality
Ammonia-Nitrogen for Waters (Titrimetric Distillation Procedure) by 4500-NH3 B/C (Modified)-1997, or EPA 350.2	1-P-QM-WI -9011636	Analysis 0221	4029 - Water Quality
Methylene-Blue-Active Substances (MBAS) by 5540 C-2000 or EPA 425.1	1-P-QM-WI -9011638	Analysis 0225	4029 - Water Quality
Orthophosphate by EPA 365.3, or 4500-P E- 1999	1-P-QM-WI -9011639	Analysis 0226	4029 - Water Quality
Sulfite by 4500-SO3 B-2000, or EPA 377.1	1-P-QM-WI -9011641	Analysis 0229	4029 - Water Quality
Colorimetric Sulfide in Waters (#0230), Sulfide as H2S (#10293 Calculation), Dissolved Sulfide in Waters (#10499) by 4500-S2 B/C/D-2000, 4500-S2 F-2000, or EPA 376.2	1-P-QM-WI -9011642	Analysis 0230, 10293, 10499	4029 - Water Quality
Chemical Oxygen Demand (COD) (Dichromate Reflux Method) (Titrimetric, Mid-Level)	1-P-QM-WI -9011644	Analysis 0234	4029 - Water Quality
Biochemical Oxygen Demand Determination in Waters by SM 5210 B-2001 or EPA 405.1	1-P-QM-WI -9011645	Analysis 0235	4029 - Water Quality
Free Carbon Dioxide (Calculation)	1-P-QM-WI -9011647	Analysis 0238	4029 - Water Quality
Chlorine Residual by 4500 Cl F-2000, or EPA 330.4	1-P-QM-WI -9011648	Analysis 0240	4029 - Water Quality
Hexavalent Chromium (Colorimetric) by SW-846 7196A	1-P-QM-WI -9011652	Analysis 0276, 10330	4029 - Water Quality
Color by 2120 B-2001, or EPA 110.2	1-P-QM-WI -9011653	Analysis 0277	4029 - Water Quality
Turbidity (Nephelometric)	1-P-QM-WI -9011654	Analysis 0279	4029 - Water Quality
pH (SW) (Electrometric)	1-P-QM-WI -9011685	Analysis 0394, 0496	4029 - Water Quality
Hexavalent Chromium in Solids (Alkaline Digestion and Analysis Methods)	1-P-QM-WI -9011687	Analysis 0425, 7825, 2432	4029 - Water Quality
Dissolved Oxygen (Membrane Electrode) by 4500 O G-2001 or EPA 360.1	1-P-QM-WI -9011688	Analysis 0428	4029 - Water Quality
Determination of Flash Point for Liquids and Solids	1-P-QM-WI -9011689	Analysis 0430	4029 - Water Quality
Acidity to pH 3.7 and pH 8.3 (Titrimetric) by EPA 305.2	1-P-QM-WI -9011691	Analysis 0475, 0476	4029 - Water Quality
Soluble Biochemical Oxygen Demand Determination in Waters by Incubation by 5210 B Modified-2001 or EPA 405.1	1-P-QM-WI -9012740	Analysis 0541	4029 - Water Quality
Ignitability of Solids	1-P-QM-WI -9012741	Analysis 0542	4029 - Water Quality
Dissolved Silica (Colorimetric) by SM4500SiO2 C-1997 or EPA 370.1	1-P-QM-WI -9012742	Analysis 0559	4029 - Water Quality
Ammonia-Nitrogen for Soils (Tritrimetric Distillation Procedure) by 4500-NH3 B/C (Modified)-1997, or EPA 350.2 (Modified)	1-P-QM-WI -9012743	Analysis 0573	4029 - Water Quality
Ammonia Nitrogen by Ion-Selective Electrode Method (ISE) in Solids by EPA 350.3 (Modified) and SM 4500-NH3B-1997	1-P-QM-WI -9012763	Analysis 10222, 10696	4029 - Water Quality

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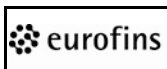
Total Suspended Solids in Waters (Gravimetric) by SM 2540 D - 1997	1-P-QM-WI -9012778	Analysis 10457	4029 - Water Quality
Hexavalent Chromium (Colorimetric) in Waters by MCP	1-P-QM-WI -9012870	Analysis 11145	4029 - Water Quality
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Hexavalent Chromium in Solids by MCP (Alkaline Digestion and Analysis Methods)	1-P-QM-WI -9012871	Analysis 11146	4029 - Water Quality
Reactivity	1-P-QM-WI -9013027	Analysis 1121	4029 - Water Quality
Reactive Sulfide	1-P-QM-WI -9013032	Analysis 1122	4029 - Water Quality
Chloride (Titrimetric Determination) by SM 4500-Cl C-1997	1-P-QM-WI -9013035	Analysis 1124	4029 - Water Quality
Sulfate (turbidimetric) in Waters	1-P-QM-WI -9013037	Analysis 1125	4029 - Water Quality
Analysis of Conductivity, Alkalinity, pH, Temperature of pH, Fluoride, Turbidity, Total Hardness, Carbonate, Bicarbonate, and Ammonia by Either Man-Tech Multi-Parameter System or Manual Technique	1-P-QM-WI -9013112	Analysis 12145, 12146, 12147, 12148, 12149, 12150, 12151, 12152, 12677, 12678, 12679	4029 - Water Quality
Specific Conductance (Solids) by SW-846 9050 (Modified), EPA 120.1 (Modified) or 2510B-1997	1-P-QM-WI -9013113	Analysis 1215	4029 - Water Quality
Sulfide Titration for Water by 4500 S2 F-2000, EPA 376.1, or SW-846 Method 9034	1-P-QM-WI -9013125	Analysis 1333	4029 - Water Quality
Carbonaceous Biochemical Oxygen Demand Determination in Waters by SM 5210 B-2001	1-P-QM-WI -9013128	Analysis 1364	4029 - Water Quality
pH (CLP) (Electrometric)	1-P-QM-WI -9013130	Analysis 1441	4029 - Water Quality
#1443 Specific Gravity by SM 2710 F #6569 Bulk Density by ASTM E868-82 Sec 9.9 Modified	1-P-QM-WI -9013131	Analysis 1443, 6569	4029 - Water Quality
Low-Level Hexavalent Chromium (colorimetric) by 3500-Cr B-2009	1-P-QM-WI -9013132	Analysis 1446	4029 - Water Quality
Bellack Distillation for Fluoride in Waters and Solids by SM 4500 F B-1997 or EPA 340.1 Procedure 6.1	1-P-QM-WI -9013133	Analysis 1448	4029 - Water Quality
Chemical Oxygen Demand (COD) in Waters (Dichromate Reflux Method) (Titrimetric, Low-Level)	1-P-QM-WI -9013143	Analysis 1553	4029 - Water Quality
Acid Volatile Sulfide in Solids	1-P-QM-WI -9013392	Analysis 1630	4029 - Water Quality
Paint Filter Liquids Test (Free Liquids Test)	1-P-QM-WI -9013402	Analysis 1820	4029 - Water Quality
Oxidation-Reduction Potential	1-P-QM-WI -9013403	Analysis 1821	4029 - Water Quality
Hexavalent Chromium in Solids by CTRCP (Alkaline Digestion and Analysis Methods)	1-P-QM-WI -9013409	Analysis 1962, 7825	4029 - Water Quality
Hexavalent Chromium (Colorimetric) in Waters by CTRCP	1-P-QM-WI -9013410	Analysis 1968	4029 - Water Quality
Percent Solids for GC/MS	1-P-QM-WI -9013444	Analysis 2365	4029 - Water Quality
n-Hexane Extractable Material (HEM) in Solids and Silica Gel Treated n-Hexane Extractable Material (SGT-HEM)	1-P-QM-WI -9013456	Analysis 2562, 6598	4029 - Water Quality
Chemical Oxygen Demand (COD) (Dichromatic Reflux Method) (Colorimetric)	1-P-QM-WI -9013470	Analysis 4001	4029 - Water Quality
Total Acidity for Wastewater by SM 2310 B-1997 or EPA 305.1	1-P-QM-WI -9013474	Analysis 4530	4029 - Water Quality
Total Dissolved Solids by 2540 C	1-P-QM-WI -9014026	Analysis 6649	4029 - Water Quality
Moisture (Gravimetric), Total Residue (#0521), Volatile Residue (#0522), Total Fixed Residue/Ash (#1029) by SM 2540 G-1997 or SM 2540 E-1997	1-P-QM-WI -9014030	Analysis 6866, 0521, 0522, 1029	4029 - Water Quality
Particle Size Distribution of Soils and Solids/Grain Size Classification by ASTM D422	1-P-QM-WI -9014165	Analysis 7103, 11601, 11604	4029 - Water Quality

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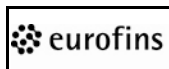
Hexane Extractable Material (HEM) and Silica Gel Treated Hexane Extractable Materials (SGT-HEM) in Waters by EPA Method 1664A and EPA Method 1664B	1-P-QM-WI -9014492	Analysis 8079, 8078, 0612	4029 - Water Quality
Ferrous Iron By Method 3500-Fe B (Modified) - 1997	1-P-QM-WI -9015060	Analysis 8344, 10328	4029 - Water Quality
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Client Specific - Hexavalent Chromium in Waters (Colorimetric) (Department of Defense)	1-P-QM-WI -9015113	Analysis DOD - 10678	4029 - Water Quality
Client Specific - Hexavalent Chromium in Solids by Alkaline Digestion and Analysis Methods (Department of Defense)	1-P-QM-WI -9015114	Analysis DOD - 10679, 7825	4029 - Water Quality
Digestion Procedure for the Determination of Hexavalent Chromium (Cr VI) Digestion of Non-aqueous Samples by Method SW-846 3060A for OH VAP	1-P-QM-WI -9022448	Analysis 7825 OH VAP	4029 - Water Quality
Calibration of Pressure Gauges	1-P-QM-PRO-9015391	DOD - MC-AL-002	4030 - Volatiles in Air
Routine Instrument Maintenance for Volatiles in Air by GC and GC/MS	1-P-QM-PRO-9015392	DOD - MC-AL-003	4030 - Volatiles in Air
Cleaning and Handling of Summa Canisters	1-P-QM-PRO-9015431	DOD - SOP-AL-001	4030 - Volatiles in Air
Cleaning and Handling of Flow Controllers	1-P-QM-PRO-9015432	DOD - SOP-AL-002	4030 - Volatiles in Air
Volatiles in Air Audit Process	1-P-QM-PRO-9015433	DOD - SOP-AL-003	4030 - Volatiles in Air
Procedure for Compositing Samples from a Tedlar Bag	1-P-QM-PRO-9017689	SOP-AL-004	4030 - Volatiles in Air
Preparing Summa Can Order	1-P-QM-PRO-9017690	SOP-AL-005	4030 - Volatiles in Air
Oxygen and Carbon Dioxide in Air	1-P-QM-WI -9011592	Analysis 0034	4030 - Volatiles in Air
Volatiles in Air Tentatively Identified Compound Method (Interpretive)	1-P-QM-WI -9012747	Analysis 0888	4030 - Volatiles in Air
Helium as a Tracer Gas	1-P-QM-WI -9012770	Analysis 10341	4030 - Volatiles in Air
The Automated Determination of Volatile Organic Compounds in Air Collected in Specially Treated Canisters Using Cryogenic Preconcentration and Gas Chromatography with Mass Selective Detection Using NJDEP Modified Low Level Method TO-15	1-P-QM-WI -9012799	Analysis 10734	4030 - Volatiles in Air
Analysis of Air for Selected Volatile Organic Compounds by Gas Chromatography with Flame Ionization Detector and Photoionization Detector for Louisiana RECAP Vapor Evaluation	1-P-QM-WI -9014029	Analysis 6820	4030 - Volatiles in Air
Volatiles in Air Tentatively Identified Compound Method	1-P-QM-WI -9014034	Analysis 6900	4030 - Volatiles in Air
The Determination of Volatile Organic Compounds in Air Collected in Summa Canisters or Tedlar Bags Using Cryogenic Preconcentration and GC/MS Detection Using EPA Method TO-14 or TO-15	1-P-QM-WI -9015155	Analysis DOD - 5265, 5298, 0015, 0037, 7199, 7869	4030 - Volatiles in Air
Analysis of Air for Selected Volatile Organic Compounds by Gas Chromatography with Flame Ionization Detector and Photo Using EPA Method 18 and 25	1-P-QM-WI -9015177	Analysis DOD - 7090	4030 - Volatiles in Air
SIM Analysis of Low-Level Volatile Organic Compounds in Air Collected in Specially Treated Canisters or Tedlar Bags Using Cryogenic Preconcentration and Gas Chromatography with SIM Mass Selective Detection Using EPA Method TO-15	1-P-QM-WI -9015182	Analysis DOD - 7345	4030 - Volatiles in Air
Collecting Water Samples for Regulatory Purposes	1-P-QM-PRO-9015458	DOD - SOP-FS-012	4031 - Field Sampling
Calibration, Operation and Maintenance of pH Probes and Meters	1-P-QM-PRO-9017426	MC-FS-002	4031 - Field Sampling

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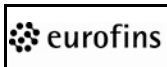
Wastewater Field Sampling Procedures	1-P-QM-PRO-9017757	SOP-FS-002	4031 - Field Sampling
Soil Sampling Procedures	1-P-QM-PRO-9017758	SOP-FS-003	4031 - Field Sampling
Collecting Potable Water Samples	1-P-QM-PRO-9017759	SOP-FS-004	4031 - Field Sampling
Groundwater Monitoring Sampling Procedure	1-P-QM-PRO-9017760	SOP-FS-006	4031 - Field Sampling
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Direct Field Readings Using Orion Model 1230 Multi-Parameter Meter	1-P-QM-PRO-9017761	SOP-FS-008	4031 - Field Sampling
Symphony Multi-Parameter Meter	1-P-QM-PRO-9017762	SOP-FS-009	4031 - Field Sampling
Low Level Mercury Sampling	1-P-QM-PRO-9017763	SOP-FS-010	4031 - Field Sampling
Performing Free Chlorine Residual Readings	1-P-QM-PRO-9017764	SOP-FS-011	4031 - Field Sampling
Sampling Swimming Pool Water	1-P-QM-PRO-9018291	SOP-TR-003	4031 - Field Sampling
Maintenance and Troubleshooting Procedures for GC-FID Instrumentation	1-P-QM-PRO-9015447	DOD - SOP-EP-006	4032 - EPH/Misc. GC
Common Equations Used During Chromatographic Analyses	1-P-QM-PRO-9015448	DOD - SOP-EP-008	4032 - EPH/Misc. GC
QC Data Acceptability and Corrective Action	1-P-QM-PRO-9015449	DOD - SOP-EP-009	4032 - EPH/Misc. GC
Monitoring QC Data Acceptance Limits	1-P-QM-PRO-9015450	DOD - SOP-EP-010	4032 - EPH/Misc. GC
Interpretation and Integration of Chromatographic Data	1-P-QM-PRO-9015451	DOD - SOP-EP-011	4032 - EPH/Misc. GC
Using "Range Compound Analysis" Software for Range Data Acquisition	1-P-QM-PRO-9017817	SOP-OR-082	4032 - EPH/Misc. GC
GC Routine and Nonroutine Maintenance for Instrumentation Used for VPH Analysis	1-P-QM-PRO-9023979	N/A	4032 - EPH/Misc. GC
Extraction of Solids/Soils for Analysis of Alcohols by Method 8015B	1-P-QM-WI -9011684	Analysis 0380	4032 - EPH/Misc. GC
Silica Gel Fractionation for Hydrocarbons by GC in Soil and Water Matrices	1-P-QM-WI -9012711	Analysis 0497	4032 - EPH/Misc. GC
CCWE Water Miscible Solvents	1-P-QM-WI -9012748	Analysis 0969	4032 - EPH/Misc. GC
Determination of Terphenyls by Method 8015B in Water and Solids Using GC-FID	1-P-QM-WI -9012769	Analysis 10318, 10319	4032 - EPH/Misc. GC
Hydrocarbon Oil Index by ISO Method 9377-2:2000	1-P-QM-WI -9012775	Analysis 10441	4032 - EPH/Misc. GC
Separatory Funnel Extraction of Hydrocarbon Oil Index in Waters	1-P-QM-WI -9012776	Analysis 10442	4032 - EPH/Misc. GC
Client Specific - Method for the Determination of Extractable Petroleum Hydrocarbons by New Jersey Protocol (NJEPH) using GC-FID	1-P-QM-WI -9012863	Analysis 10967, 10973	4032 - EPH/Misc. GC
Client Specific - Microwave Extraction Procedure for the Determination of Extractable Petroleum Hydrocarbons (EPH) in a Solid Matrix by New Jersey Protocol	1-P-QM-WI -9012864	Analysis 10979, 11990	4032 - EPH/Misc. GC
Extraction Procedure for Wisconsin DRO Soils and Solid Waste	1-P-QM-WI -9012868	Analysis 11029	4032 - EPH/Misc. GC
Client Specific - Separatory Funnel Extraction Procedure for the Determination of Diesel Range Organics in a Water or Wastewater Matrix by Maine Methodology	1-P-QM-WI -9013014	Analysis 11165	4032 - EPH/Misc. GC
Separatory Funnel Extraction Procedure for the Determination of Diesel Range Organics in a Water or Wastewater Matrix by Wisconsin Protocol	1-P-QM-WI -9013015	Analysis 11166	4032 - EPH/Misc. GC
Extraction Procedure for the Determination of Diesel Range Organics in a Water or Wastewater Matrix by Oklahoma Methodology	1-P-QM-WI -9013016	Analysis 11168	4032 - EPH/Misc. GC
Client Specific - Separatory Funnel Extraction Procedure for the Determination of Total Petroleum Hydrocarbon Organics in a Water or	1-P-QM-WI -9013017	Analysis 11170	4032 - EPH/Misc. GC

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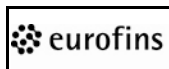
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Wastewater Matrix by FL-PRO			
Separatory Funnel Extraction Procedure for the Determination of Extractable Petroleum Hydrocarbons in a Water or Wastewater Matrix by Montana Protocol	1-P-QM-WI -9013018	Analysis 11174, 11243	4032 - EPH/Misc. GC

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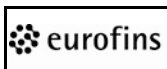
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Client Specific - Separatory Funnel Extraction Procedure for the Determination of Extractable Petroleum Hydrocarbons in a Water Matrix by Washington Methodology	1-P-QM-WI -9013019	Analysis 11175	4032 - EPH/Misc. GC
Extraction Procedure for the Determination of Total Petroleum Hydrocarbons in a Water or Wastewater Matrix by Connecticut Methodology	1-P-QM-WI -9013020	Analysis 11178	4032 - EPH/Misc. GC
Client Specific - Separatory Funnel Extract Procedure for the Determination of Extractable Petroleum Hydrocarbons (EPH) in a Water or Wastewater Matrix by Tennessee Methodology	1-P-QM-WI -9013021	Analysis 11179	4032 - EPH/Misc. GC
Separatory Funnel Extraction Procedure for the Determination of Diesel Range Organics in a Water Matrix by Alaska 102/103	1-P-QM-WI -9013022	Analysis 11184, 11185, 11242, 13027, 13030	4032 - EPH/Misc. GC
Client Specific - Extraction Procedure for the Determination of Total Petroleum Hydrocarbon Organics in a Water or Wastewater Matrix by Texas Methodology	1-P-QM-WI -9013023	Analysis 11192	4032 - EPH/Misc. GC
Client Specific - Sonication Extraction Procedure for the Determination of Diesel Organics in Soil or Solid Matrix Oklahoma Methodology	1-P-QM-WI -9013024	Analysis 11206	4032 - EPH/Misc. GC
Client Specific - Sonication Extraction Procedure for the Determination of Diesel Range Organics in Soil or Solid Matrix California Methodology	1-P-QM-WI -9013025	Analysis 11207, 11214	4032 - EPH/Misc. GC
Sonic Probe Extraction Procedure for the Determination of Total Petroleum Hydrocarbon Organics in Soil or Solid Matrix Florida Methodology	1-P-QM-WI -9013026	Analysis 11208	4032 - EPH/Misc. GC
Client Specific - Microwave Extraction Procedure for the Determination of Extractable Petroleum Hydrocarbons in a Solid Matrix by Montana Protocol	1-P-QM-WI -9013028	Analysis 11212	4032 - EPH/Misc. GC
Client Specific - Microwave Extraction Procedure for the Determination of Extractable Petroleum Hydrocarbons in a Solid Matrix by Washington Protocol	1-P-QM-WI -9013029	Analysis 11213	4032 - EPH/Misc. GC
Client Specific - Sonic Probe Extraction for the Determination of Extractable Total Petroleum Hydrocarbons in Soil or Solid Matrix Connecticut Methodology	1-P-QM-WI -9013030	Analysis 11216	4032 - EPH/Misc. GC
Sonic Probe Extraction Procedure for the Determination of Extractable Petroleum Hydrocarbons in Soil or Solid Matrix Tennessee Methodology	1-P-QM-WI -9013031	Analysis 11217	4032 - EPH/Misc. GC
Client Specific - Extraction Procedure for the Determination of Total Petroleum Hydrocarbons in a Soil or Solid Matrix by Texas Methodology	1-P-QM-WI -9013033	Analysis 11230, 11244	4032 - EPH/Misc. GC
Total Saturated Hydrocarbons by Method 8015C in Waters and Solids using GC/FID	1-P-QM-WI -9013038	Analysis 11507, 11554	4032 - EPH/Misc. GC
Extraction of Soils/Solids for Glycol Analysis	1-P-QM-WI -9013039	Analysis 11551	4032 - EPH/Misc. GC
Alumina Column Cleanup of Solids	1-P-QM-WI -9013040	Analysis 11599, 11600	4032 - EPH/Misc. GC
Waste Dilution for the Determination of Saturated Hydrocarbons in an Oil Matrix	1-P-QM-WI -9013051	Analysis 11657	4032 - EPH/Misc. GC
10g Silica Gel Cleanup for Hydrocarbons by GC in Soil and Water Matrices	1-P-QM-WI -9013055	Analysis 11681	4032 - EPH/Misc. GC
Microextraction by Method 3511 for the Determination of Diesel Range Organics in Water	1-P-QM-WI -9013110	Analysis 12059, 12866, 12895, 12896, 12897, 12898	4032 - EPH/Misc. GC

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Client Specific - Total Extractable Hydrocarbons (TEH) by Method 8015B Modified Using GC-FID	1-P-QM-WI -9013137	Analysis 1464, 1469, 10007	4032 - EPH/Misc. GC
Analysis of DRO/RRO by Alaska 102/103 in Waters and Soils	1-P-QM-WI -9013394	Analysis 1738, 1741, 1742, 2238, 2244, 2245, 2923	4032 - EPH/Misc. GC
Qualitative/Quantitative GC Fingerprint by 8015B Mod/ 8015C Mod/ or 8015D Mod	1-P-QM-WI -9013412	Analysis 2012, 2535	4032 - EPH/Misc. GC
Determination of Petroleum Range Organics in Waters and Solids using FL-PRO	1-P-QM-WI -9013420	Analysis 0347, 0359, 2099, 2100	4032 - EPH/Misc. GC
Method for the Determination of Extractable Petroleum Hydrocarbons by GC/FID using OA-2 Iowa/Missouri Protocol for Waters and Soils	1-P-QM-WI -9013421	Analysis 2110, 2112	4032 - EPH/Misc. GC
Separatory Funnel Extraction Method ECY 97-602 NWTPH-DX for TPH in a Water or Wastewater Matrix	1-P-QM-WI -9013424	Analysis 2135, 11197, 12007, 12119, 12120, 12907, 12916, 12924	4032 - EPH/Misc. GC
Client Specific - Microwave Extraction for the Determination of Extractable Petroleum Hydrocarbons (EPH) in a Solid Matrix by Massachusetts Protocol	1-P-QM-WI -9013429	Analysis 2168, 11235	4032 - EPH/Misc. GC
Quick Silica Gel Cleanup for Hydrocarbons by GC in Solid and Water Matrices	1-P-QM-WI -9013430	Analysis 2176	4032 - EPH/Misc. GC
Client Specific - TNRCC TX Method 1005 - Total Petroleum Hydrocarbons (Gasoline Range, Diesel Range, and Extended Range Organics)	1-P-QM-WI -9013442	Analysis 2318, 2321	4032 - EPH/Misc. GC
PMI Volatile Organic Compounds by Direct Injection GC/FID	1-P-QM-WI -9013445	Analysis 2366, 2380	4032 - EPH/Misc. GC
Client Specific - Separatory Funnel Extraction Procedure for the Determination of Diesel Range Organics in a Water or Wastewater Matrix by California Methodology	1-P-QM-WI -9013446	Analysis 2376, 11169, 11180, 11187, 11188, 11198, 11199	4032 - EPH/Misc. GC
TPH by CT ETPH	1-P-QM-WI -9013462	Analysis 2768, 2769	4032 - EPH/Misc. GC
Client Specific - TPH by TN EPH in Water and Soil using GC/FID	1-P-QM-WI -9013463	Analysis 2784, 2785	4032 - EPH/Misc. GC
Client Specific - Method for the Determination of Extractable Petroleum Hydrocarbons by Massachusetts Protocol (MAEPH)	1-P-QM-WI -9013971	Analysis 5331, 5332, 5944, 5949, 5968, 5969	4032 - EPH/Misc. GC
VPH in Waters and Solids Using GC-FID by Method ECY 97-602 WA VPH	1-P-QM-WI -9013982	Analysis 5665, 5666	4032 - EPH/Misc. GC
EPH in Waters and Solids Using GC-FID by Method ECY97-602 WA EPH	1-P-QM-WI -9013990	Analysis 5979, 5970	4032 - EPH/Misc. GC
Client Specific - TNRCC TX Method 1006 Characterization of C6-C35 Petroleum Hydrocarbons in Environmental Samples	1-P-QM-WI -9013996	Analysis 6091, 6104	4032 - EPH/Misc. GC
Determination of the Volatile Organic Concentration of Waste Samples by FID and ELCD	1-P-QM-WI -9014040	Analysis 7001	4032 - EPH/Misc. GC
Sonic Probe Extraction for TPH in Solids by Washington DX	1-P-QM-WI -9014041	Analysis 7024, 11234, 12008, 12117, 12118	4032 - EPH/Misc. GC
Client Specific - Separatory Funnel Extraction Procedure for the Determination of Extractable Petroleum Hydrocarbons in a Water or Wastewater Matrix by Massachusetts or New Jersey Protocol	1-P-QM-WI -9014170	Analysis 7326, 10980, 11200 MA/LA/NJ	4032 - EPH/Misc. GC
Analysis for TPH-DRO (Diesel Range Organics) in Soils or Waters by Wisconsin DRO Methodology	1-P-QM-WI -9014172	Analysis 7553, 7554	4032 - EPH/Misc. GC
TPH DRO (Diesel Range Organics) by Oklahoma DEQ Method	1-P-QM-WI -9014308	Analysis 7784, 7785, 10024, 10027	4032 - EPH/Misc. GC
TPH by NWTPH-Dx (modified) in Waters using GC-FID	1-P-QM-WI -9015026	Analysis 8271, 2211, 12005	4032 - EPH/Misc. GC

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TPH by NWTPH-Dx (modified) in Soils using GC-FID	1-P-QM-WI -9015027	Analysis 8272, 2214, 12006	4032 - EPH/Misc. GC
Analysis of Glycols in Waters by Method 8015B or 8015C	1-P-QM-WI -9015028	Analysis 8278, 11099, 12926	4032 - EPH/Misc. GC
Analysis of Glycols in Soils by Method 8015B	1-P-QM-WI -9015029	Analysis 8283	4032 - EPH/Misc. GC
Method for the Determination of Fractionated Extractable Petroleum Hydrocarbons using LA RECAP Ranges	1-P-QM-WI -9015030	Analysis 8323, 8324, 6976, 7062	4032 - EPH/Misc. GC
Client Specific - MA VPH Analysis of Water and Soil Samples	1-P-QM-WI -9015061	Analysis 8754, 8765, 5869, 5988, 6629, 6630, 10886, 10889	4032 - EPH/Misc. GC
TPH-DRO by 8015C/8015D in Water using GC-FID (Diesel Range Organics)	1-P-QM-WI -9015111	Analysis DOD - 10600	4032 - EPH/Misc. GC
TPH-DRO by 8015C/8015D in Solids using GC-FID (Diesel Range Organics)	1-P-QM-WI -9015112	Analysis DOD - 10601, 12838	4032 - EPH/Misc. GC
Microwave Extraction for the Determination of Diesel Range Organics (DRO) and Saturated Hydrocarbons in a Solid Matrix	1-P-QM-WI -9015120	Analysis DOD - 10942, 11509	4032 - EPH/Misc. GC
Sonication Extraction Procedure for the Determination of Diesel Organics in Soil or Solid Matrix by Alaska Methodology	1-P-QM-WI -9015123	Analysis DOD - 11222, 11223, 11239, 11248	4032 - EPH/Misc. GC
Sonic Disruption Extraction Procedure for the Determination of GC Fingerprint on Petroleum Products in Soil or Solid Matrix	1-P-QM-WI -9015151	Analysis DOD - 4833, 11227	4032 - EPH/Misc. GC
TPH by GC-FID and TPH by Custom 8015B	1-P-QM-WI -9015154	Analysis DOD - 5256, 5260, 8734, 8735	4032 - EPH/Misc. GC
Water Miscible Solvents by Method 8015B/8015C/8015D Using GC-FID	1-P-QM-WI -9015169	Analysis DOD - 6624, 10501, 10603, 10604	4032 - EPH/Misc. GC
Separatory Funnel Extraction Method 3510C for DRO in Water or Wastewater	1-P-QM-WI -9015175	Analysis DOD - 7003, 10304, 11164, 11167, 11171, 11172, 11176, 11177, 11181, 11183, 11189, 11190, 11191, 11195, 11196, 11201, 11203, 11596, 12820, 12906, 12915, 12923, 13095	4032 - EPH/Misc. GC
Sonication Extraction Method 3550C for DRO in Soils or Solids	1-P-QM-WI -9015176	Analysis DOD - 7004, 10303, 11204, 11205, 11209, 11215, 11218, 11219, 11225, 11228, 11229, 11233, 11236, 11237, 11238, 13097	4032 - EPH/Misc. GC
Volatile Hydrocarbons in Water by Method RSK-175 Modified and SW-846 8015 Using Headspace Sampling Techniques and GC-FID	1-P-QM-WI -9015178	Analysis DOD - 7105, 10602	4032 - EPH/Misc. GC
Analysis of Total Petroleum Hydrocarbons with Ranges by GC-FID, Based on Method 8015B	1-P-QM-WI -9015186	Analysis DOD - 8093, 8107, 2500, 2516, 2729, 2740, 0071, 0072, 0965, 1020, 6631, 6635, 10199, 10365	4032 - EPH/Misc. GC
Determination of Carbon Dioxide in Water Using Headspace Sampling Techniques and Gas Chromatography with Thermal Conductivity Detection (GC-TCD)	1-P-QM-WI -9015187	Analysis DOD - 8097	4032 - EPH/Misc. GC
TPH-DRO by 8015B in Solids using GC-FID (Diesel Range Organics)	1-P-QM-WI -9015191	Analysis DOD - 1104, 2222, 5868, 6901, 6902, 8270, 8345, 10941, 12831	4032 - EPH/Misc. GC

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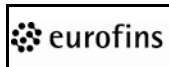
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TPH-DRO by 8015B in Water using GC-FID (Diesel Range Organics)	1-P-QM-WI -9020088	1070, 1737, 2216, 2251, 5867, 6609, 6610, 6884, 6885, 6912, 6913, 8269, 8349, 11918, 12680, 12816	4032 - EPH/Misc. GC
Silica Gel Column Cleanup for Hydrocarbons by GC in Aqueous Matrices	1-P-QM-WI -9020897	Analysis 12894	4032 - EPH/Misc. GC
Analysis of DRO/TPH by 8015B or NWTPH-Dx (Modified) in Waters using Microextraction and GC-FID	1-P-QM-WI -9020899	Analysis 12858, 12872, 12879	4032 - EPH/Misc. GC
Analysis of DRO by 8015B and TPH by NWTPH-DX (Modified) in Water using Mini-Extraction and GC-FID	1-P-QM-WI -9021423	Analysis 12899, 12908, 12917	4032 - EPH/Misc. GC
3 g Silica Gel Column Cleanup for DRO	1-P-QM-WI -9021425	Analysis 12932	4032 - EPH/Misc. GC
Determination of Diesel and Residual Range Organics using Alaska 102/103 Small Volume (SV) Protocols in Aqueous Samples	1-P-QM-WI -9021778	Analysis 13025, 13028	4032 - EPH/Misc. GC
TPH-DX with Fuel Identification in Waters and Solids by NWTPH-DX	1-P-QM-WI -9023949	Analysis 12071, 12082, 12093, 12094	4032 - EPH/Misc. GC
TPH-DRO by 8015C South Carolina Methodology Using GC-FID	1-P-QM-WI -9024963	Analysis 13094, 13096	4032 - EPH/Misc. GC
Extraction of Nicotine from Tobacco Products Using the Centers for Disease Control Protocol	1-P-QM-WI -9011593	Analysis 0088	4035 - Nitrosamines
CDC Tobacco Moisture	1-P-QM-WI -9011594	Analysis 0091	4035 - Nitrosamines
Analysis of Nicotine in Tobacco by GC/FID for Smokeless Tobacco Products Using the CDC Method	1-P-QM-WI -9011595	Analysis 0097	4035 - Nitrosamines
Nitrite in Tobacco Prep	1-P-QM-WI -9013438	Analysis 2264	4035 - Nitrosamines
Nitrite Nitrogen Analysis in Tobacco	1-P-QM-WI -9013440	Analysis 2266	4035 - Nitrosamines
Extraction of Tobacco Specific N-Nitrosamines in Tobacco Filler	1-P-QM-WI -9013443	Analysis 2326LC	4035 - Nitrosamines
Nitrate in Tobacco Prep	1-P-QM-WI -9013457	Analysis 2610	4035 - Nitrosamines
Nitrate Nitrogen in Tobacco (Colorimetric, Automated Cadmium Reduction)	1-P-QM-WI -9013464	Analysis 2808	4035 - Nitrosamines
Tobacco Drying and Grinding	1-P-QM-WI -9013801	Analysis 4998	4035 - Nitrosamines
Analysis of Tobacco Specific Nitrosamines (TSNA) in Tobacco Leaf by LC/MS/MS	1-P-QM-WI -9013802	Analysis 5102	4035 - Nitrosamines
Extraction of Nicotine from Tobacco and Tobacco Products	1-P-QM-WI -9014031	Analysis 6870	4035 - Nitrosamines
Analysis of Nicotine in Tobacco by GC/FID Following Coresta 62	1-P-QM-WI -9014032	Analysis 6878	4035 - Nitrosamines
Extraction of Tobacco for Benzo[a]Pyrene	1-P-QM-WI -9014033	Analysis 6883	4035 - Nitrosamines
Column Cleanup of Tobacco for TSNAs	1-P-QM-WI -9014036	Analysis 6962	4035 - Nitrosamines
Ultrasonic Processor Maintenance and Tuning	1-P-QM-PRO-9015405	DOD - MC-OE-002	4036 - Organic Extraction
Semivolatile Extract Cleanup Using Gel Permeation Chromatography	1-P-QM-PRO-9015406	DOD - MC-OE-003	4036 - Organic Extraction
Pesticide Extract Cleanup Using Gel Permeation Chromatography	1-P-QM-PRO-9015407	DOD - MC-OE-004	4036 - Organic Extraction
Steam Bath and N-Evap Usage, Calibration and Maintenance	1-P-QM-PRO-9015408	DOD - MC-OE-007	4036 - Organic Extraction
Refrigerated Recirculators	1-P-QM-PRO-9015409	DOD - MC-OE-008	4036 - Organic Extraction
Electrothermal Heating Mantles	1-P-QM-PRO-9015410	DOD - MC-OE-009	4036 - Organic Extraction
N-Evap	1-P-QM-PRO-9015411	DOD - MC-OE-010	4036 - Organic Extraction
Glassware Cleaning for Organic Extractions	1-P-QM-PRO-9015475	DOD - SOP-OE-001	4036 - Organic Extraction
Solvent and Reagent Lot Testing for Organic	1-P-QM-PRO-9015476	DOD - SOP-OE-002	4036 - Organic Extraction

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Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)	1-P-QM-PRO-9015477	DOD - SOP-OE-004	4036 - Organic Extraction
pH Meters and Electrodes	1-P-QM-PRO-9015478	DOD - SOP-OE-005	4036 - Organic Extraction
Procedure for Containment and Clean Up of Hazardous Materials Spills in Organic Prep Lab	1-P-QM-PRO-9015479	DOD - SOP-OE-006	4036 - Organic Extraction
Determining QC Sample Volume for Organic Extractions	1-P-QM-PRO-9015480	DOD - SOP-OE-007	4036 - Organic Extraction
Scheduling Extraction Batches	1-P-QM-PRO-9015481	DOD - SOP-OE-008	4036 - Organic Extraction
Spike Solution Testing and Approval	1-P-QM-PRO-9015482	DOD - SOP-OE-009	4036 - Organic Extraction
Ultrasonic Probe Horn Cleaning	1-P-QM-PRO-9015483	DOD - SOP-OE-010	4036 - Organic Extraction
Routine Maintenance of Miele Glass Washers	1-P-QM-PRO-9015484	DOD - SOP-OE-011	4036 - Organic Extraction
Pesticide Extract Concentration Using a Zymark TurboVap II Concentration Workstation	1-P-QM-PRO-9015485	DOD - SOP-OE-012	4036 - Organic Extraction
Maintenance of Accelerated Solvent Extractor (ASE) and the Pressurized Solvent Extractor (PSE)	1-P-QM-PRO-9015486	DOD - SOP-OE-013	4036 - Organic Extraction
Glassware Cleaning using Automatic Washers for non-Organic Extraction Glassware	1-P-QM-PRO-9015487	DOD - SOP-OE-014	4036 - Organic Extraction
Semivolatile Extract Concentration Using a Zymark TurboVap II Concentration Workstation	1-P-QM-PRO-9015488	DOD - SOP-OE-015	4036 - Organic Extraction
Concentration Using a TurboVap LV Concentration Workstation	1-P-QM-PRO-9015489	DOD - SOP-OE-016	4036 - Organic Extraction
Organic Extraction Standards Storage and Handling	1-P-QM-PRO-9015490	DOD - SOP-OE-017	4036 - Organic Extraction
Maintenance and Calibration of the Microwave Accelerated Reaction System	1-P-QM-PRO-9017428	MC-OE-013	4036 - Organic Extraction
Pesticide Extract Cleanup Using Gel Permeation Chromatography for OH VAP	1-P-QM-PRO-9023663	N/A	4036 - Organic Extraction
Semivolatile Extract Cleanup Using Gel Permeation Chromatography for OH VAP	1-P-QM-PRO-9023664	N/A	4036 - Organic Extraction
Pesticides and Polychlorinated Biphenyls (PCBs) Cleanup Procedures for OH VAP	1-P-QM-PRO-9024148	N/A	4036 - Organic Extraction
Silica Gel Fractionation for Hydrocarbons by GC in Soil and Water Matrices	1-P-QM-WI -9012711	Analysis 0497	4036 - Organic Extraction
Medium Level Sonic Probe Extraction Procedure for the Determination of Pesticides and PCBs in a Solid Matrix	1-P-QM-WI -9012745	Analysis 0819M, 11144	4036 - Organic Extraction
Liquid/Liquid Extraction Procedure for the Determination of Organophosphorous Pesticides in a Wastewater Matrix	1-P-QM-WI -9012765	Analysis 10240	4036 - Organic Extraction
Separatory Funnel Extraction of Hydrocarbon Oil Index in Waters	1-P-QM-WI -9012776	Analysis 10442	4036 - Organic Extraction
Extraction Procedure for the Determination of 2-Chlorobenzalmalonitrile (CS) and 3-Quinuclidinyl Benzilate (BZ) in Water and Wastewater	1-P-QM-WI -9012779	Analysis 10475	4036 - Organic Extraction
Microwave Extraction for the Determination of Semivolatiles in a Solid Matrix	1-P-QM-WI -9012780	Analysis 10481, 11598	4036 - Organic Extraction
Client Specific - Microwave Extraction Procedure for the Determination of Extractable Petroleum Hydrocarbons (EPH) in a Solid Matrix by New Jersey Protocol	1-P-QM-WI -9012864	Analysis 10979, 11990	4036 - Organic Extraction
Solid Phase Extraction Procedure for the Determination of THPA, THPI and PA in a Water Matrix	1-P-QM-WI -9012865	Analysis 11011	4036 - Organic Extraction
Extraction Procedure for Wisconsin DRO Soils	1-P-QM-WI -9012868	Analysis 11029	4036 - Organic Extraction

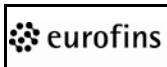
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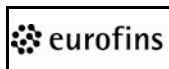
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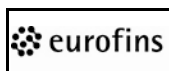
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Client Specific - Separatory Funnel Extraction Procedure for the Determination of Diesel Range Organics in a Water or Wastewater Matrix by Maine Methodology	1-P-QM-WI -9013014	Analysis 11165	4036 - Organic Extraction
Separatory Funnel Extraction Procedure for the Determination of Diesel Range Organics in a Water or Wastewater Matrix by Wisconsin Protocol	1-P-QM-WI -9013015	Analysis 11166	4036 - Organic Extraction
Extraction Procedure for the Determination of Diesel Range Organics in a Water or Wastewater Matrix by Oklahoma Methodology	1-P-QM-WI -9013016	Analysis 11168	4036 - Organic Extraction
Client Specific - Separatory Funnel Extraction Procedure for the Determination of Total Petroleum Hydrocarbon Organics in a Water or Wastewater Matrix by FL-PRO	1-P-QM-WI -9013017	Analysis 11170	4036 - Organic Extraction
Separatory Funnel Extraction Procedure for the Determination of Extractable Petroleum Hydrocarbons in a Water or Wastewater Matrix by Montana Protocol	1-P-QM-WI -9013018	Analysis 11174, 11243	4036 - Organic Extraction
Client Specific - Separatory Funnel Extraction Procedure for the Determination of Extractable Petroleum Hydrocarbons in a Water Matrix by Washington Methodology	1-P-QM-WI -9013019	Analysis 11175	4036 - Organic Extraction
Extraction Procedure for the Determination of Total Petroleum Hydrocarbons in a Water or Wastewater Matrix by Connecticut Methodology	1-P-QM-WI -9013020	Analysis 11178	4036 - Organic Extraction
Client Specific - Separatory Funnel Extract Procedure for the Determination of Extractable Petroleum Hydrocarbons (EPH) in a Water or Wastewater Matrix by Tennessee Methodology	1-P-QM-WI -9013021	Analysis 11179	4036 - Organic Extraction
Separatory Funnel Extraction Procedure for the Determination of Diesel Range Organics in a Water Matrix by Alaska 102/103	1-P-QM-WI -9013022	Analysis 11184, 11185, 11242, 13027, 13030	4036 - Organic Extraction
Client Specific - Extraction Procedure for the Determination of Total Petroleum Hydrocarbon Organics in a Water or Wastewater Matrix by Texas Methodology	1-P-QM-WI -9013023	Analysis 11192	4036 - Organic Extraction
Client Specific - Sonication Extraction Procedure for the Determination of Diesel Organics in Soil or Solid Matrix Oklahoma Methodology	1-P-QM-WI -9013024	Analysis 11206	4036 - Organic Extraction
Client Specific - Sonication Extraction Procedure for the Determination of Diesel Range Organics in Soil or Solid Matrix California Methodology	1-P-QM-WI -9013025	Analysis 11207, 11214	4036 - Organic Extraction
Sonic Probe Extraction Procedure for the Determination of Total Petroleum Hydrocarbon Organics in Soil or Solid Matrix Florida Methodology	1-P-QM-WI -9013026	Analysis 11208	4036 - Organic Extraction
Client Specific - Microwave Extraction Procedure for the Determination of Extractable Petroleum Hydrocarbons in a Solid Matrix by Montana Protocol	1-P-QM-WI -9013028	Analysis 11212	4036 - Organic Extraction
Client Specific - Microwave Extraction Procedure for the Determination of Extractable Petroleum Hydrocarbons in a Solid Matrix by Washington Protocol	1-P-QM-WI -9013029	Analysis 11213	4036 - Organic Extraction

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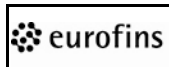
Client Specific - Sonic Probe Extraction for the Determination of Extractable Total Petroleum Hydrocarbons in Soil or Solid Matrix Connecticut Methodology	1-P-QM-WI -9013030	Analysis 11216	4036 - Organic Extraction
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Sonic Probe Extraction Procedure for the Determination of Extractable Petroleum Hydrocarbons in Soil or Solid Matrix Tennessee Methodology	1-P-QM-WI -9013031	Analysis 11217	4036 - Organic Extraction
Client Specific - Extraction Procedure for the Determination of Total Petroleum Hydrocarbons in a Soil or Solid Matrix by Texas Methodology	1-P-QM-WI -9013033	Analysis 11230, 11244	4036 - Organic Extraction
Alumina Column Cleanup of Solids	1-P-QM-WI -9013040	Analysis 11599, 11600	4036 - Organic Extraction
Liquid/Liquid Extraction Procedure for the Determination of Neutral Extractables in a Wastewater Matrix	1-P-QM-WI -9013043	Analysis 11629	4036 - Organic Extraction
Waste Dilution for the Determination of Saturated Hydrocarbons in an Oil Matrix	1-P-QM-WI -9013051	Analysis 11657	4036 - Organic Extraction
10g Silica Gel Cleanup for Hydrocarbons by GC in Soil and Water Matrices	1-P-QM-WI -9013055	Analysis 11681	4036 - Organic Extraction
Soxhlet Extraction Procedure for the Determination of Polychlorinated Biphenyls (PCBs) in a Solid Matrix	1-P-QM-WI -9013065	Analysis 11696	4036 - Organic Extraction
Microextraction by Method 3511 for the Determination of Diesel Range Organics in Water	1-P-QM-WI -9013110	Analysis 12059, 12866, 12895, 12896, 12897, 12898	4036 - Organic Extraction
Passive In-Situ Chemical Extraction Sampler (PISCES) Procedure for the Determination of Polychlorinated Biphenyls (PCBs)	1-P-QM-WI -9013121	Analysis 12801	4036 - Organic Extraction
Extraction Procedure for the Determination of Carbamate and Urea Pesticides in a Soil or Solid Waste Matrix	1-P-QM-WI -9013140	Analysis 1510, 11143	4036 - Organic Extraction
Separatory Funnel Extraction Method ECY 97-602 NWT PH-DX for TPH in a Water or Wastewater Matrix	1-P-QM-WI -9013424	Analysis 2135, 11197, 12007, 12119, 12120, 12907, 12916, 12924	4036 - Organic Extraction
Client Specific - Microwave Extraction for the Determination of Extractable Petroleum Hydrocarbons (EPH) in a Solid Matrix by Massachusetts Protocol	1-P-QM-WI -9013429	Analysis 2168, 11235	4036 - Organic Extraction
Quick Silica Gel Cleanup for Hydrocarbons by GC in Solid and Water Matrices	1-P-QM-WI -9013430	Analysis 2176	4036 - Organic Extraction
Client Specific - Separatory Funnel Extraction Procedure for the Determination of Diesel Range Organics in a Water or Wastewater Matrix by California Methodology	1-P-QM-WI -9013446	Analysis 2376, 11169, 11180, 11187, 11188, 11198, 11199	4036 - Organic Extraction
Extraction of Chlorinated Herbicides in a Soil Matrix	1-P-QM-WI -9013472	Analysis 4181	4036 - Organic Extraction
Soxhlet Extraction Procedure for the Determination of Pesticides in a Solid Matrix	1-P-QM-WI -9013991	Analysis 6006SOX	4036 - Organic Extraction
Separatory Funnel Extraction Procedure for the Determination of Chlorinated Pesticides; Nitrogen and Phosphorus Containing Pesticides; and PCBs in a Drinking Water Matrix	1-P-QM-WI -9014001	Analysis 6368, 11127	4036 - Organic Extraction
Extraction of Chlorinated Acids and Herbicides in Drinking Water by Method 515.1	1-P-QM-WI -9014002	Analysis 6369	4036 - Organic Extraction
Sonic Probe Extraction for TPH in Solids by Washington DX	1-P-QM-WI -9014041	Analysis 7024, 11234, 12008, 12117, 12118	4036 - Organic Extraction
Client Specific - Separatory Funnel Extraction Procedure for the Determination of	1-P-QM-WI -9014170	Analysis 7326, 10980, 11200 MA/LA/NJ	4036 - Organic Extraction

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Extractable Petroleum Hydrocarbons in a Water or Wastewater Matrix by Massachusetts or New Jersey Protocol			
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Microextraction of 1,2-Dibromoethane (EDB), 1,2-Dibromo-3-chloropropane (DBCP), and 1,2,3-Trichloropropane (TCP), in Water	1-P-QM-WI -9014309	Analysis 7786	4036 - Organic Extraction
Low-Level Sonication Extraction Procedure for the Determination of Polynuclear Aromatic Hydrocarbons (PAHs) in a Solid Matrix by GC/MS	1-P-QM-WI -9014490	Analysis 7806	4036 - Organic Extraction
Extraction Procedure for the Determination of PAHs in an XAD Air Tube Sample by TO-15A	1-P-QM-WI -9014491	Analysis 7806AIR	4036 - Organic Extraction
Low-Level Sonic Probe Extraction Procedure by Method 3550C for the Determination of Semivolatiles in a Solid Matrix	1-P-QM-WI -9015070	Analysis DOD - 0381, 10478, 10480, 10483, 10486, 10487L	4036 - Organic Extraction
Waste Dilution Procedure for the Determination of Acid Extractables and Base-Neutrals in a Non-Water Soluble Matrix	1-P-QM-WI -9015071	Analysis DOD - 0381DIL	4036 - Organic Extraction
Separatory Funnel Extraction Procedure for the Determination of Base-Neutrals and Acid Extractables in a Wastewater Matrix by SW-846 Method 3510C	1-P-QM-WI -9015076	Analysis DOD - 0813, 11010, 11015, 10464, 10467, 10476	4036 - Organic Extraction
Waste Dilution Procedure for the Determination of PCBs in Oil	1-P-QM-WI -9015077	Analysis DOD - 0815	4036 - Organic Extraction
Extraction of Chlorinated Herbicides in a Water Matrix by SW-846 8151A	1-P-QM-WI -9015078	Analysis DOD - 0816, 11110, 11111	4036 - Organic Extraction
Separatory Funnel Extraction Procedure for the Determination of Pesticides and PCBs in a Wastewater Matrix	1-P-QM-WI -9015079	Analysis DOD - 0817, 6654, 10241, 11112, 11113, 11114, 11116, 11117, 11118, 11119, 11120, 11121, 11123, 11126, 11960	4036 - Organic Extraction
Waste Dilution Procedure for the Determination of Pesticides and PCBs in a Non-Water Soluble Leachate Matrix	1-P-QM-WI -9015080	Analysis DOD - 11114DIL	4036 - Organic Extraction
Sonic Probe Extraction Procedure for the Determination of Polychlorinated Biphenyls (PCBs) in a Solid Matrix	1-P-QM-WI -9015081	Analysis DOD - 0819, 11128, 11132, 11135	4036 - Organic Extraction
Sampling Equipment Cleaning and Validation for Metals Analysis	1-P-QM-WI -9015089	Analysis DOD - 10068	4036 - Organic Extraction
Extraction Procedure for the Determination of Formaldehyde and Aldehydes in a Water Matrix	1-P-QM-WI -9015090	Analysis DOD - 1013	4036 - Organic Extraction
Liquid/Liquid Extraction Procedure for the Determination of Base-Neutrals and Acid Extractables in a Wastewater Matrix by Method 8270	1-P-QM-WI -9015098	Analysis DOD - 10458	4036 - Organic Extraction
Extraction Procedure for the Determination of Tetraethyl Lead in a Water or Wastewater Matrix	1-P-QM-WI -9015101	Analysis DOD - 10472	4036 - Organic Extraction
Sonic Probe Extraction Procedure for the Determination of Semivolatiles in a Solid Matrix by SIM	1-P-QM-WI -9015102	Analysis DOD - 10479, 10484, 10489	4036 - Organic Extraction
Microwave Extraction Procedure for the Determination of Pesticides in a Solid Matrix	1-P-QM-WI -9015103	Analysis DOD - 10496, 11141	4036 - Organic Extraction
Microwave Extraction Procedure for the Determination of PCBs in a Solid Matrix	1-P-QM-WI -9015104	Analysis DOD - 10497, 11140	4036 - Organic Extraction
Microwave Extraction by Method 3546 for Semivolatiles	1-P-QM-WI -9015105	Analysis DOD - 10498, 10809, 10810, 10811, 10812, 10813, 10814, 11630, 11916	4036 - Organic Extraction

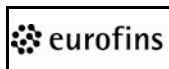
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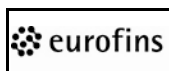
Pore Water Generation Procedure	1-P-QM-WI -9015106	Analysis DOD - 10500	4036 - Organic Extraction
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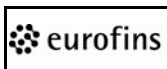
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Microwave Extraction for the Determination of Diesel Range Organics (DRO) and Saturated Hydrocarbons in a Solid Matrix	1-P-QM-WI -9015120	Analysis DOD - 10942, 11509	4036 - Organic Extraction
Separatory Funnel Extraction Procedure for the Determination of Base-Neutrals and Acid Extractables by SIM in a Wastewater Matrix	1-P-QM-WI -9015121	Analysis DOD - 11012, 10465, 10466, 10470, 10471, 11912	4036 - Organic Extraction
Sonication Extraction Procedure for the Determination of Diesel Organics in Soil or Solid Matrix by Alaska Methodology	1-P-QM-WI -9015123	Analysis DOD - 11222, 11223, 11239, 11248	4036 - Organic Extraction
Soxhlet Extraction Procedure for Extractable Matter in Textiles	1-P-QM-WI -9015134	Analysis DOD - 1948, 1949, 1950, 1951, 1952	4036 - Organic Extraction
Determination of Percentage Fat Using Accelerated Solvent Extraction (ASE)	1-P-QM-WI -9015144	Analysis DOD - 4193ASE	4036 - Organic Extraction
Liquid-Liquid Extraction Procedure for the Determination of Target Compound List Analytes in a Water Matrix	1-P-QM-WI -9015147	Analysis DOD - 4606	4036 - Organic Extraction
Low-Level Sonic Probe Extraction Procedure for the Determination of Target Compound List Analytes in a Solid Matrix	1-P-QM-WI -9015148	Analysis DOD - 4607	4036 - Organic Extraction
Separatory Funnel Extraction Procedure for the Determination of Base Neutrals and Acid Extractables in a Toxicity Characteristic Leachate by SW-846 Method 3510C	1-P-QM-WI -9015149	Analysis DOD - 4731	4036 - Organic Extraction
Waste Dilution Procedure for the Determination of Acid Extractables and Base-Neutrals in a Non-Water Soluble Leachate Matrix	1-P-QM-WI -9015150	Analysis DOD - 4731DIL	4036 - Organic Extraction
Sonic Disruption Extraction Procedure for the Determination of GC Fingerprint on Petroleum Products in Soil or Solid Matrix	1-P-QM-WI -9015151	Analysis DOD - 4833, 11227	4036 - Organic Extraction
Extraction of Organic Compounds in Drinking Water By Method 525.2	1-P-QM-WI -9015152	Analysis DOD - 4894	4036 - Organic Extraction
Extraction Procedure for the Determination of Formaldehyde and Aldehydes in a Solid Matrix	1-P-QM-WI -9015162	Analysis DOD - 5876, 11139	4036 - Organic Extraction
Sonic Probe Extraction for the Determination of Pesticides in a Solid Matrix	1-P-QM-WI -9015163	Analysis DOD - 11129, 11131, 11134	4036 - Organic Extraction
Extraction Procedure for Perchlorate in Soil Samples by LC/MS/MS	1-P-QM-WI -9015167	Analysis DOD - 6568	4036 - Organic Extraction
Soxhlet Extraction Procedure for the Determination of Triazine Herbicides and Organophosphorous Pesticides in a Solid Matrix	1-P-QM-WI -9015170	Analysis DOD - 6677, 11130, 11133, 11142	4036 - Organic Extraction
Extraction of Nitroaromatics and Nitroamines in Water	1-P-QM-WI -9015171	Analysis DOD - 6915, 11122, 11125	4036 - Organic Extraction
Extraction of Nitroaromatics and Nitroamines in Soil	1-P-QM-WI -9015173	Analysis DOD - 6917, 11137, 11138	4036 - Organic Extraction
Sonication Extraction of Nitroaromatics and Nitroamines in Soil (DoD)	1-P-QM-WI -9015174	Analysis DOD - 6917DoD	4036 - Organic Extraction
Separatory Funnel Extraction Method 3510C for DRO in Water or Wastewater	1-P-QM-WI -9015175	Analysis DOD - 7003, 10304, 11164, 11167, 11171, 11172, 11176, 11177, 11181, 11183, 11189, 11190, 11191, 11195, 11196, 11201, 11203, 11596, 12820, 12906, 12915, 12923, 13095	4036 - Organic Extraction

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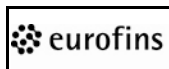
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Sonication Extraction Method 3550C for DRO in Soils or Solids	1-P-QM-WI -9015176	Analysis DOD - 7004, 10303, 11204, 11205, 11209, 11215, 11218, 11219, 11225, 11228, 11229, 11233, 11236, 11237, 11238, 13097	4036 - Organic Extraction
Separatory Funnel Extraction for the Determination of PAHs in Water by GC/MS Using Method 3510C	1-P-QM-WI -9015185	Analysis DOD - 7807	4036 - Organic Extraction
Separatory Funnel Extraction Procedure for the Determination of Base-Neutrals and Acid Extractables in a Wastewater Matrix by Method 625	1-P-QM-WI -9015188	Analysis DOD - 8108, 10463	4036 - Organic Extraction
Sonic Probe Extraction Procedure for the Determination of Semivolatiles in a Complex Matrix	1-P-QM-WI -9015189	Analysis DOD - 8108TJ	4036 - Organic Extraction
Silica Gel Column Cleanup for Hydrocarbons by GC in Aqueous Matrices	1-P-QM-WI -9020897	Analysis 12894	4036 - Organic Extraction
3 g Silica Gel Column Cleanup for DRO	1-P-QM-WI -9021425	Analysis 12932	4036 - Organic Extraction
Separatory Funnel Extraction of Pesticides and PCBs in Aqueous Samples by SW-846 Method 3510C for OH VAP	1-P-QM-WI -9022427	Analysis 11117, 11118 OH VAP	4036 - Organic Extraction
Sonic Probe Extraction of Pesticides and PCBs in Solid Samples by SW-846 Method 3550C for OH VAP	1-P-QM-WI -9022432	Analysis 0819, 11134 OH VAP	4036 - Organic Extraction
Microwave Extraction of Pesticides and PCBs in Non-aqueous Samples by SW-846 Method 3546 for OH VAP	1-P-QM-WI -9022433	Analysis 10496, 10497 OH VAP	4036 - Organic Extraction
Separatory Funnel Extraction Semivolatile Organic Compounds in an Aqueous Samples by SW-846 Method 3510C for OH VAP	1-P-QM-WI -9022472	Analysis 10464 OH VAP	4036 - Organic Extraction
Microwave Extraction of Semivolatiles in Non-Aqueous Samples by SW-846 Method 3546 for OH VAP	1-P-QM-WI -9022475	Analysis 10813 OH VAP	4036 - Organic Extraction
Sonic Probe Extraction Procedure for the Determination of Semivolatiles in Non-Aqueous Samples by SW-846 Method 3550C for OH VAP	1-P-QM-WI -9022476	Analysis 0381 10478 OH VAP	4036 - Organic Extraction
Microextraction of EDB, DBCP, and TCP in Solids by Method 8011	1-P-QM-WI -9025371	Analysis 13218	4036 - Organic Extraction
DFS HRGC/HRMS Preventative and Corrective Maintenance	1-P-QM-PRO-9015412	DOD - MC-SP-001	4037 - Specialty Services Group
Sample Extract Column Cleanup Procedure for HRMS Analysis	1-P-QM-PRO-9015510	DOD - SOP-SP-003	4037 - Specialty Services Group
Thermo Scientific Trace Ultra Gas Chromatograph Quantum XLS Tandem Mass Spectrometer (GC/MS/MS) Preventative and Corrective Maintenance	1-P-QM-PRO-9017429	MC-SP-002	4037 - Specialty Services Group
Maintenance and Tuning for Thermo Scientific TSQ Quantum Access Tandem Mass Spectrometer with a Thermo Electron Accela HPLC System (LC/MS/MS)	1-P-QM-PRO-9018268	SOP-SP-001	4037 - Specialty Services Group
Processing EPA 1613B PCDD/PCDF High Resolution Mass Spectrometry Data using TargetQuan 2.0	1-P-QM-PRO-9018269	SOP-SP-004	4037 - Specialty Services Group
Standards Management in the High Resolution Mass Spectrometry Laboratory	1-P-QM-PRO-9018270	SOP-SP-005	4037 - Specialty Services Group
Glassware Cleaning for HRMS Extractions	1-P-QM-PRO-9025452	N/A	4037 - Specialty Services Group
Determination of Selected Perfluorinated	1-P-QM-WI -9012802	Analysis 10954	4037 - Specialty Services

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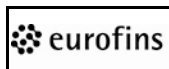
Alkyl Acids (PFAAs) in Aqueous Samples by LC/MS/MS			Group
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Determination of Perfluorooctanoic Acid (PFOA) in Aqueous Samples by LC/MS/MS	1-P-QM-WI -9012866	Analysis 11016	4037 - Specialty Services Group
Determination of Diuron, Fenuron and Monuron in Water Samples by SPE Extraction and LC/MS/MS	1-P-QM-WI -9013044	Analysis 11639	4037 - Specialty Services Group
Determination of Diuron, Fenuron and Monuron in Soil Samples by LC/MS/MS	1-P-QM-WI -9013054	Analysis 11663	4037 - Specialty Services Group
Determination of Dioxin-like Polychlorinated Biphenyls by HRGC/HRMS	1-P-QM-WI -9013071	Analysis 11773, 12416	4037 - Specialty Services Group
The Determination of Pesticides by Gas Chromatography/Tandem Mass Spectrometry (GC/MS/MS)	1-P-QM-WI -9013072	Analysis 11788	4037 - Specialty Services Group
Extraction of Vegetation utilizing the QuEChERS (Quick, Easy, Cheap, Effective, Rugged, Safe) Technique for Pesticides	1-P-QM-WI -9013073	Analysis 11911	4037 - Specialty Services Group
Determination of Perchlorate in Milk and Milk Powder by LCMSMS	1-P-QM-WI -9013074	Analysis 11962, 11964	4037 - Specialty Services Group
Determination of Glycols in Waters by Direct Injection LC/MS/MS Method	1-P-QM-WI -9013111	Analysis 12060	4037 - Specialty Services Group
Determination of Polychlorinated Biphenyl Congeners by HRGC/HRMS	1-P-QM-WI -9013114	Analysis 12154, 12429	4037 - Specialty Services Group
Determination of Hydrazine, Monomethylhydrazine and 1,1-Dimethylhydrazine in Aqueous Samples by LC/MS/MS Using SW-846 8315A Modified	1-P-QM-WI -9015095	Analysis DOD - 10342	4037 - Specialty Services Group
Determination of Hydrazine, Monomethylhydrazine and 1,1-Dimethylhydrazine in Soil Samples by LC/MS/MS	1-P-QM-WI -9015096	Analysis DOD - 10346	4037 - Specialty Services Group
Separatory Funnel Sample Extraction Procedure for HRMS Analysis in a Water Matrix	1-P-QM-WI -9015118	Analysis DOD - 10914	4037 - Specialty Services Group
Determination of Tetra- Through Octa-Chlorinated Dioxins and Furans using HRGC/HRMS by EPA 1613B or SW-846 8290A	1-P-QM-WI -9015119	Analysis DOD - 10915, 11031, 11645, 11650, 12935, 12936, 12937	4037 - Specialty Services Group
Soxhlet Sample Extraction Procedure for HRMS Analysis in a Solid Matrix	1-P-QM-WI -9015122	Analysis DOD - 11030	4037 - Specialty Services Group
Determination of Endothall in Soil Samples by LCMSMS	1-P-QM-WI -9015125	Analysis DOD - 11688	4037 - Specialty Services Group
Client Specific - Trace Analysis of 16 Phthalates in Cosmetic Products by Gas Chromatography Selective Ion Monitoring Mass Spectroscopy (GC/SIM/MS) (Client Specific Method)	1-P-QM-WI -9017430	NS-37-010	4037 - Specialty Services Group
Client Specific - Analysis of Furan in Tobacco Products by Headspace Gas Chromatography Mass Spectroscopy (HS/GC/MS)	1-P-QM-WI -9020124	NA	4037 - Specialty Services Group
Determination of Hydrazine in Mainstream Smoke via Liquid Chromatography/Tandem Mass Spectrometry	1-P-QM-WI -9020139	NA	4037 - Specialty Services Group
Client Specific - Analysis of Glycerol Monolaurate and Propylene Glycol Monolaurate in BioPolySan by Gas Chromatography Mass Spectroscopy (GC/MS)	1-P-QM-WI -9020891	N/A	4037 - Specialty Services Group
Client Specific – Analysis of Aflatoxin B1 in Tobacco and Tobacco Related Products	1-P-QM-WI -9021796	N/A	4037 - Specialty Services Group

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 Lancaster Laboratories Environmental	Document Title: SOPs and Analytical Methods	Eurofins Document Reference: 1-P-QM-GDL-9015382
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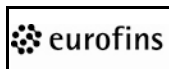
using LC/MS/MS			
Client Specific - Analysis of Piperonyl Butoxide (PBO) in Wastewater by GC/MS/MS	1-P-QM-WI -9022844	N/A	4037 - Specialty Services Group
Document Title	Document ID	Historical Document ID	Department Owner
Level 3 – Environmental Sciences (continued)			
Client Specific - Trimethylamine by Headspace Gas Chromatography Mass Spectroscopy (HS GCMS)	1-P-QM-WI -9023280	N/A	4037 - Specialty Services Group
Determination of Multiple Client Specific APIs in Surface Water by LCMSMS	1-P-QM-WI -9023568	N/A	4037 - Specialty Services Group
Processing and Sending Data Packages	1-P-QM-PRO-9015441	DOD - SOP-DP-007	4038 - Data Deliverables
Overchecking the Electronic Data Deliverable	1-P-QM-PRO-9015442	DOD - SOP-DP-009	4038 - Data Deliverables
Preparation of Data Packages on CD ROM	1-P-QM-PRO-9015444	DOD - SOP-DP-014	4038 - Data Deliverables
Archiving Department 4025 Raw Sample Data and Other Miscellaneous Data	1-P-QM-PRO-9015445	DOD - SOP-DP-022	4038 - Data Deliverables
Generation and Content Review of GLP Compliant Data Packages	1-P-QM-PRO-9017747	SOP-DP-034	4038 - Data Deliverables
Assembly and Review of Environmental Data Packages	1-P-QM-PRO-9017748	SOP-DP-037	4038 - Data Deliverables
Tracking and Communicating Rush Results	1-P-QM-PRO-9015434	DOD - SOP-CL-005	4039 - Environmental Client Services and Inside Business Development
Phone Log and Email Documentation	1-P-QM-PRO-9015435	DOD - SOP-CL-006	4039 - Environmental Client Services and Inside Business Development
Auditing Client Paperwork	1-P-QM-PRO-9015436	DOD - SOP-CL-007	4039 - Environmental Client Services and Inside Business Development
Scheduling and Pricing of Rush Samples	1-P-QM-PRO-9015437	DOD - SOP-CL-010	4039 - Environmental Client Services and Inside Business Development
Sample Set-Up Form Creation Guide	1-P-QM-PRO-9015438	DOD - SOP-CL-014	4039 - Environmental Client Services and Inside Business Development
Client Concern and ISPD Code Entry	1-P-QM-PRO-9015439	DOD - SOP-CL-015	4039 - Environmental Client Services and Inside Business Development
Preparing Quotations	1-P-QM-PRO-9017698	SOP-CL-008	4039 - Environmental Client Services and Inside Business Development
Daily or Weekly DEP Reporting	1-P-QM-PRO-9017699	SOP-CL-012	4039 - Environmental Client Services and Inside Business Development
Monthly DEP Reporting	1-P-QM-PRO-9017700	SOP-CL-013	4039 - Environmental Client Services and Inside Business Development
Creating Bottle Orders	1-P-QM-PRO-9017701	SOP-CL-016	4039 - Environmental Client Services and Inside Business Development
Creating Project Information Lists	1-P-QM-PRO-9017702	SOP-CL-017	4039 - Environmental Client Services and Inside Business Development
Client/Prospects Visits	1-P-QM-PRO-9017799	SOP-MK-104	4039 - Environmental Client Services and Inside Business Development
Proposal Preparation	1-P-QM-PRO-9017800	SOP-MK-105	4039 - Environmental Client Services and Inside Business Development
ETM System Probe Calibration	1-P-QM-PRO-9015418	DOD - MC-WQ-003	4052 - Environmental Quality Assurance
Proficiency Test and Double Blind Samples	1-P-QM-PRO-9018237	SOP-QC-003	4052 - Environmental Quality

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			Assurance
Environmental Quality Assurance Approval of Subcontractor Laboratories	1-P-QM-PRO-9018248	SOP-QC-023	4052 - Environmental Quality Assurance
Quality Assurance Review of End-of-Month QC Reports	1-P-QM-PRO-9018253	SOP-QC-028	4052 - Environmental Quality Assurance
Document Title	Document ID	Historical Document ID	Department Owner
Level 3 – Environmental Sciences (continued)			
Environmental Quality Assurance Functions for GLP Compliance	1-P-QM-PRO-9018256	SOP-QC-032	4052 - Environmental Quality Assurance
Performing Electronic Data Audits using Mint Miner Software	1-P-QM-PRO-9018259	SOP-QC-036	4052 - Environmental Quality Assurance
Maintenance of Environmental Certifications and Accreditations	1-P-QM-PRO-9018261	SOP-QC-039	4052 - Environmental Quality Assurance
Performing Environmental Quality Assurance Audits	1-P-QM-PRO-9020535	N/A	4052 - Environmental Quality Assurance
Preparing Environmental Quality Assurance Reports for Management	1-P-QM-PRO-9020717	N/A	4052 - Environmental Quality Assurance
QA Approval of Environmental Analytical Procedures and Standard Operating Procedures	1-P-QM-PRO-9022099	N/A	4052 - Environmental Quality Assurance
Hosting of Environmental Client and Agency Audits	1-P-QM-PRO-9022134	N/A	4052 - Environmental Quality Assurance
Environmental Quality Assurance Review of Client Project and Bid Documents	1-P-QM-PRO-9022599	N/A	4052 - Environmental Quality Assurance
Introduction to Software Quality	1-P-QM-TMA-9018310	TRN-CS-001	4057 - Environmental Software Quality
Level 3 – Transportation			
What to Do in Case of Vehicular Accident or Breakdown	1-P-QM-PRO-9018292	SOP-TR-010	6041 – Transportation
Sample Pick-Up, Transportation, and Delivery	1-P-QM-PRO-9018293	SOP-TR-018	6041 - Transportation
Transportation Summary SOP	1-P-QM-PRO-9028514	N/A	6041 - Transportation
Level 3 – Environmental Sample Administration			
Environmental Sample Entry	1-P-QM-PRO-9015502	DOD - SOP-SA-101	6042 - Environmental Sample Administration
Sample Receipt at Sample Receipt Desk	1-P-QM-PRO-9015503	DOD - SOP-SA-102	6042 - Environmental Sample Administration
Environmental Sample Receipt and Unpacking	1-P-QM-PRO-9015504	DOD - SOP-SA-103	6042 - Environmental Sample Administration
Filing of Sample Information	1-P-QM-PRO-9015505	DOD - SOP-SA-107	6042 - Environmental Sample Administration
Assigning Sample Delivery Group Numbers and Five-Digit Sample Codes to Sample Groups	1-P-QM-PRO-9015506	DOD - SOP-SA-119	6042 - Environmental Sample Administration
Entry of Environmental Samples Requiring Subcontracting	1-P-QM-PRO-9015507	DOD - SOP-SA-129	6042 - Environmental Sample Administration
Taking the Temperature of Environmental Samples Upon Arrival at the Lab	1-P-QM-PRO-9015508	DOD - SOP-SA-138	6042 - Environmental Sample Administration
Level 3 – Sample Support			
Sample Support Ovens	1-P-QM-PRO-9015413	DOD - MC-SS-001	6055 - Sample Support
Maintenance of Desiccators	1-P-QM-PRO-9015414	DOD - MC-SS-002	6055 - Sample Support
Liquid Sample Preservation	1-P-QM-PRO-9015511	DOD - SOP-SS-002	6055 - Sample Support

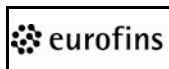
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Automated Storage, Retrieval, and Discarding of Samples	1-P-QM-PRO-9015512	DOD - SOP-SS-006	6055 - Sample Support
Homogenization and Subsampling of Solid Waste Samples from Environmental Sources	1-P-QM-PRO-9015513	DOD - SOP-SS-009	6055 - Sample Support

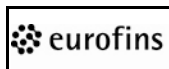
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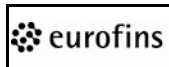
 Lancaster Laboratories Environmental	Document Title: SOPs and Analytical Methods	Eurofins Document Reference: 1-P-QM-GDL-9015382
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Document Title	Document ID	Historical Document ID	Department Owner
Level 3 – Sample Support (continued)			
Subsampling for Subcontracted Analyses	1-P-QM-PRO-9015514	DOD - SOP-SS-010	6055 - Sample Support
Hardware Procedures for ASRS	1-P-QM-PRO-9015515	DOD - SOP-SS-015	6055 - Sample Support
Preservation and Bottles Room Preservative Traceability	1-P-QM-PRO-9015516	DOD - SOP-SS-017	6055 - Sample Support
Pipette Dispenser Calibration Procedure	1-P-QM-PRO-9015517	DOD - SOP-SS-018	6055 - Sample Support
Automated Storage and Retrieval System (ASRS) Lockout/Tagout Procedure	1-P-QM-PRO-9015518	DOD - SOP-SS-019	6055 - Sample Support
Outlier Quality Control Data	1-P-QM-PRO-9015519	DOD - SOP-SS-020	6055 - Sample Support
Instructions for Collecting Data on the LLENS System	1-P-QM-PRO-9015520	DOD - SOP-SS-021	6055 - Sample Support
Non-Automated Storage, Retrieval, and Discarding of Samples	1-P-QM-PRO-9015521	DOD - SOP-SS-022	6055 - Sample Support
Prescreening Water and Soil Samples for Volatile Organic Compounds	1-P-QM-PRO-9015522	DOD - SOP-SS-023	6055 - Sample Support
ASRS Emergency Failure Procedure	1-P-QM-PRO-9015523	DOD - SOP-SS-024	6055 - Sample Support
Incremental Sampling of Soil/Solid Samples	1-P-QM-PRO-9015524	DOD - SOP-SS-025	6055 - Sample Support
Glassware Cleaning	1-P-QM-PRO-9018271	SOP-SS-026	6055 - Sample Support
Bulk Solid Sample Preparation by SW-846 5035A for OH VAP	1-P-QM-WI -9012777	Analysis 11967 OH VAP	6055 - Sample Support
Water Content (Moisture) by ASTM D 2216	1-P-QM-WI -9014166	Analysis 7116, 7119	6055 - Sample Support
Moisture (Gravimetric)	1-P-QM-WI -9015065	Analysis DOD - 0111, 6111, 7611, 11624, 12845	6055 - Sample Support
GC/MS - Bulk Solid Matrix Sample Preparation	1-P-QM-WI -9015069	Analysis DOD - 0374, 6646, 10445, 11966, 11967	6055 - Sample Support
Preparation of Vials for Field Preservation of Soils for Volatile Analysis	1-P-QM-WI -9015073	Analysis DOD - 0388, 6119, 6169, 6647, 0405, 1169, 6171, 6172, 6173, 6645, 2392, 6176, 7579, 0069, 11014, 11764	6055 - Sample Support
Preparation of Soil and Solid Samples for GC Volatile Analyses	1-P-QM-WI -9015124	Analysis DOD - 1150, 6170, 11968, 11969	6055 - Sample Support
Tobacco Moisture	1-P-QM-WI -9015168	Analysis DOD - 6611	6055 - Sample Support
Total Residue by SM 2540G-1997	1-P-QM-WI -9015183	Analysis DOD - 7400	6055 - Sample Support
Preparation of Soils for Volatile Analysis by EPA SW-846 Method 5035	1-P-QM-WI -9015193	Analysis DOD - 8389, 8390, 6130, 6117, 6174, 7578, 7320	6055 - Sample Support
Preparation of Solid Samples by SW-846 Method 5035A (Field Preserved and EnCores) for OH VAP	1-P-QM-WI -9022845	Analysis 2392, 6171, 6176, 7320, 7578, 7579, 8389, 8390 OH VAP	6055 - Sample Support

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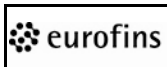
 Lancaster Laboratories Environmental	Document Title: SOPs and Analytical Methods	Eurofins Document Reference: 1-P-QM-GDL-9015382
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Document Title	Document ID	Historical Document ID	Department Owner
Level 3 – Sample Bottles			
Bottle Preparation	1-P-QM-PRO-9018263	SOP-SB-003	6059 - Sample Bottles
Packing Bottle Orders	1-P-QM-PRO-9018264	SOP-SB-008	6059 - Sample Bottles
Preparation of Trip Blanks	1-P-QM-PRO-9018265	SOP-SB-012	6059 - Sample Bottles
Processing Bottle Orders	1-P-QM-PRO-9018266	SOP-SB-016	6059 - Sample Bottles
Preparation of Acid Dilutions	1-P-QM-PRO-9018267	SOP-SB-017	6059 - Sample Bottles

 Lancaster Laboratories Environmental	Document Title: Instrument and Equipment List	Eurofins Document Reference: 1-P-QM-GDL-9015383
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Eurofins Document Reference	1-P-QM-GDL-9015383	Revision	3
Effective Date	Aug 8, 2014	Status	Effective
Historical/Local Document Number	DOD - Environmental Quality Policy Manual Appendix F		
Local Document Level	Level 1		
Local Document Type	POL - Policy		
Local Document Category	ES - Environmental Sciences		

Prepared by	Kathryn Brungard
Reviewed and Approved by	Duane Luckenbill;Review;Tuesday, July 29, 2014 11:14:09 AM EDT Robert Strocko;Review;Wednesday, July 30, 2014 1:25:50 PM EDT Dorothy Love;Approval;Wednesday, July 30, 2014 2:13:19 PM EDT

 <div> Lancaster Laboratories Environmental </div>	Document Title: Instrument and Equipment List	Eurofins Document Reference: 1-P-QM-GDL-9015383
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Instrument	# of Units	Manufacturer/Model #
Liquid Chromatography/Gas Chromatography/Mass Spectrometry (LC/GC/MS)		
LC/MS/MS	1	Agilent 1200 LC with Agilent 6410 MS/MS
LC/MS/MS	1	Agilent 1290 LC with Micromass Quattro micro MS/MS and Waters 2996 Photodiode Array UV-Vis Detector
LC/MS/MS	1	Thermo Scientific TSQ Quantum Access with Acella LC
LC/MS/MS	2	Waters 2795 LC with Micromass Quattro micro MS/MS
GC/MS	3	Agilent 5972
GC/MS	20	Agilent 5973
GC/MS	10	Agilent 5975
GC/MS	2	Agilent 5977A
GC/MS	2	Shimadzu
GC/MS	1	Thermo Scientific ISQ
GC/MS	1	DSQ II MS with Trace GC Ultra GC
GC/MS/MS	1	Thermo TSQ 8000 MSMS with Trace 1310 GC
GC/MS/MS	1	Thermo TSQ Quantum XLS MSMS with Trace GC Ultra GC
HRGC/HRMS	4	Thermo Scientific DFS
Gas Chromatograph	14	Agilent 5890
Gas Chromatograph	40	Agilent 6890
Gas Chromatograph	2	Shimadzu
Gas Chromatograph	27	Agilent 7890
Gas Chromatograph	1	Varian 3400
Auxiliary Equipment for Gas Chromatographs		
Most of the GC/MS and GC systems include autosamplers and approximately half are fitted with purge and trap concentrators for analysis of volatiles.		
Purge/Trap Concentrators	30	OI 4560/4660
Autosamplers	13	Archon 5100/5100A
Autosamplers	20	Agilent 7673
Autosamplers	21	Agilent 7683
Autosamplers	28	Agilent 7693
Autosamplers	6	OI 4551/4552
Autosamplers	5	EST Centruion
Autosamplers	7	Thermo Scientific AS TriPlus
Autosamplers	3	CTC Combipal Headspace
Automated Sampling System (Tedlar Bags)	1	Tekmar 2016/2032/LSC2000
Automated Sampling System (Summa Canisters)	3	Entech 7016CR Autosamplers
Automated Sampling System (Tedlar Bags/Summa Canisters)	1	Entech 7032A
Automated Concentrator	3	Entech 7100
Detectors available for GC: Electron Capture, Flame Ionization, Photoionization, Hall Electrolytic Conductivity, Nitrogen/Phosphorus, and Thermal Conductivity. All of the chromatographs are connected to electronic integration systems.		

 <div> Lancaster Laboratories Environmental </div>	Document Title: Instrument and Equipment List	Eurofins Document Reference: 1-P-QM-GDL-9015383
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High Performance Liquid Chromatography		
High Performance Liquid Chromatograph	2	Agilent 1100 LC
High Performance Liquid Chromatograph	2	Agilent 1200 HPLC
High Performance Liquid Chromatograph	1	Waters alliance 2695
High Performance Liquid Chromatograph	1	Waters alliance 2795
Gel Permeation Chromatography		
Gel Permeation Chromatograph	3	J2Scientific AccuPrep
Ion Chromatography		
Ion Chromatograph	1	Metrohm 881 IC Pro
Ion Chromatograph	2	Dionex ICS1000
Ion Chromatograph	1	Dionex ICS3000
Ion Chromatograph	1	Dionex ICS2000
Ion Chromatograph	3	Dionex ICS1100
Atomic Absorption/Emission Spectrophotometry		
ICAP™ 6000 Duo ICP Analyzer	4	Thermo
ICP/MS	1	P/E Sciex Elan 9000
ICP/MS	1	Agilent 7500ce
ICP/MS	1	Agilent 7700x
Mercury Analyzer	2	Leeman Labs Hydra II
Mercury Analyzer	1	Leeman Labs HYDRA AF _{GOLD+}
Prep Station	3	Thomas Cain DEENA 60
UV Vis/IR Spectrophotometry:		
UV-Vis Spectrophotometer	3	Spectronic Genesys
UV-Vis Spectrophotometer	1	Hach DR2800
Miscellaneous Chemistry Instrumentation		
Auto-titrator System	2	Mantech
Block Digestion Systems	8	Environmental Express SC150
Block Digestion Systems	6	Environmental Express SC154
Centrifuge	5	Various
Chilled water recirculators		Various
Closed Cup Flashpoint Apparatus, Pensky-Martin	1	Fisher Scientific TA6
Cyanide Midi Distillation Kits	3	Various
Dissolved Oxygen Meter	1	YSI Model 59
Flow Solution Autoanalyzer	2	Alpkem
Glassware washer - automated	1	Miele – (2) PG8257 (1) G7827 (1) G7704
Kjeldhal Distillation Apparatus	2	Fisher
Microwave Extractors	3	CEM MarsXpress
pH meters	13	Various
Phenol Midi Distillation	2	Andrews Glass
Pressurized Solvent Extractor	2	Dionex ASE200
Sonicators	12	Various
Total Organic Carbon Analyzer	2	O.I. Corp. 1030
Total Organic Carbon Combustion Analyzer	1	O.I. Corp. 1010
Turbidimeter	1	Hach 2100AN
Zero Headspace Extractor	74	Various Models

Microbiology Equipment		
Autoclave	2	Steris – Amsco,
Balance	5	Mettler, PB 3002
Balance	1	Mettler-Toledo, AT200
Balance	2	Mettler-Toledo, PR2002
Balance	1	Sartorius BP4100
Biological Safety Cabinet	4	NuAire NU-425-600 Type A/B 3
Biological Safety Cabinet	1	NuAire NU-435-600 Type B2 Fume Hood
Colony Counter	3	Quebec Dark Field
Microbiology Equipment		
Incubator	1	PGC 9311-1127
Incubator	1	PS WFY20SAWI
Microscope	1	Stereoscope with Zoom, AO Model 570
Microscope	1	Zeiss
pH Meter	2	Orion Model 410A
Quanti-Tray Sealer	1	IDEXX Model 2X
Water Bath	1	Boekel Grant with Removal Heater Circulator
Water Bath	1	Thermo Electron Corp.
Water Bath	1	Precision Coliform Incubator Bath
Water Bath	1	VWR 1275PC
UV Light	2	Spectronics
UV Sterilizer	1	Millipore

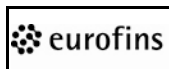
Computer Equipment

Our laboratories make extensive use of computers for business applications, technical operations (e.g., our sample management system), and QA Program (see section on Quality Assurance). The following is a list of the major components of our computer systems.

Numerous physical and virtual servers used to support the systems

Oracle systems run on IBM UNIX servers:

- One IBM Power 740 Server running AIX UNIX with 6 - 3.3 GHz Power7 Cores CPUs, 128GB RAM.
- One IBM P5-520 Server running AIX UNIX with 4-way 1.90GHz CPUs, 24GB RAM.
- 40+ Terra Bytes of disk storage and several SAN devices including V7000, DS4100, HP2000 and Clarion CX4-40.
- Various tape backup systems
- On-line fail over databases are available for all corporate production Oracle databases.

 <div>Lancaster Laboratories Environmental</div>	<p>Document Title: Instrument and Equipment List</p>	<p>Eurofins Document Reference: 1-P-QM-GDL-9015383</p>
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Networks/Telecommunication:

- TCP/IP based network
- Ten Gigabit switch to accommodate company server farm
- Dual Cisco 6506E network cores

Personal Computers/Servers:

- Internet access is provided with an ASA firewall to control incoming and outgoing traffic
- ArcServe backup server
- Microsoft Exchange server
- Dell PowerEdge file and print servers
- More than 30 Network File Servers
- More than 1000 Personal Computers

Power Systems:

- 3 Phase Uninterrupted Power System

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 <div>Lancaster Laboratories Environmental</div>	Document Title: Preventative Maintenance Schedules	Eurofins Document Reference: 1-P-QM-GDL-9015384
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Eurofins Document Reference	1-P-QM-GDL-9015384	Revision	3
Effective Date	Aug 8, 2014	Status	Effective
Historical/Local Document Number	DOD - Environmental Quality Policy Manual Appendix G		
Local Document Level	Level 1		
Local Document Type	POL - Policy		
Local Document Category	ES - Environmental Sciences		

Prepared by	Kathryn Brungard
Reviewed and Approved by	Duane Luckenbill;Review;Tuesday, July 29, 2014 11:01:38 AM EDT Robert Strocko;Review;Wednesday, July 30, 2014 1:13:46 PM EDT Dorothy Love;Approval;Wednesday, July 30, 2014 2:16:10 PM EDT

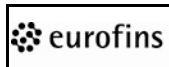
Preventive Maintenance Schedule

Instrument	Preventive Maintenance	Frequency
GC/MS GC/MS/MS	Change septum	AN* : Min. weekly
	Clean/replace injection port seal & liner	AN
	Check/clean fans	Monthly or AN
	Check/clean cool flow	Monthly or AN
	Clean source and replace parts	Bimonthly or AN
	Change oil in diffusion pump	Annually or AN
	Change oil and service rough pump	Annually
	Change column	AN
GC and GC/MS Purge and Trap Concentrators	Check gas flows and pressures	Prior to calib. or AN
	Replace adsorbent trap in concentrators	AN
	Flush purge pathways	Monthly or AN
	Clean/replace water management	AN
GC	Septum change	AN: Min. weekly
	Column/injection port maintenance	AN
	Clean detector	AN
	Leak check ECDs	Semiannually
	Change/clean PID lamp	AN
	Change/clean/Replace FID parts	AN
	Change column	AN
	System bakeout	AN
GC/HRMS	Replacing the Secondary Electron Multiplier (SEM)	AN
	Adjusting potentials on ion source	AN
	Check sensitivity and resolution on ion source	Daily
	Cleaning ion source	AN
	Replace filament on ion source	AN
	Cleaning reference inlet	AN
	Check oil level on forepumps	monthly
	Change oil on forepumps	Yearly or if oil is cloudy or discolored
	Exchange lubricant reservoir on turbopumps	Yearly or after 5000 hours of operation
	Replace injection port liner	AN
	Clip injection port end of column	AN
	Replace septum	AN
	Clean chiller water/air filters and inspect fluid level	Monthly
	Change column	AN
LC/MS/MS	Change rough pump (vacuum) oil	Annually
	Clean cones and spray chamber	As needed, before each calibration
	Clean source and ion lenses	Annually
	Check electrospray capillary	AN
	Empty waste liquid reservoir	AN
	Tune and calibrate MS	AN

Instrument	Preventive Maintenance	Frequency
HPLC	Pump lubrication	Annually
	Check pump seals	Annually
	Check-valves cleaned or rebuilt	AN
	Replace and/or adjust detector bulb	AN
	Clean detector flow cell	AN
	Replace Teflon lines	AN
	Autosampler septa replacement	AN
	In-line filter sonication/cleaning	AN
	System passivation	AN
	PCRS pump lubrication	AN
	Empty waste liquid reservoir	AN
Cold Vapor AA and Cold Vapor AF	Replace pump tubing	AN
	Lubricate pump head & autosampler	AN
	Clean optical cells and windows	AN
ICP	Replace pump winding	AN
	Lubricate autosampler	AN
	Vacuum instrument airfilters and air intakes	AN
	Clean optics and lenses	AN
	Clean Torch and injector tip	AN
	Clean nebulizer and spray chamber	AN
ICP/MS	Change interface rough pump oil	AN
	Change MS rough pump oil	AN
	Clean cones and ion lenses	AN
	Clean Torch, injector tip, nebulizer and spray chamber	AN
	Change peristaltic tubing	AN
	Vacuum instrument airfilters and air intakes	AN
	Empty waste liquid reservoir	AN
Total Organic Carbon Analyzer	Check for leaks	AN
	Inspect rotary valve	AN
	Clean gas permeation tube	AN
	Check halide scrubber	AN
	Check dessicant tube	AN
	Dust back and clean circuit boards	AN
Autoanalyzer spectrophotometer	Clean sample probe	AN
	Clean proportioning pump	AN
	Inspect pump tubing, replace if worn	AN
	Clean wash receptacles	AN

*AN = as needed. These actions may be performed more frequently as required by the instrument's operational response.

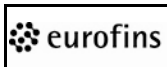
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 eurofins Lancaster Laboratories Environmental	Document Title: Calibration Schedules	Eurofins Document Reference: 1-P-QM-GDL-9015385
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Eurofins Document Reference	1-P-QM-GDL-9015385	Revision	3
Effective Date	Aug 8, 2014	Status	Effective
Historical/Local Document Number	DOD - Environmental Quality Policy Manual Appendix H		
Local Document Level	Level 1		
Local Document Type	POL - Policy		
Local Document Category	ES - Environmental Sciences		

Prepared by	Kathryn Brungard
Reviewed and Approved by	Duane Luckenbill;Review;Tuesday, July 29, 2014 11:06:27 AM EDT Robert Strocko;Review;Wednesday, July 30, 2014 1:22:59 PM EDT Dorothy Love;Approval;Wednesday, July 30, 2014 2:14:49 PM EDT

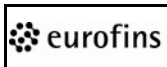
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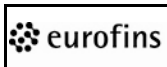
Details on method/instrument calibration processes are provided in the individual Analytical Procedures. This appendix provides an overview for representative methodology.

Note: This appendix is not applicable to OH VAP work. See the OH VAP approved SOPs for calibration information.

Calibration Summary for SW-846 Methods						
Instrument	Initial Calibration			Continuing Calibration Verification		
	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria
GC/MS Volatiles* (8260B)	After C-cal fails	6	RF for SPCCs >0.300 for chlorobenzene and 1,1,2,2-tetrachloroethane, and >0.100 for 1,1-dichloroethene, bromoform and chloromethane %RSD CCCs <30%	Every 12 hours	1	RF for SPCCs >0.300 for chlorobenzene and 1,1,2,2-tetrachloroethane, and >0.100 for 1,1-dichloroethene, bromoform and chloromethane %Drift for CCCs <20
GC/MS Volatiles* (8260C)	After C-cal fails	7	<u>RF must meet minimum RF listed in SOP</u> <u>%RSD of <20% for all analytes (10% may fail)</u>	Every 12 hours	1	<u>RF must meet minimum RF listed in SOP</u> <u>%Drift for CCCs <20, 20% can fail if not detected in proceeding samples</u>
GC/MS Semivolatiles (8270C)*	After C-cal fails	6	RF for SPCCs >0.050 Max %RSD for CCCs <30%	Every 12 hours	1	RF for SPCCs 0.050 %Drift for CCCs <20
GC/MS Semivolatiles (8270D)*	After C-cal fails	6	% RSD ≤ 20% for each compound, (no more than 10% of the compounds can exceed 20% RSD); alternate fit must be used for any analyte with RSD >20% (use linear fit if correlation coefficient is 0.990 or greater; if correlation coefficient is < 0.990 then quadratic fit can be used, but the coefficient of determination must be 0.990 or greater). If linear fit is used, it must pass a linear regression check (the low standard must be within 30% of its true concentration)	Every 12 hours	1	%Drift ± 20%; (no more than 20% of the compounds can exceed 20% drift, and all compounds that exceed 20% drift must be ≤ 50% drift)
GC/MS Semi-volatiles SIM	After C-cal Fails	6	% RSD for all compounds ≤20%	Every 12 hours	1	%Drift ± 20%

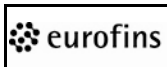
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Calibration Summary for SW-846 Methods						
Instrument	Initial Calibration			Continuing Calibration Verification		
	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria
GC VOA	After C-cal fails	At least 5	% RSD \leq 20% for individual compounds. Alternatively, if the average of the %RSDs of all compounds in the calibration standard is \leq 20% then the average RF can be used for all compounds.	Every 10 samples	1	%Drift \pm 15% for individual compounds or average % drift for all compounds in the standard \pm 15%
GC Pesticides (8081A)	After C-cal fails	5	20% RSD of RFs of initial calibration to use avg. RF, otherwise use curve fit. Degradation for DDT, endrin 15% Alternatively, if the average of the %RSDs of all compounds in the calibration standard is \leq 20%, then the AVG RF can be used for all compounds.	Every 20 samples or 12 hours	1	\leq 15% drift from initial response for quantitation C-cal - A CCV is also compliant if the average % difference is \leq 15% for all compounds in the CCV standard. DDT/Endrin breakdown check 15% every 12 hours or 20 injections
GC Pesticides (8081B)	After C-cal fails	5	20% RSD of RFs of initial calibration to use avg. RF, otherwise use curve fit. Degradation for DDT, endrin 15%	Every 20 samples or 12 hours ,	1	\leq 20% drift from initial response for quantitation DDT/Endrin breakdown check 15% every 12 hours or 20 injections
GC PCBs (8082)	After C-cal fails	5	20% RSD of RFs of initial calibration to use avg. RF, otherwise use curve fit. Alternatively, if the average of the %RSDs of all compounds in the calibration standard is \leq 20%, then the AVG RF can be used for all compounds.	Every 20 samples or 12 hours	1	\leq 15% drift from initial response for quantitation C-cal - A CCV is also compliant if the average % difference is \leq 15% for all compounds in the CCV standard.
GC PCBs (8082A)	After C-cal fails	5	20% RSD of RFs of initial calibration to use avg. RF, otherwise use curve fit.	Every 20 samples or 12 hours	1	\leq 20% drift from initial response for quantitation
GC Herbicides (8151A)	After C-cal fails	5	20% RSD of RFs of initial calibration to use avg. RF, otherwise use curve fit. Alternatively, if the average of the %RSDs of all compounds in the calibration standard is \leq 20%, then the AVG RF can be used for all compounds.	Every 10 samples	1	\leq 15% drift from initial response for quantitation C-cal - A CCV is also compliant if the average % difference is \leq 15% for all compounds in the CCV standard.

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Calibration Summary for SW-846 Methods						
Instrument	Initial Calibration			Continuing Calibration Verification		
	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria
Explosives by HPLC (8330)	Each new run or after C-cal fails	5	20% RSD of RFs of initial calibration to use average RF, otherwise use curve fit Alternatively, if the average of the %RSDs of all compounds in the calibration standard is $\leq 20\%$, then the AVG RF can be used for all compounds.	Every 10 samples	1	$\leq 15\%$ drift from initial response for quantitation C-cal - A CCV is also compliant if the average % difference is $\leq 15\%$ for all compounds in the CCV standard.
Congeners by HRGC/HRMS	After C-cal fails	6	If %RSD for native compounds $< 20\%$ and for labeled compounds $< 35\%$, otherwise a calibration curve is used	Every 12 hours	1	$< 15\%$ valley peak resolution for 2378-TCDD All native and labeled compounds meet method defined recovery limits RTs within ± 15 secs of RT in ICAL
Dioxins by HRGC/HRMS	After C-cal fails	6	If %RSD for native compounds $< 20\%$ and for labeled compounds $< 35\%$, otherwise a calibration curve is used	Every 12 hours	1	$< 25\%$ valley peak resolution for 2378-TCDD All native and labeled compounds meet method defined recovery limits RTs within ± 15 secs of RT in ICAL
GC TPH-GRO	After C-cal fails	At least 5	% RSD of $< 20\%$ to use the average CF, otherwise use calibration curve	Every 12 hours	1	%Drift $\pm 15\%$
GC TPH-DRO	After C-cal fails	5	20% RSD of RFs of initial calibration to use average RF, otherwise use curve fit.	Every 12 hours	1	% Drift $\pm 15\%$
ICP/MS	Each new run	1	Independent calibration verification (ICV) within $\pm 10\%$	Every 10 samples	1	$\pm 10\%$ of true value
ICP	Each new run	1	Independent calibration verification within $\pm 10\%$, standards $< 5\%$ RSD	Every 10 samples	1	Same as initial
CVAA	Each new run	5	Independent calibration verification within $\pm 10\%$ Correlation coefficient > 0.995	Every 10 samples	1	$\pm 20\%$ of true value
Autoanalyzer	Daily	6	Correlation coefficient > 0.995	Every 10 samples	1	$\pm 10\%$ of true value
TOC Analyzer	Monthly	Water – 6 Soil – 4	Corr. Coeff. > 0.995	Every 10 samples	1	$\pm 10\%$ of true value

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Calibration Summary for SW-846 Methods						
Instrument	Initial Calibration			Continuing Calibration Verification		
	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria
Balance	Daily	bracket range of use	Top-loading: $\pm 2\%$ or $\pm 0.02\text{g}$ of true value of weight, whichever is greater. Analytical: $\pm 0.1\%$ or $\pm 0.5\text{mg}$ of true value of weight, whichever is greater.	N/A	N/A	N/A

*All compounds with %RSD >15 must use first or second order regression fit of the six calibration points. Alternatively, if average of the %RSD of all compounds in calibration standard is $\leq 15\%$, the AVG RF can be used for all compounds.

Abbreviations

Std Conc - The number of standard concentrations used

%RSD - Percent Relative Standard Deviation CF – Calibration Factor

SPCCs - System Performance Check Compounds

CCCs - Calibration Check Compounds C-cal - Continuing Calibration

RF - Response factor

CVAA - Cold Vapor Atomic Absorption

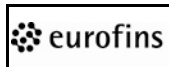
ICP/MS - Inductively Coupled Plasma – Mass Spectrometry

ICP - Inductively Coupled Plasma spectrophotometer; ICP run also includes inter-element correction check standard (at beginning and end of run)

Method standard (at beginning and end of run)

GC/MS Tuning Criteria			
BFB Key Ions and Ion Abundance Criteria:			
Mass	Method 8260B	Method 524.2	
50	15% to 40% of mass 95	15% to 40% of mass 95	
75	30% to 60% of mass 95	30% to 80% of mass 95	
95	Base peak = 100%	Base peak = 100%	
96	5% to 9% of mass 95	5% to 9% of mass 95	
173	<2% of mass 174	<2% of mass 174	
174	>50% of mass 95	>50% of mass 95	
175	5% to 9% of mass 174	5% to 9% of mass 174	
176	>95% but <101% of mass 174	>95% but <101% of mass 174	
177	5% to 9% of mass 176	5% to 9% of mass 176	
DFTPP Key Ions and Ion Abundance Criteria:			
Mass	Method 8270D	Method 8270C	Method 525.2
51	30 % to 80 % of mass 198	30 % to 60 % of mass 198	10 % to 80 % of base peak
68	<2% of mass 69	<2% of mass 69	<2% of mass 69
69	mass 69 relative abundance	mass 69 relative abundance	mass 69 relative abundance
70	<2% of mass 69	<2% of mass 69	<2% of mass 69
127	25 % to 75 % of mass 198	40% to 60 % of mass 198	10% to 80 % of base peak
197	<1% of mass 198	<1% of mass 198	<2% of mass 198
198	Base Peak = 100%	Base Peak = 100%	Base peak or >50 % of mass 442

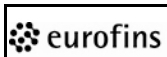
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199	5% to 9% of mass 198	5% to 9% of mass 198	5% to 9% of mass 198
275	10% to 30% of mass 198	10% to 30% of mass 198	10% to 60% of base peak
365	>0.75% of mass 198	>1% of mass 198	>1% of base peak
441	Present but < 24% mass 442	Present but < mass 443	Present but < mass 443
442	>50% of mass 198	>40% of mass 198	Base peak or >50% of mass 198
443	15% to 24% of mass 442	17% to 23% of mass 442	15% to 24% of mass 442

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Calibration Summary for Drinking Water Methods						
Instrument	Initial Calibration			Continuing Calibration Verification		
	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria
GC/MS 525.2	After C-cal fails	6	The RSD for each analyte mean RF must be $\leq 30\%$. Or a linear regression calibration curve may be used.	Every 12 hours	1	%D for RF must be $\leq 30\%$. If curve used, the point must fall on curve from I-cal.
GC 504.1	Every new run	5	% RSD $< 20\%$ to use Average RF, otherwise use calibration curve.	Every 10 samples or each batch if < 10 samples	1	70% to 130% of expected value
GC/MS 524.2	After C-cal fails	4	% RSD $< 20\%$ otherwise use calibration curve	Every 12 hours	1	%D for RF must be $\leq 30\%$. If curved used, the % recovery based on the concentration spiked must be 70% to 130% of expected value.
GC 507 508 515.1	Each new run, or after C-cal fails	3	$\leq 20\%$ RSD of RFs of Initial Calibration to use avg. RF, otherwise use curve fit. (Degradation for DDT, Endrin $\leq 20\%$ initially - Method 508.)	Every 10 samples	1	$\leq 20\%$ drift from initial response for both quantitation and confirmation.
HPLC 531.1	Each new run, or after C-cal fails	3	$\leq 20\%$ RSD of RFs of initial calibration to use avg. RF, otherwise use curve fit	Every 10 samples and/or blanks	1	$\leq 20\%$ drift from initial response.
Mercury auto-analyzer	Each new run	5	Initial calibration verification with $\pm 5\%$	Every 10 samples	1	$\pm 10\%$ of true value
Auto-analyzer	Daily	6	Correlation coefficient > 0.995	Every 10 samples	1	$\pm 10\%$ of true value
Balance	Daily	bracket range of use	Top-loading: $\pm 2\%$ or $\pm 0.02\text{g}$ of true value of weight, whichever is greater. Analytical: $\pm 0.1\%$ or $\pm 0.5\text{mg}$ of true value of weight, whichever is greater.	N/A	N/A	N/A

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Calibration Summary for Drinking Water Methods						
	Initial Calibration			Continuing Calibration Verification		
Instrument	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria
ICP	Each new run	1	Initial calibration verification $\pm 5\%$	Every 10 samples	1	$\pm 10\%$ of true value
ICP-MS	Each new run	1	Independent calibration verification within $\pm 10\%$	Every 10 samples	1	$\pm 15\%$ of true value
pH meter	Daily	3	See SOP	Every 10 samples	1	Statistical limits
IC	Monthly	5	Correlation coefficient >0.995	Every 10 samples	1	$\pm 10\%$ of true value
ISE	Every 3 months	5	Correlation coefficient >0.995	Every 10 samples	1	$\pm 10\%$ of true value

Abbreviations

Std Conc - The number of standard concentrations used
 SPCCs - System Performance Check Compounds
 CCCs - Calibration Check Compounds
 RF - Response Factor
 %RSD - Percent Relative Standard Deviation
 %D - Percent Difference
 C-cal - Continuing Calibration
 CVAf - Cold Vapor Atomic Fluorescence
 HPLC - High Performance Liquid Chromatography
 GC - Gas Chromatograph
 GC/MS - Gas Chromatography/Mass Spectrometry
 ICP - Inductively Coupled Plasma spectrophotometer
 ICP/MS - Inductively Coupled Plasma – Mass Spectrometry
 IC - Ion Chromatograph
 ISE - Ion Specific Electrode

Method 507			
Laboratory Performance Check Solution (analyzed prior to system calibration)			
Test	Analyte	Conc. µg/mL	Requirements
Sensitivity	Vernolate	0.05	Detection of analyte; S/N > 3
Chromatographic performance	Bromacil	5.0	$0.80 < PGF^a < 1.20$
Column performance	Prometon	0.30	Resolution ^b > 0.7
	Atrazine	0.15	

^aPGF - Peak Gaussian factor. Calculated using the equation:

$$PGF = \frac{1.83 \times W(1/2)}{W(1/10)}$$

Where W(1/2) is the peak width at half height and W(1/10) is the peak width at 10% peak height.

^bResolution between the two peaks as defined by the equation:

$$R = \frac{t}{W}$$

Where t is the difference in elution times between the two peaks and W is the average peak width, at the baseline, of the two peaks.

Method 508 Laboratory Performance Check Solution (analyzed prior to system calibration)			
Test	1.	Conc. µg/mL	Requirements
Sensitivity	Chlorpyrifos	0.0020	Detection of analyte; S/N > 3
Chromatographic performance	DCPA	0.0500	$0.80 < PGF^a < 1.15$
Column performance	Chlorothalonil	0.0500	Resolution ^b > 0.50
	HCH-delta	0.0400	

^aPGF - Peak Gaussian factor. Calculated using the equation:

$$PGF = \frac{1.83 \times W(1/2)}{W(1/10)}$$

Where W(1/2) is the peak width at half height and W(1/10) is the peak width at 10% peak height.

^bResolution between the two peaks as defined by the equation:

$$R = \frac{t}{W}$$

Where t is the difference in elution times between the two peaks and W is the average peak width, at the baseline, of the two peaks.

Method 515			
Laboratory Performance Check Solution (analyzed prior to system calibration)			
Test	Analyte	Conc. µg/mL	Requirements
Sensitivity	Dinoseb	0.004	Detection of analyte; S/N >3
Chromatographic performance	4-Nitrophenol	1.6	$0.70 < PGF^a < 1.05$
Column performance	3,5-Dichlorobenzoic acid 4-Nitrophenol	0.6 1.6	Resolution ^b >0.40

^aPGF - Peak Gaussian factor. Calculated using the equation:

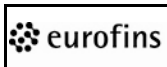
$$PGF = \frac{1.83 \times W(1/2)}{W(1/10)}$$

Where W(1/2) is the peak width at half height and W(1/10) is the peak width at tenth height.

^bResolution between the two peaks as defined by the equation:

$$R = \frac{t}{W}$$

Where t is the difference in elution times between the two peaks and W is the average peak width, at the baseline, of the two peaks.

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Calibration Summary for EPA 100, 200, 300, 600 & 1600 Series Methods						
Instrument	Initial Calibration			Continuing Calibration Verification		
	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria
GC/MS Volatiles*	After C-cal fails	5	RSD \leq 35% for all compounds*, or a linear regression may be used	Every 24 hours	1	All compounds must meet the QC acceptance criteria as stated in the method. Compounds not stated must meet a 65% -135% recovery criteria.
GC/MS Semivolatiles**	After C-cal fails	5	RSD \leq 35% for all compounds**, or a linear regression may be used Tailing factors: Benzidine < 3 Pentachlorophenol < 5	Every 24 hours	1	All compounds calibrating for <20
GC Pesticides & PCBs (Method 608)	After C-cal fails	5	10% RSD of RFs of initial calibration to use avg. RF, otherwise use curve fit. Degradation for DDT, Endrin 15%	Every 10 samples	1	\leq 15% drift from initial response for quantitation
GC VOA Halocarbons and/or Aromatics	After C-cal fails	At least 5	%RSD of \leq 10% for individual compounds to use average RFs. If %RSD >10%, a quadratic fit type is used if correlation coefficient is >0.995.	Every 12 hours, or every 10 samples	1	Method defined limits
Dioxins by HRGC/HRMS	After C-cal fails	6	If %RSD for native compounds <20% and for labeled compounds <20%, otherwise a calibration curve is used	Every 12 hours	1	<25% valley peak resolution for 2378-TCDD All native and labeled compounds meet method defined recovery limits RTs within \pm 15 secs of RT in ICAL
HPLC	Each new run or after C-cal fails	5	10% RSD of RFs of initial calibration to use average RF, otherwise use curve fit	Every 10 samples	1	\leq 15% difference from initial response for quantitation
ICP/MS	Each new run	1	Independent calibration verification (ICV) within \pm 10%	Every 10 samples	1	\pm 15% of true value
ICP	Each new run	1	Independent calibration verification within \pm 3%, standards <5%RSD	Every 10 samples	1	\pm 10% of true value

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Calibration Summary for EPA 100, 200, 300, 600 & 1600 Series Methods						
Instrument	Initial Calibration			Continuing Calibration Verification		
	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria
CVAA	Each new run	5	Independent calibration verification within $\pm 5\%$ Correlation coefficient > 0.995	Every 10 samples	1	$\pm 10\%$ of true value
CVAF	Each new run	5	The RSD $\leq 15\%$, and the low standard recovers $\pm 23\%$ of the true value	After the calibration and at the end of the analytical batch	1	$\pm 23\%$ of the true value
Auto-analyzer	Daily	6	Correlation coefficient > 0.995	Every 10 samples	1	$\pm 10\%$ of true value
TOC	Monthly	6	Corr. Coeff. > 0.995	Every 10 samples	1	$\pm 10\%$ of true value
Balance	Daily	4	Top-loading $\pm 0.5\%$, Analytical $\pm 0.1\%$ for weights > 0.1 g 50 mg $\pm 0.5\%$, 20 mg $\pm 1.0\%$ 10 mg and 5 mg $\pm 2.0\%$	N/A	N/A	N/A

*All compounds with %RSD > 35 must use first or second order regression fit of the five calibration points. The first order regression may only be used if the correlation coefficient $r \geq 0.990$. The second order regression may only be used if the coefficient of determination $r^2 \geq 0.990$.

** All compounds with % RSD > 35 must use first order regression fit of the five calibration points. The first order regression may only be used if the correlation coefficient $r \geq 0.990$.

Abbreviations

Std Conc - The number of standard concentrations used

SPCCs - System Performance Check Compounds

CCCs - Calibration Check Compounds

RF - Response Factor

%RSD - Percent Relative Standard Deviation

C-cal - Continuing Calibration

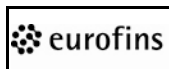
CVAA - Cold Vapor Atomic Absorption spectrophotometer

CVAF - Cold Vapor Fluorescence spectrophotometer

HPLC - High Performance Liquid Chromatography

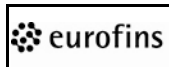
ICP - Inductively Coupled Plasma spectrophotometer; ICP run also includes inter-element correction check standard (beginning and end of run)

ICP/MS - Inductively Coupled Plasma - Mass Spectrometry

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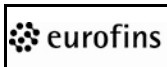
Calibration Summary for EPA TO Series Methods						
Instrument	Initial Calibration			Continuing Calibration Verification		
	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria
GC/MS Volatiles TO-15	After C-cal fails	Minimum of 5	RSD \leq 30% for all compounds, 2 allowed to be $>$ 30% as long as $<$ 40%.	Every 24 hours	1	All compounds \leq 30 difference.
GC/MS Volatiles TO-14A	After C-cal fails	Minimum of 5	RSD \leq 30% for all compounds, 2 allowed to be $>$ 30% as long as $<$ 40%.	Every 24 hours	1	All compounds \leq 30 difference.

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Eurofins Document Reference	1-P-QM-GDL-9015386	Revision	3
Effective Date	Aug 8, 2014	Status	Effective
Historical/Local Document Number	DOD - Environmental Quality Policy Manual Appendix I		
Local Document Level	Level 1		
Local Document Type	POL - Policy		
Local Document Category	ES - Environmental Sciences		

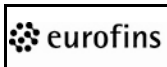
Prepared by	Kathryn Brungard
Reviewed and Approved by	Duane Luckenbill;Review;Tuesday, July 29, 2014 11:03:54 AM EDT Robert Strocko;Review;Wednesday, July 30, 2014 1:37:47 PM EDT Dorothy Love;Approval;Wednesday, July 30, 2014 2:09:25 PM EDT

 <div>Lancaster Laboratories Environmental</div>	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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NOTE: Current certificates are maintained by the QA Department and are available on our website at <http://env.lancasterlabs.com/resources/certifications>

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 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Laboratory Scope of Accreditation



Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037
PADWIS ID: 36037

EPA Lab Code: PA00009

TNI Code: (717) 656-2300

Eurofins Lancaster Laboratories Environmental LLC
2425 New Holland Pike
Lancaster, PA 17601-5994

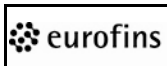
Matrix: Drinking Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 110.2		Color	NELAP	PA	4/4/2005
EPA 150.1		pH	NELAP	PA	2/28/2002
EPA 1613	B	Dioxin	NELAP	PA	10/5/2010
EPA 1664	B	Oil and grease	NELAP	PA	1/27/2014
EPA 1664	A	Oil and grease	NELAP	PA	5/24/2011
EPA 180.1		Turbidity	NELAP	PA	4/4/2005
EPA 200.7	4.4	Aluminum	NELAP	PA	4/4/2005
EPA 200.7	4.4	Barium	NELAP	PA	1/22/2001
EPA 200.7	4.4	Beryllium	NELAP	PA	6/2/2004
EPA 200.7	4.4	Cadmium	NELAP	PA	1/22/2001
EPA 200.7	4.4	Calcium	NELAP	PA	11/28/2001
EPA 200.7	4.4	Chromium	NELAP	PA	1/22/2001
EPA 200.7	4.4	Cobalt	NELAP	PA	10/16/2008
EPA 200.7	4.4	Copper	NELAP	PA	1/22/2001
EPA 200.7	4.4	Iron	NELAP	PA	4/4/2005
EPA 200.7	4.4	Lithium	NELAP	PA	11/13/2012
EPA 200.7	4.4	Magnesium	NELAP	PA	12/4/2007
EPA 200.7	4.4	Manganese	NELAP	PA	4/4/2005
EPA 200.7	4.4	Nickel	NELAP	PA	1/22/2001
EPA 200.7	4.4	Potassium	NELAP	PA	5/24/2011
EPA 200.7	4.4	Silver	NELAP	PA	1/26/2001
EPA 200.7	4.4	Sodium	NELAP	PA	1/22/2001
EPA 200.7	4.4	Strontium	NELAP	PA	5/24/2011
EPA 200.7	4.4	Sulfur	NELAP	PA	11/9/2012
EPA 200.7	4.4	Tin	NELAP	PA	11/3/2008
EPA 200.7	4.4	Vanadium	NELAP	PA	10/16/2008
EPA 200.7	4.4	Zinc	NELAP	PA	4/4/2005
EPA 200.8	5.4	Antimony	NELAP	PA	2/10/2005
EPA 200.8	5.4	Arsenic	NELAP	PA	2/10/2005
EPA 200.8	5.4	Barium	NELAP	PA	11/16/2011
EPA 200.8	5.4	Beryllium	NELAP	PA	2/10/2005
EPA 200.8	5.4	Cadmium	NELAP	PA	2/10/2005
EPA 200.8	5.4	Calcium	NELAP	PA	11/16/2011
EPA 200.8	5.4	Chromium	NELAP	PA	2/10/2005
EPA 200.8	5.4	Copper	NELAP	PA	3/9/2007
EPA 200.8	5.4	Iron	NELAP	PA	11/2/2012
EPA 200.8	5.4	Lead	NELAP	PA	2/10/2005
EPA 200.8	5.4	Magnesium	NELAP	PA	11/2/2012
EPA 200.8	5.4	Manganese	NELAP	PA	11/16/2011

Raven Alger

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TNI Code:

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PADWIS ID: 36037

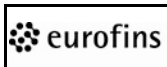
Matrix: Drinking Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 200.8	5.4	Nickel	NELAP	PA	2/10/2005
EPA 200.8	5.4	Potassium	NELAP	PA	11/16/2011
EPA 200.8	5.4	Selenium	NELAP	PA	2/10/2005
EPA 200.8	5.4	Sodium	NELAP	PA	11/16/2011
EPA 200.8	5.4	Strontium	NELAP	PA	11/16/2011
EPA 200.8	5.4	Thallium	NELAP	PA	2/10/2005
EPA 200.8	5.4	Zinc	NELAP	PA	11/16/2011
EPA 218.7		Chromium VI	NELAP	PA	11/27/2013
EPA 245.1	3.0	Mercury	NELAP	PA	8/29/2001
EPA 300.0	2.1	Bromide	NELAP	PA	11/9/2012
EPA 300.0	2.1	Chloride	NELAP	PA	5/17/2005
EPA 300.0	2.1	Fluoride	NELAP	PA	1/22/2004
EPA 300.0	2.1	Nitrate as N	NELAP	PA	10/31/2002
EPA 300.0	2.1	Nitrite as N	NELAP	PA	10/31/2002
EPA 300.0	2.1	Sulfate	NELAP	PA	7/7/2003
EPA 314.0		Perchlorate	NELAP	PA	5/24/2007
EPA 335.4		Cyanide	NELAP	PA	7/1/2006
EPA 353.2		Nitrate as N	NELAP	PA	2/28/2002
EPA 353.2		Nitrite as N	NELAP	PA	2/28/2002
EPA 353.2		Total nitrate-nitrite	NELAP	PA	5/24/2011
EPA 504.1	1.1	1,2,3-Trichloropropane (1,2,3-TCP)	NELAP	PA	5/17/2005
EPA 504.1	1.1	1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	NELAP	PA	2/28/2002
EPA 504.1	1.1	1,2-Dibromooethane (EDB, Ethylene dibromide)	NELAP	PA	1/26/2001
EPA 507	2.1	Alachlor (Lasso)	NELAP	PA	2/28/2002
EPA 507	2.1	Atrazine	NELAP	PA	2/28/2002
EPA 507	2.1	Simazine	NELAP	PA	2/28/2002
EPA 508	3.1	Aldrin (HHDN)	NELAP	PA	5/18/2005
EPA 508	3.1	Aroclor-1016 (PCB-1016)	NELAP	PA	4/24/2007
EPA 508	3.1	Aroclor-1221 (PCB-1221)	NELAP	PA	4/24/2007
EPA 508	3.1	Aroclor-1232 (PCB-1232)	NELAP	PA	4/24/2007
EPA 508	3.1	Aroclor-1242 (PCB-1242)	NELAP	PA	4/24/2007
EPA 508	3.1	Aroclor-1248 (PCB-1248)	NELAP	PA	4/24/2007
EPA 508	3.1	Aroclor-1254 (PCB-1254)	NELAP	PA	4/24/2007
EPA 508	3.1	Aroclor-1260 (PCB-1260)	NELAP	PA	4/24/2007
EPA 508	3.1	Chlordane (tech.)	NELAP	PA	2/28/2002
EPA 508	3.1	Dieldrin	NELAP	PA	1/3/2002
EPA 508	3.1	Endrin	NELAP	PA	2/28/2002
EPA 508	3.1	Heptachlor	NELAP	PA	2/28/2002
EPA 508	3.1	Heptachlor epoxide	NELAP	PA	2/28/2002
EPA 508	3.1	Hexachlorobenzene	NELAP	PA	2/28/2002
EPA 508	3.1	Hexachlorocyclopentadiene	NELAP	PA	2/28/2002
EPA 508	3.1	Methoxychlor	NELAP	PA	2/28/2002
EPA 508	3.1	Toxaphene (Chlorinated camphene)	NELAP	PA	5/25/2007

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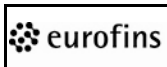
Matrix: Drinking Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 508	3.1	gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	NELAP	PA	2/28/2002
EPA 515.1	4.0	2,4,5-TP (Silvex)	NELAP	PA	1/24/2001
EPA 515.1	4.0	2,4-D	NELAP	PA	1/24/2001
EPA 515.1	4.0	Dalapon (2,2-Dichloropropionic acid)	NELAP	PA	1/24/2001
EPA 515.1	4.0	Dicamba	NELAP	PA	1/24/2001
EPA 515.1	4.0	Dinoseb (2-sec-Butyl-4,6-dinitrophenol, DNBP)	NELAP	PA	1/24/2001
EPA 515.1	4.0	Pentachlorophenol (PCP)	NELAP	PA	1/24/2001
EPA 515.1	4.0	Picloram (4-Amino-3,5,6-trichloro-2-pyridinecarboxylic acid)	NELAP	PA	1/24/2001
EPA 524.2	4.1	1,1,1,2-Tetrachloroethane	NELAP	PA	10/31/2002
EPA 524.2	4.1	1,1,1-Trichloroethane	NELAP	PA	10/31/2002
EPA 524.2	4.1	1,1,2,2-Tetrachloroethane	NELAP	PA	10/31/2002
EPA 524.2	4.1	1,1,2-Trichloroethane	NELAP	PA	10/31/2002
EPA 524.2	4.1	1,1-Dichloro-2-propanone (1,1-Dichloropropanone)	NELAP	PA	5/17/2005
EPA 524.2	4.1	1,1-Dichloroethane	NELAP	PA	10/31/2002
EPA 524.2	4.1	1,1-Dichloroethene (1,1-Dichloroethylene)	NELAP	PA	10/31/2002
EPA 524.2	4.1	1,1-Dichloropropene	NELAP	PA	10/31/2002
EPA 524.2	4.1	1,2,3-Trichlorobenzene	NELAP	PA	4/4/2005
EPA 524.2	4.1	1,2,3-Trichloropropane (1,2,3-TCP)	NELAP	PA	10/31/2002
EPA 524.2	4.1	1,2,4-Trichlorobenzene	NELAP	PA	10/31/2002
EPA 524.2	4.1	1,2,4-Trimethylbenzene	NELAP	PA	4/4/2005
EPA 524.2	4.1	1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	10/31/2002
EPA 524.2	4.1	1,2-Dichloroethane	NELAP	PA	10/31/2002
EPA 524.2	4.1	1,2-Dichloropropane	NELAP	PA	10/31/2002
EPA 524.2	4.1	1,3,5-Trimethylbenzene	NELAP	PA	5/17/2005
EPA 524.2	4.1	1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	10/31/2002
EPA 524.2	4.1	1,3-Dichloropropane	NELAP	PA	10/31/2002
EPA 524.2	4.1	1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	10/31/2002
EPA 524.2	4.1	1-Chlorobutane	NELAP	PA	5/24/2007
EPA 524.2	4.1	2,2-Dichloropropane	NELAP	PA	10/31/2002
EPA 524.2	4.1	2-Butanone (Methyl ethyl ketone, MEK)	NELAP	PA	5/24/2007
EPA 524.2	4.1	2-Chlorotoluene	NELAP	PA	10/31/2002
EPA 524.2	4.1	2-Hexanone	NELAP	PA	5/24/2007
EPA 524.2	4.1	2-Nitropropane	NELAP	PA	5/24/2007
EPA 524.2	4.1	4-Chlorotoluene	NELAP	PA	10/31/2002
EPA 524.2	4.1	4-Methyl-2-pentanone (MIBK)	NELAP	PA	5/24/2007
EPA 524.2	4.1	Acetone	NELAP	PA	5/24/2007
EPA 524.2	4.1	Acrylonitrile	NELAP	PA	5/24/2007
EPA 524.2	4.1	Allyl chloride (3-Chloropropene)	NELAP	PA	7/3/2007
EPA 524.2	4.1	Benzene	NELAP	PA	10/31/2002
EPA 524.2	4.1	Bromobenzene	NELAP	PA	10/31/2002
EPA 524.2	4.1	Bromochloromethane	NELAP	PA	4/4/2005
EPA 524.2	4.1	Bromodichloromethane	NELAP	PA	10/31/2002

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COMPANY CONFIDENTIAL		

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DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

Matrix: Drinking Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 524.2	4.1	Bromoform	NELAP	PA	10/31/2002
EPA 524.2	4.1	Carbon disulfide	NELAP	PA	5/24/2007
EPA 524.2	4.1	Carbon tetrachloride	NELAP	PA	10/31/2002
EPA 524.2	4.1	Chloroacetonitrile	NELAP	PA	5/24/2007
EPA 524.2	4.1	Chlorobenzene	NELAP	PA	10/31/2002
EPA 524.2	4.1	Chloroethane	NELAP	PA	10/31/2002
EPA 524.2	4.1	Chloroform	NELAP	PA	10/31/2002
EPA 524.2	4.1	Dibromochloromethane	NELAP	PA	10/31/2002
EPA 524.2	4.1	Dibromomethane	NELAP	PA	10/31/2002
EPA 524.2	4.1	Dichlorodifluoromethane (Freon 12)	NELAP	PA	4/4/2005
EPA 524.2	4.1	Diethyl ether (Ethyl ether)	NELAP	PA	5/24/2007
EPA 524.2	4.1	Diisopropyl ether (DIPE)	NELAP	PA	1/7/2010
EPA 524.2	4.1	Ethyl methacrylate	NELAP	PA	5/24/2007
EPA 524.2	4.1	Ethyl tert-butyl ether (ETBE)	NELAP	PA	1/24/2007
EPA 524.2	4.1	Ethylbenzene	NELAP	PA	10/31/2002
EPA 524.2	4.1	Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	4/4/2005
EPA 524.2	4.1	Hexachloroethane	NELAP	PA	5/24/2007
EPA 524.2	4.1	Isopropylbenzene (Cumene)	NELAP	PA	4/4/2005
EPA 524.2	4.1	Methacrylonitrile	NELAP	PA	5/24/2007
EPA 524.2	4.1	Methyl bromide (Bromomethane)	NELAP	PA	10/31/2002
EPA 524.2	4.1	Methyl chloride (Chloromethane)	NELAP	PA	10/31/2002
EPA 524.2	4.1	Methyl iodide (Iodomethane)	NELAP	PA	5/24/2007
EPA 524.2	4.1	Methyl tert-butyl ether (MTBE)	NELAP	PA	4/4/2005
EPA 524.2	4.1	Methylacrylate	NELAP	PA	5/24/2007
EPA 524.2	4.1	Methylene chloride (Dichloromethane)	NELAP	PA	10/31/2002
EPA 524.2	4.1	Methylmethacrylate	NELAP	PA	5/24/2007
EPA 524.2	4.1	Naphthalene	NELAP	PA	5/17/2005
EPA 524.2	4.1	Nitrobenzene	NELAP	PA	5/17/2005
EPA 524.2	4.1	Pentachloroethane	NELAP	PA	5/24/2007
EPA 524.2	4.1	Propionitrile (Ethyl cyanide)	NELAP	PA	5/24/2007
EPA 524.2	4.1	Styrene	NELAP	PA	10/31/2002
EPA 524.2	4.1	Tetrachloroethene (PCE, Perchloroethylene)	NELAP	PA	10/31/2002
EPA 524.2	4.1	Tetrahydrofuran (THF)	NELAP	PA	5/24/2007
EPA 524.2	4.1	Toluene	NELAP	PA	10/31/2002
EPA 524.2	4.1	Total trihalomethanes (TTHMs)	NELAP	PA	10/31/2002
EPA 524.2	4.1	Trichloroethene (TCE, Trichloroethylene)	NELAP	PA	10/31/2002
EPA 524.2	4.1	Trichlorofluoromethane (Freon 11)	NELAP	PA	4/4/2005
EPA 524.2	4.1	Vinyl chloride (Chloroethene)	NELAP	PA	10/31/2002
EPA 524.2	4.1	Xylenes, total	NELAP	PA	10/31/2002
EPA 524.2	4.1	cis-1,2-Dichloroethene	NELAP	PA	10/31/2002
EPA 524.2	4.1	cis-1,3-Dichloropropene	NELAP	PA	10/31/2002
EPA 524.2	4.1	n-Butylbenzene	NELAP	PA	4/4/2005
EPA 524.2	4.1	n-Propylbenzene	NELAP	PA	5/17/2005
EPA 524.2	4.1	p-Isopropyltoluene (4-Isopropyltoluene)	NELAP	PA	5/17/2005
EPA 524.2	4.1	sec-Butylbenzene	NELAP	PA	4/4/2005

Raven Alger

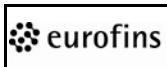
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Issue Date: 04/23/2014

Revision: 3	Effective date: Aug 8, 2014	Page 6 of 101
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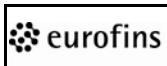
Matrix: Drinking Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 524.2	4.1	tert-Amyl methyl ether (TAME)	NELAP	PA	1/24/2007
EPA 524.2	4.1	tert-Butyl alcohol (2-Methyl-2-propanol)	NELAP	PA	5/24/2007
EPA 524.2	4.1	tert-Butylbenzene	NELAP	PA	4/4/2005
EPA 524.2	4.1	trans-1,2-Dichloroethene	NELAP	PA	10/31/2002
EPA 524.2	4.1	trans-1,3-Dichloropropene	NELAP	PA	10/31/2002
EPA 524.2	4.1	trans-1,4-Dichloro-2-butene	NELAP	PA	5/24/2007
EPA 525.2	2.0	2,3-Dichlorobiphenyl (BZ 5)	NELAP	PA	5/17/2005
EPA 525.2	2.0	Acenaphthene	NELAP	PA	5/25/2007
EPA 525.2	2.0	Acenaphthylene	NELAP	PA	4/28/2010
EPA 525.2	2.0	Alachlor (Lasso)	NELAP	PA	2/28/2002
EPA 525.2	2.0	Aldrin (HHDN)	NELAP	PA	10/9/2013
EPA 525.2	2.0	Anthracene	NELAP	PA	5/25/2007
EPA 525.2	2.0	Atrazine	NELAP	PA	1/3/2002
EPA 525.2	2.0	Benzo[a]anthracene	NELAP	PA	5/25/2007
EPA 525.2	2.0	Benzo[a]pyrene	NELAP	PA	1/24/2001
EPA 525.2	2.0	Benzo[b]fluoranthene	NELAP	PA	6/4/2007
EPA 525.2	2.0	Benzo[ghi]perylene	NELAP	PA	7/3/2007
EPA 525.2	2.0	Benzo[k]fluoranthene	NELAP	PA	6/4/2007
EPA 525.2	2.0	Benzyl butyl phthalate (Butyl benzyl phthalate)	NELAP	PA	5/25/2007
EPA 525.2	2.0	Butachlor	NELAP	PA	12/19/2002
EPA 525.2	2.0	Chrysene (Benzo[a]phenanthrene)	NELAP	PA	5/25/2007
EPA 525.2	2.0	Di-n-butyl phthalate	NELAP	PA	5/25/2007
EPA 525.2	2.0	Dibenzof[a,h]anthracene	NELAP	PA	5/25/2007
EPA 525.2	2.0	Dieldrin	NELAP	PA	5/17/2005
EPA 525.2	2.0	Diethyl phthalate	NELAP	PA	5/25/2007
EPA 525.2	2.0	Dimethyl phthalate	NELAP	PA	5/25/2007
EPA 525.2	2.0	Endrin	NELAP	PA	5/17/2005
EPA 525.2	2.0	Fluoranthene	NELAP	PA	3/7/2012
EPA 525.2	2.0	Fluorene	NELAP	PA	2/7/2012
EPA 525.2	2.0	Heptachlor	NELAP	PA	5/17/2005
EPA 525.2	2.0	Heptachlor epoxide	NELAP	PA	5/17/2005
EPA 525.2	2.0	Hexachlorobenzene	NELAP	PA	2/11/2005
EPA 525.2	2.0	Hexachlorocyclopentadiene	NELAP	PA	1/24/2001
EPA 525.2	2.0	Indeno[1,2,3-cd]pyrene	NELAP	PA	2/7/2012
EPA 525.2	2.0	Methoxychlor	NELAP	PA	1/24/2001
EPA 525.2	2.0	Metolachlor	NELAP	PA	12/19/2002
EPA 525.2	2.0	Metribuzin	NELAP	PA	12/19/2002
EPA 525.2	2.0	Phenanthrene	NELAP	PA	5/25/2007
EPA 525.2	2.0	Propachlor (Ramrod)	NELAP	PA	1/24/2001
EPA 525.2	2.0	Pyrene	NELAP	PA	5/25/2007
EPA 525.2	2.0	Simazine	NELAP	PA	1/3/2002
EPA 525.2	2.0	bis(2-Ethylhexyl) adipate (di(2-Ethylhexyl) adipate)	NELAP	PA	1/24/2001
EPA 525.2	2.0	bis(2-Ethylhexyl) phthalate (DEHP)	NELAP	PA	1/24/2001

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Revision: 3	Effective date: Aug 8, 2014	Page 7 of 101
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 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

Matrix: Drinking Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 525.2	2.0	gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	NELAP	PA	1/24/2001
EPA 531.1	3.1	3-Hydroxycarbofuran	NELAP	PA	1/17/2006
EPA 531.1	3.1	Aldicarb (Temik)	NELAP	PA	1/24/2001
EPA 531.1	3.1	Aldicarb sulfone	NELAP	PA	1/24/2001
EPA 531.1	3.1	Aldicarb sulfoxide	NELAP	PA	1/24/2001
EPA 531.1	3.1	Carbaryl (Sovin)	NELAP	PA	10/9/2002
EPA 531.1	3.1	Carbofuran (Furaden)	NELAP	PA	1/24/2001
EPA 531.1	3.1	Methomyl (Lannate)	NELAP	PA	1/24/2001
EPA 531.1	3.1	Oxamyl (Vydate)	NELAP	PA	1/24/2001
EPA 8015		Ethane	NELAP	PA	5/24/2011
EPA 8015		Methane	NELAP	PA	5/24/2011
EPA 8015		Propane	NELAP	PA	1/19/2012
SM 2120 B		Color	NELAP	PA	5/25/2005
SM 2130 B		Turbidity	NELAP	PA	5/17/2005
SM 2320 B		Alkalinity as CaCO ₃	NELAP	PA	1/24/2001
SM 2340 C		Total hardness as CaCO ₃	NELAP	PA	5/24/2011
SM 2510 B		Conductivity	NELAP	PA	5/17/2005
SM 2540 C		Total dissolved solids (TDS)	NELAP	PA	6/2/2004
SM 2540 D		Residue, nonfilterable (TSS)	NELAP	PA	5/24/2011
SM 2550 B		Temperature, deg. C	NELAP	PA	4/4/2005
SM 4500-Cl F		Total residual chlorine	NELAP	PA	5/24/2011
SM 4500-Cl G		Residual free chlorine	NELAP	PA	1/7/2010
SM 4500-F- C		Fluoride	NELAP	PA	10/15/2003
SM 4500-H+ B		pH	NELAP	PA	5/16/2007
SM 4500-P E		Orthophosphate as P	NELAP	PA	6/12/2007
SM 4500-SiO ₂ C	20-22	Silica, dissolved	NELAP	PA	5/24/2007
SM 5310 C		Total organic carbon (TOC)	NELAP	PA	4/18/2013
SM 5540 C		Surfactants as MBAS	NELAP	PA	5/24/2007
SM 9215 B		Heterotrophic bacteria (Enumeration)	NELAP	PA	2/5/2003
SM 9223 Collert		Total coliform & E. coli	NELAP	PA	1/26/2001

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
AK-101		Gasoline-range organics (GRO)	NELAP	PA	12/12/2005
AK-102		Diesel-range organics (DRO)	NELAP	PA	12/12/2005
ASTM D7511-09		Total cyanide	NELAP	PA	2/15/2013
EPA 1010		Ignitability	NELAP	PA	12/12/2005
EPA 130.2		Hardness	NELAP	PA	1/19/2005
EPA 1311		Toxicity characteristic leaching procedure (TCLP)	NELAP	PA	12/12/2005
EPA 1312		Synthetic precipitation leaching procedure (SPLP)	NELAP	PA	12/12/2005
EPA 160.1		Residue, filterable (TDS)	NELAP	PA	1/19/2005

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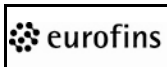
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Issue Date: 04/23/2014

Revision: 3	Effective date: Aug 8, 2014	Page 8 of 101
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 <p>Lancaster Laboratories Environmental</p>	<p>Document Title: NELAP Scope of Testing</p>	<p>Eurofins Document Reference: 1-P-QM-GDL-9015386</p>
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Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037
PADWIS ID: 36037

BPA Lab Code: PA00009

TNI Code: (717) 656-2300

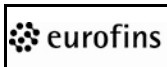
Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 160.4		Residue, volatile	NELAP	PA	1/19/2005
EPA 1613	B	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	NELAP	PA	6/30/2010
EPA 1613	B	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	NELAP	PA	6/30/2010
EPA 1613	B	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	NELAP	PA	6/30/2010
EPA 1613	B	1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	NELAP	PA	6/30/2010
EPA 1613	B	1,2,3,4,7,8,9-Heptachlorodibenzo-p-dioxin (1,2,3,4,7,8,9-hpcdd)	NELAP	PA	6/30/2010
EPA 1613	B	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 1613	B	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 1613	B	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 1613	B	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 1613	B	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 1613	B	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 1613	B	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	NELAP	PA	6/30/2010
EPA 1613	B	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	NELAP	PA	6/30/2010
EPA 1613	B	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 1613	B	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	NELAP	PA	6/30/2010
EPA 1613	B	2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD)(Dioxin)	NELAP	PA	6/30/2010
EPA 1613	B	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	NELAP	PA	6/30/2010
EPA 1613	B	Total heptachlorodibenzo-p-dioxin (HpCDD)	NELAP	PA	8/6/2010
EPA 1613	B	Total heptachlorodibenzofuran (HpCDF)	NELAP	PA	8/6/2010
EPA 1613	B	Total hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	8/6/2010
EPA 1613	B	Total hexachlorodibenzofuran (HxCDF)	NELAP	PA	8/6/2010
EPA 1613	B	Total pentachlorodibenzo-p-dioxin (PeCDD)	NELAP	PA	8/6/2010
EPA 1613	B	Total pentachlorodibenzofuran (PeCDF)	NELAP	PA	8/6/2010
EPA 1613	B	Total tetrachlorodibenzo-p-dioxin (TCDD)	NELAP	PA	8/6/2010
EPA 1613	B	Total tetrachlorodibenzofuran (TCDF)	NELAP	PA	8/6/2010
EPA 1625	C	N-Nitrosodimethylamine	NELAP	PA	11/23/2010
EPA 1631	E	Mercury	NELAP	PA	6/11/2007
EPA 1664	A	Non-polar material	NELAP	PA	11/17/2006
EPA 1664	B	Oil and grease	NELAP	PA	1/27/2014
EPA 1664	A	Oil and grease	NELAP	PA	1/19/2005
EPA 1666	A	4-Methyl-2-pentanone (MIBK)	NELAP	PA	12/12/2005
EPA 1666	A	Diisopropyl ether (DIPE)	NELAP	PA	1/19/2005

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Revision: 3	Effective date: Aug 8, 2014	Page 9 of 101
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 <p>Lancaster Laboratories Environmental</p>	<p>Document Title: NELAP Scope of Testing</p>	<p>Eurofins Document Reference: 1-P-QM-GDL-9015386</p>
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Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

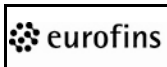
Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 1666	A	Ethyl acetate	NELAP	PA	1/19/2005
EPA 1666	A	Isobutyraldehyde	NELAP	PA	1/19/2005
EPA 1666	A	Isopropyl acetate	NELAP	PA	1/19/2005
EPA 1666	A	Isopropyl alcohol (2-Propanol)	NELAP	PA	12/2/2009
EPA 1666	A	Methyl formate	NELAP	PA	1/19/2005
EPA 1666	A	Tetrahydrofuran (THF)	NELAP	PA	1/19/2005
EPA 1666	A	Xylenes, total	NELAP	PA	1/19/2005
EPA 1666	A	n-Amyl acetate (n-Pentyl acetate)	NELAP	PA	4/4/2005
EPA 1666	A	n-Amyl alcohol (1-Pentanol)	NELAP	PA	4/4/2005
EPA 1666	A	n-Butyl acetate	NELAP	PA	4/4/2005
EPA 1666	A	n-Heptane	NELAP	PA	1/19/2005
EPA 1666	A	n-Hexane	NELAP	PA	1/19/2005
EPA 1666	A	tert-Butyl alcohol (2-Methyl-2-propanol)	NELAP	PA	4/4/2005
EPA 1668		2,2',3,3',4,4',5,5',6'-Nonachlorobiphenyl (BZ 206)	NELAP	PA	2/1/2013
EPA 1668		2,2',3,3',4,4',5,5',6'-Octachlorobiphenyl (BZ 194)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,4',5,5',6'-Octachlorobiphenyl (BZ 196)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,4',5,5',6'-Nonachlorobiphenyl (BZ 207)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,4',5,5',6'-Octachlorobiphenyl (BZ 195)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ 170)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,4',6,6'-Octachlorobiphenyl (BZ 197)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,4',6-Heptachlorobiphenyl (BZ 171)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,4',4-Hexachlorobiphenyl (BZ 128)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ 177)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,5,6'-Octachlorobiphenyl (BZ 201)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ 175)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,5'-Hexachlorobiphenyl (BZ 130)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ 199)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,5,5',6'-Nonachlorobiphenyl (BZ 208)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ 198)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ 172)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ 174)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,5,6,6'-Octachlorobiphenyl (BZ 200)	NELAP	PA	12/17/2012

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Revision: 3	Effective date: Aug 8, 2014	Page 10 of 101
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 <p>Lancaster Laboratories Environmental</p>	<p>Document Title: NELAP Scope of Testing</p>	<p>Eurofins Document Reference: 1-P-QM-GDL-9015386</p>
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Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 1668		2,2',3,3',4,5,6-Heptachlorobiphenyl (BZ 173)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,5-Hexachlorobiphenyl (BZ 129)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,6'-Hexachlorobiphenyl (BZ 132)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ 176)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,6-Hexachlorobiphenyl (BZ 131)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4-Pentachlorobiphenyl (BZ 82)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ 202)	NELAP	PA	2/1/2013
EPA 1668		2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ 178)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',5,5'-Hexachlorobiphenyl (BZ 133)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',5,6'-Hexachlorobiphenyl (BZ 135)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',5,6,6'-Heptachlorobiphenyl (BZ 179)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',5,6-Hexachlorobiphenyl (BZ 134)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',5-Pentachlorobiphenyl (BZ 83)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',6,6'-Hexachlorobiphenyl (BZ 136)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',6-Pentachlorobiphenyl (BZ 84)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3'-Tetrachlorobiphenyl (BZ 40)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4',5',6-Hexachlorobiphenyl (BZ 149)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4',5'-Pentachlorobiphenyl (BZ 97)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ 187)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4',5,5'-Hexachlorobiphenyl (BZ 146)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4',5,6'-Hexachlorobiphenyl (BZ 148)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ 188)	NELAP	PA	2/1/2013
EPA 1668		2,2',3,4',5,6-Hexachlorobiphenyl (BZ 147)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4',5-Pentachlorobiphenyl (BZ 90)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4',6'-Pentachlorobiphenyl (BZ 98)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4',6-Hexachlorobiphenyl (BZ 150)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4',6-Pentachlorobiphenyl (BZ 91)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4'-Tetrachlorobiphenyl (BZ 42)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ 183)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,4',5'-Hexachlorobiphenyl (BZ 138)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ 203)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,4',5'-Heptachlorobiphenyl (BZ 180)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,4',5,6'-Heptachlorobiphenyl (BZ 182)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ 204)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ 181)	NELAP	PA	12/17/2012

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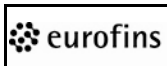
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Issue Date: 04/23/2014

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 <p>Lancaster Laboratories Environmental</p>	<p>Document Title: NELAP Scope of Testing</p>	<p>Eurofins Document Reference: 1-P-QM-GDL-9015386</p>
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Laboratory Scope of Accreditation



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DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 1668		2,2',3,4,4',5'-Hexachlorobiphenyl (BZ 137)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,4',6'-Hexachlorobiphenyl (BZ 140)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ 184)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,4',6'-Hexachlorobiphenyl (BZ 139)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,4'-Pentachlorobiphenyl (BZ 85)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,5',6'-Hexachlorobiphenyl (BZ 144)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,5'-Pentachlorobiphenyl (BZ 87)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,5,5',6'-Heptachlorobiphenyl (BZ 185)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,5,5'-Hexachlorobiphenyl (BZ 141)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,5,6'-Hexachlorobiphenyl (BZ 143)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ 186)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,5,6'-Hexachlorobiphenyl (BZ 142)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,5'-Pentachlorobiphenyl (BZ 86)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,6'-Pentachlorobiphenyl (BZ 89)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,6,6'-Hexachlorobiphenyl (BZ 145)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,6'-Pentachlorobiphenyl (BZ 88)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4-Tetrachlorobiphenyl (BZ 41)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,5',6'-Pentachlorobiphenyl (BZ 95)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,5'-Tetrachlorobiphenyl (BZ 44)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,5,5',6'-Hexachlorobiphenyl (BZ 151)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,5,5'-Pentachlorobiphenyl (BZ 92)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,5,6'-Pentachlorobiphenyl (BZ 94)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,5,6,6'-Hexachlorobiphenyl (BZ 152)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,5,6'-Pentachlorobiphenyl (BZ 93)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,5-Tetrachlorobiphenyl (BZ 43)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,6'-Tetrachlorobiphenyl (BZ 46)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,6,6'-Pentachlorobiphenyl (BZ 96)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,6-Tetrachlorobiphenyl (BZ 45)	NELAP	PA	12/17/2012
EPA 1668		2,2',3-Trichlorobiphenyl (BZ 16)	NELAP	PA	12/17/2012
EPA 1668		2,2',4,4',5,5'-Hexachlorobiphenyl (BZ 153)	NELAP	PA	12/17/2012
EPA 1668		2,2',4,4',5,6'-Hexachlorobiphenyl (BZ 154)	NELAP	PA	12/17/2012
EPA 1668		2,2',4,4',5'-Pentachlorobiphenyl (BZ 99)	NELAP	PA	12/17/2012
EPA 1668		2,2',4,4',6,6'-Hexachlorobiphenyl (BZ 155)	NELAP	PA	12/17/2012
EPA 1668		2,2',4,4',6'-Pentachlorobiphenyl (BZ 100)	NELAP	PA	12/17/2012
EPA 1668		2,2',4,4'-Tetrachlorobiphenyl (BZ 47)	NELAP	PA	12/17/2012
EPA 1668		2,2',4,5',6'-Pentachlorobiphenyl (BZ 103)	NELAP	PA	12/17/2012
EPA 1668		2,2',4,5'-Tetrachlorobiphenyl (BZ 49)	NELAP	PA	12/17/2012
EPA 1668		2,2',4,5,5'-Pentachlorobiphenyl (BZ 101)	NELAP	PA	12/17/2012
EPA 1668		2,2',4,5,6'-Pentachlorobiphenyl (BZ 102)	NELAP	PA	12/17/2012
EPA 1668		2,2',4,5-Tetrachlorobiphenyl (BZ 48)	NELAP	PA	12/17/2012
EPA 1668		2,2',4,6'-Tetrachlorobiphenyl (BZ 51)	NELAP	PA	12/17/2012
EPA 1668		2,2',4,6,6'-Pentachlorobiphenyl (BZ 104)	NELAP	PA	2/1/2013
EPA 1668		2,2',4,6-Tetrachlorobiphenyl (BZ 50)	NELAP	PA	12/17/2012

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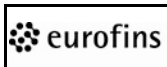
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Issue Date: 04/23/2014

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 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 1668		2,2',4'-Trichlorobiphenyl (BZ 17)	NELAP	PA	12/17/2012
EPA 1668		2,2',5,5'-Tetrachlorobiphenyl (BZ 52)	NELAP	PA	12/17/2012
EPA 1668		2,2',5,6'-Tetrachlorobiphenyl (BZ 53)	NELAP	PA	12/17/2012
EPA 1668		2,2',5'-Trichlorobiphenyl (BZ 18)	NELAP	PA	12/17/2012
EPA 1668		2,2',6,6'-Tetrachlorobiphenyl (BZ 54)	NELAP	PA	12/17/2012
EPA 1668		2,2',6'-Trichlorobiphenyl (BZ 19)	NELAP	PA	12/17/2012
EPA 1668		2,2'-Dichlorobiphenyl (BZ 4)	NELAP	PA	12/17/2012
EPA 1668		2,3',4',5',6'-Pentachlorobiphenyl (BZ 125)	NELAP	PA	12/17/2012
EPA 1668		2,3',4',5'-Tetrachlorobiphenyl (BZ 76)	NELAP	PA	12/17/2012
EPA 1668		2,3',4',5,5'-Pentachlorobiphenyl (BZ 124)	NELAP	PA	12/17/2012
EPA 1668		2,3',4',5'-Tetrachlorobiphenyl (BZ 70)	NELAP	PA	12/17/2012
EPA 1668		2,3',4',6'-Tetrachlorobiphenyl (BZ 71)	NELAP	PA	12/17/2012
EPA 1668		2,3',4'-Trichlorobiphenyl (BZ 33)	NELAP	PA	12/17/2012
EPA 1668		2,3',4,4',5',6'-Hexachlorobiphenyl (BZ 168)	NELAP	PA	12/17/2012
EPA 1668		2,3',4,4',5'-Pentachlorobiphenyl (BZ 123)	NELAP	PA	12/17/2012
EPA 1668		2,3',4,4',5,5'-Hexachlorobiphenyl (BZ 167)	NELAP	PA	12/17/2012
EPA 1668		2,3',4,4',5'-Pentachlorobiphenyl (BZ 118)	NELAP	PA	12/17/2012
EPA 1668		2,3',4,4',6'-Pentachlorobiphenyl (BZ 119)	NELAP	PA	12/17/2012
EPA 1668		2,3',4,4'-Tetrachlorobiphenyl (BZ 66)	NELAP	PA	12/17/2012
EPA 1668		2,3',4,5',6'-Pentachlorobiphenyl (BZ 121)	NELAP	PA	12/17/2012
EPA 1668		2,3',4,5'-Tetrachlorobiphenyl (BZ 68)	NELAP	PA	12/17/2012
EPA 1668		2,3',4,5,5'-Pentachlorobiphenyl (BZ 120)	NELAP	PA	12/17/2012
EPA 1668		2,3',4,5'-Tetrachlorobiphenyl (BZ 67)	NELAP	PA	12/17/2012
EPA 1668		2,3',4,6'-Tetrachlorobiphenyl (BZ 69)	NELAP	PA	12/17/2012
EPA 1668		2,3',4'-Trichlorobiphenyl (BZ 25)	NELAP	PA	12/17/2012
EPA 1668		2,2',5,6'-Tetrachlorobiphenyl (BZ 73)	NELAP	PA	12/17/2012
EPA 1668		2,3',5'-Trichlorobiphenyl (BZ 34)	NELAP	PA	12/17/2012
EPA 1668		2,3',5,5'-Tetrachlorobiphenyl (BZ 72)	NELAP	PA	12/17/2012
EPA 1668		2,3',5'-Trichlorobiphenyl (BZ 26)	NELAP	PA	12/17/2012
EPA 1668		2,3',6'-Trichlorobiphenyl (BZ 27)	NELAP	PA	12/17/2012
EPA 1668		2,3'-Dichlorobiphenyl (BZ 6)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4',5',6'-Hexachlorobiphenyl (BZ 164)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4',5'-Pentachlorobiphenyl (BZ 122)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4',5,5'-Heptachlorobiphenyl (BZ 193)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4',5,5'-Hexachlorobiphenyl (BZ 162)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4',5,6'-Hexachlorobiphenyl (BZ 163)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4',5'-Pentachlorobiphenyl (BZ 107)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4',6'-Pentachlorobiphenyl (BZ 110)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4'-Tetrachlorobiphenyl (BZ 56)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4,4',5',6'-Heptachlorobiphenyl (BZ 191)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4,4',5'-Hexachlorobiphenyl (BZ 157)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4,4',5,5',6'-Octachlorobiphenyl (BZ 205)	NELAP	PA	2/1/2013

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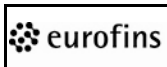
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Issue Date: 04/23/2014

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 <p>Lancaster Laboratories Environmental</p>	<p>Document Title: NELAP Scope of Testing</p>	<p>Eurofins Document Reference: 1-P-QM-GDL-9015386</p>
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Laboratory Scope of Accreditation



Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

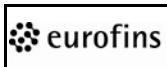
Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 1668		2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ 189)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ 190)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4,4',5-Hexachlorobiphenyl (BZ 156)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4,4',6-Hexachlorobiphenyl (BZ 158)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4,4'-Pentachlorobiphenyl (BZ 105)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4,5'-Hexachlorobiphenyl (BZ 161)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4,5'-Pentachlorobiphenyl (BZ 108)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4,5,6-Heptachlorobiphenyl (BZ 192)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4,5,5'-Hexachlorobiphenyl (BZ 159)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4,5,6-Hexachlorobiphenyl (BZ 160)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4,5-Pentachlorobiphenyl (BZ 106)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4,6-Pentachlorobiphenyl (BZ 109)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4-Tetrachlorobiphenyl (BZ 55)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',5,6-Pentachlorobiphenyl (BZ 113)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',5-Tetrachlorobiphenyl (BZ 58)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',5,5',6-Hexachlorobiphenyl (BZ 165)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',5,5'-Pentachlorobiphenyl (BZ 111)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',5,6-Pentachlorobiphenyl (BZ 112)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',5-Tetrachlorobiphenyl (BZ 57)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',6-Tetrachlorobiphenyl (BZ 59)	NELAP	PA	12/17/2012
EPA 1668		2,3,3'-Trichlorobiphenyl (BZ 20)	NELAP	PA	12/17/2012
EPA 1668		2,3,4',5,6-Pentachlorobiphenyl (BZ 117)	NELAP	PA	12/17/2012
EPA 1668		2,3,4',5-Tetrachlorobiphenyl (BZ 63)	NELAP	PA	12/17/2012
EPA 1668		2,3,4',6-Tetrachlorobiphenyl (BZ 64)	NELAP	PA	12/17/2012
EPA 1668		2,3,4'-Trichlorobiphenyl (BZ 22)	NELAP	PA	12/17/2012
EPA 1668		2,3,4,4',5,6-Hexachlorobiphenyl (BZ 166)	NELAP	PA	12/17/2012
EPA 1668		2,3,4,4',5-Pentachlorobiphenyl (BZ 114)	NELAP	PA	12/17/2012
EPA 1668		2,3,4,4',6-Pentachlorobiphenyl (BZ 115)	NELAP	PA	12/17/2012
EPA 1668		2,3,4,4'-Tetrachlorobiphenyl (BZ 60)	NELAP	PA	12/17/2012
EPA 1668		2,3,4,5,6-Pentachlorobiphenyl (BZ 116)	NELAP	PA	12/17/2012
EPA 1668		2,3,4,5-Tetrachlorobiphenyl (BZ 61)	NELAP	PA	12/17/2012
EPA 1668		2,3,4,6-Tetrachlorobiphenyl (BZ 62)	NELAP	PA	12/17/2012
EPA 1668		2,3,4-Trichlorobiphenyl (BZ 21)	NELAP	PA	12/17/2012
EPA 1668		2,3,5,6-Tetrachlorobiphenyl (BZ 65)	NELAP	PA	12/17/2012
EPA 1668		2,3,5-Trichlorobiphenyl (BZ 23)	NELAP	PA	12/17/2012
EPA 1668		2,3,6-Trichlorobiphenyl (BZ 24)	NELAP	PA	12/17/2012
EPA 1668		2,3-Dichlorobiphenyl (BZ 5)	NELAP	PA	12/17/2012
EPA 1668		2,4',5-Trichlorobiphenyl (BZ 31)	NELAP	PA	12/17/2012
EPA 1668		2,4',6-Trichlorobiphenyl (BZ 32)	NELAP	PA	12/17/2012
EPA 1668		2,4'-Dichlorobiphenyl (BZ 8)	NELAP	PA	12/17/2012
EPA 1668		2,4,4',5-Tetrachlorobiphenyl (BZ 74)	NELAP	PA	12/17/2012
EPA 1668		2,4,4',6-Tetrachlorobiphenyl (BZ 75)	NELAP	PA	12/17/2012
EPA 1668		2,4,4'-Trichlorobiphenyl (BZ 28)	NELAP	PA	12/17/2012

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 <p>Lancaster Laboratories Environmental</p>	<p>Document Title: NELAP Scope of Testing</p>	<p>Eurofins Document Reference: 1-P-QM-GDL-9015386</p>
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Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

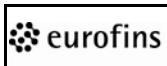
Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 1668		2,4,5-Trichlorobiphenyl (BZ 29)	NELAP	PA	12/17/2012
EPA 1668		2,4,6-Trichlorobiphenyl (BZ 30)	NELAP	PA	12/17/2012
EPA 1668		2,4-Dichlorobiphenyl (BZ 7)	NELAP	PA	12/17/2012
EPA 1668		2,5-Dichlorobiphenyl (BZ 9)	NELAP	PA	12/17/2012
EPA 1668		2,6-Dichlorobiphenyl (BZ 10)	NELAP	PA	12/17/2012
EPA 1668		2-Chlorobiphenyl (BZ 1)	NELAP	PA	12/17/2012
EPA 1668		3,3',4,4',5,5'-Hexachlorobiphenyl (BZ 169)	NELAP	PA	12/17/2012
EPA 1668		3,3',4,4',5-Pentachlorobiphenyl (BZ 126)	NELAP	PA	12/17/2012
EPA 1668		3,3',4,4'-Tetrachlorobiphenyl (BZ 77)	NELAP	PA	12/17/2012
EPA 1668		3,3',4,5'-Tetrachlorobiphenyl (BZ 79)	NELAP	PA	12/17/2012
EPA 1668		3,3',4,5,5'-Pentachlorobiphenyl (BZ 127)	NELAP	PA	12/17/2012
EPA 1668		3,3',4,5-Tetrachlorobiphenyl (BZ 78)	NELAP	PA	12/17/2012
EPA 1668		3,3',4-Trichlorobiphenyl (BZ 35)	NELAP	PA	12/17/2012
EPA 1668		3,3',5,5'-Tetrachlorobiphenyl (BZ 80)	NELAP	PA	12/17/2012
EPA 1668		3,3',5-Trichlorobiphenyl (BZ 36)	NELAP	PA	12/17/2012
EPA 1668		3,3'-Dichlorobiphenyl (BZ 11)	NELAP	PA	12/17/2012
EPA 1668		3,4',5-Trichlorobiphenyl (BZ 39)	NELAP	PA	12/17/2012
EPA 1668		3,4'-Dichlorobiphenyl (BZ 13)	NELAP	PA	12/17/2012
EPA 1668		3,4,4',5-Tetrachlorobiphenyl (BZ 81)	NELAP	PA	12/17/2012
EPA 1668		3,4,4'-Trichlorobiphenyl (BZ 37)	NELAP	PA	12/17/2012
EPA 1668		3,4,5-Trichlorobiphenyl (BZ 38)	NELAP	PA	12/17/2012
EPA 1668		3,4-Dichlorobiphenyl (BZ 12)	NELAP	PA	12/17/2012
EPA 1668		3,5-Dichlorobiphenyl (BZ 14)	NELAP	PA	12/17/2012
EPA 1668		3-Chlorobiphenyl (BZ 2)	NELAP	PA	12/17/2012
EPA 1668		4,4'-Dichlorobiphenyl (BZ 15)	NELAP	PA	12/17/2012
EPA 1668		4-Chlorobiphenyl (BZ 3)	NELAP	PA	12/17/2012
EPA 1668		Decachlorobiphenyl	NELAP	PA	2/1/2013
EPA 1671	A	Acetonitrile	NELAP	PA	1/19/2005
EPA 1671	A	Diethylamine	NELAP	PA	1/19/2005
EPA 1671	A	Dimethyl sulfoxide	NELAP	PA	1/19/2005
EPA 1671	A	Ethanol	NELAP	PA	1/19/2005
EPA 1671	A	Methanol	NELAP	PA	1/19/2005
EPA 1671	A	Methyl cellosolve (2-Methoxyethanol)	NELAP	PA	1/19/2005
EPA 1671	A	Triethylamine	NELAP	PA	1/19/2005
EPA 1671	A	n-Propanol (1-Propanol)	NELAP	PA	1/19/2005
EPA 170.1		Temperature, deg. C	NELAP	PA	4/4/2005
EPA 180.1		Turbidity	NELAP	PA	1/19/2005
EPA 200.2		Metals sample preparation	NELAP	PA	1/24/2007
EPA 200.7	4.4	Aluminum	NELAP	PA	1/19/2005
EPA 200.7	4.4	Antimony	NELAP	PA	1/19/2005
EPA 200.7	4.4	Arsenic	NELAP	PA	1/19/2005
EPA 200.7	4.4	Barium	NELAP	PA	1/19/2005
EPA 200.7	4.4	Beryllium	NELAP	PA	1/19/2005
EPA 200.7	4.4	Boron	NELAP	PA	1/19/2005
EPA 200.7	4.4	Cadmium	NELAP	PA	1/19/2005

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Revision: 3	Effective date: Aug 8, 2014	Page 15 of 101
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 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Laboratory Scope of Accreditation



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DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 200.7	4.4	Calcium	NELAP	PA	1/19/2005
EPA 200.7	4.4	Chromium	NELAP	PA	1/19/2005
EPA 200.7	4.4	Cobalt	NELAP	PA	1/19/2005
EPA 200.7	4.4	Copper	NELAP	PA	1/19/2005
EPA 200.7	4.4	Iron	NELAP	PA	1/19/2005
EPA 200.7	4.4	Lead	NELAP	PA	1/19/2005
EPA 200.7	4.4	Lithium	NELAP	PA	2/7/2012
EPA 200.7	4.4	Magnesium	NELAP	PA	1/19/2005
EPA 200.7	4.4	Manganese	NELAP	PA	1/19/2005
EPA 200.7	4.4	Molybdenum	NELAP	PA	1/19/2005
EPA 200.7	4.4	Nickel	NELAP	PA	1/19/2005
EPA 200.7	4.4	Potassium	NELAP	PA	1/19/2005
EPA 200.7	4.4	Selenium	NELAP	PA	1/19/2005
EPA 200.7	4.4	Silver	NELAP	PA	4/4/2005
EPA 200.7	4.4	Sodium	NELAP	PA	1/19/2005
EPA 200.7	4.4	Strontium	NELAP	PA	5/24/2011
EPA 200.7	4.4	Thallium	NELAP	PA	1/19/2005
EPA 200.7	4.4	Tin	NELAP	PA	1/19/2005
EPA 200.7	4.4	Titanium	NELAP	PA	1/19/2005
EPA 200.7	4.4	Vanadium	NELAP	PA	1/19/2005
EPA 200.7	4.4	Zinc	NELAP	PA	1/19/2005
EPA 200.8	5.4	Aluminum	NELAP	PA	1/7/2010
EPA 200.8	5.4	Antimony	NELAP	PA	4/4/2005
EPA 200.8	5.4	Arsenic	NELAP	PA	4/4/2005
EPA 200.8	5.4	Barium	NELAP	PA	4/4/2005
EPA 200.8	5.4	Beryllium	NELAP	PA	4/4/2005
EPA 200.8	5.4	Boron	NELAP	PA	1/11/2012
EPA 200.8	5.4	Cadmium	NELAP	PA	4/4/2005
EPA 200.8	5.4	Calcium	NELAP	PA	1/7/2010
EPA 200.8	5.4	Chromium	NELAP	PA	4/4/2005
EPA 200.8	5.4	Cobalt	NELAP	PA	11/23/2010
EPA 200.8	5.4	Copper	NELAP	PA	4/4/2005
EPA 200.8	5.4	Iron	NELAP	PA	11/23/2010
EPA 200.8	5.4	Lead	NELAP	PA	4/4/2005
EPA 200.8	5.4	Magnesium	NELAP	PA	1/7/2010
EPA 200.8	5.4	Manganese	NELAP	PA	11/23/2010
EPA 200.8	5.4	Molybdenum	NELAP	PA	1/7/2010
EPA 200.8	5.4	Nickel	NELAP	PA	4/4/2005
EPA 200.8	5.4	Potassium	NELAP	PA	1/7/2010
EPA 200.8	5.4	Selenium	NELAP	PA	12/12/2005
EPA 200.8	5.4	Silver	NELAP	PA	1/2/2007
EPA 200.8	5.4	Sodium	NELAP	PA	1/7/2010
EPA 200.8	5.4	Strontium	NELAP	PA	1/7/2010
EPA 200.8	5.4	Thallium	NELAP	PA	5/31/2006
EPA 200.8	5.4	Tin	NELAP	PA	1/7/2010

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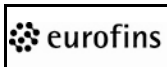
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	Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 200.8	5.4	Titanium	NELAP	PA	1/7/2010
EPA 200.8	5.4	Vanadium	NELAP	PA	1/7/2010
EPA 200.8	5.4	Zinc	NELAP	PA	1/18/2011
EPA 218.6		Chromium VI	NELAP	PA	4/4/2005
EPA 245.1	3.0	Mercury	NELAP	PA	1/19/2005
EPA 300.0	2.1	Bromide	NELAP	PA	4/4/2005
EPA 300.0	2.1	Chloride	NELAP	PA	1/19/2005
EPA 300.0	2.1	Fluoride	NELAP	PA	5/25/2005
EPA 300.0	2.1	Nitrate as N	NELAP	PA	1/19/2005
EPA 300.0	2.1	Nitrite as N	NELAP	PA	1/19/2005
EPA 300.0	2.1	Sulfate	NELAP	PA	1/19/2005
EPA 3005	A	Preconcentration under acid	NELAP	PA	12/12/2005
EPA 3010	A	Hot plate acid digestion (HNO ₃ + HCl)	NELAP	PA	12/12/2005
EPA 3020	A	Hot plate acid digestion (HNO ₃ only)	NELAP	PA	12/12/2005
EPA 305.2		Acidity as CaCO ₃	NELAP	PA	1/24/2007
EPA 3060	A	Alkaline digestion of Cr(VI)	NELAP	PA	1/24/2007
EPA 314.0		Perchlorate	NELAP	PA	11/23/2009
EPA 335.4		Total cyanide	NELAP	PA	1/19/2005
EPA 350.1		Ammonia as N	NELAP	PA	10/9/2013
EPA 351.2		Kjeldahl nitrogen, total (TKN)	NELAP	PA	1/19/2005
EPA 3510	C	Separator funnel liquid-liquid extraction	NELAP	PA	12/12/2005
EPA 3511		Organic compounds in water by microextraction	NELAP	PA	3/7/2012
EPA 3520	C	Continuous liquid-liquid extraction	NELAP	PA	12/12/2005
EPA 353.2		Nitrate as N	NELAP	PA	1/19/2005
EPA 353.2		Nitrite as N	NELAP	PA	1/19/2005
EPA 353.2		Total nitrate-nitrite	NELAP	PA	4/4/2005
EPA 3620	B	Florisil cleanup	NELAP	PA	12/12/2005
EPA 3630	C	Silica gel cleanup	NELAP	PA	12/12/2005
EPA 3640	A	Gel permeation cleanup (GPC)	NELAP	PA	12/12/2005
EPA 365.1		Phosphorus, total	NELAP	PA	4/4/2005
EPA 365.3		Orthophosphate as P	NELAP	PA	1/19/2005
EPA 3660	B	Sulfur cleanup	NELAP	PA	12/12/2005
EPA 375.4		Sulfate	NELAP	PA	4/4/2005
EPA 410.4		Chemical oxygen demand (COD)	NELAP	PA	4/1/2005
EPA 415.1		Total organic carbon (TOC)	NELAP	PA	1/19/2005
EPA 420.4		Total phenolics	NELAP	PA	4/17/2007
EPA 425.1		Surfactants as MBAS	NELAP	PA	1/19/2005
EPA 5030	B	Aqueous-phase purge-and-trap	NELAP	PA	12/12/2005
EPA 5030	C	Aqueous-phase purge-and-trap	NELAP	PA	1/27/2014
EPA 524.2	4.1	1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	1/18/2011
EPA 524.2	4.1	1,2-Dichloroethane	NELAP	PA	1/18/2011
EPA 524.2	4.1	4-Methyl-2-pentanone (MIBK)	NELAP	PA	5/24/2011
EPA 524.2	4.1	Acetone	NELAP	PA	1/18/2011
EPA 524.2	4.1	Benzene	NELAP	PA	1/18/2011
EPA 524.2	4.1	Chlorobenzene	NELAP	PA	1/18/2011

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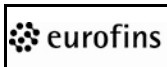
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Laboratory Scope of Accreditation

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DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 524.2	4.1	Chloroform	NELAP	PA	1/18/2011
EPA 524.2	4.1	Methylene chloride (Dichloromethane)	NELAP	PA	5/24/2011
EPA 524.2	4.1	Tetrahydrofuran (THF)	NELAP	PA	5/24/2011
EPA 524.2	4.1	Toluene	NELAP	PA	1/18/2011
EPA 524.2	4.1	m+p-Xylene	NELAP	PA	7/25/2011
EPA 524.2	4.1	o-Xylene	NELAP	PA	5/24/2011
EPA 6010		Aluminum	NELAP	PA	12/12/2005
EPA 6010		Antimony	NELAP	PA	12/12/2005
EPA 6010		Arsenic	NELAP	PA	12/12/2005
EPA 6010		Barium	NELAP	PA	12/12/2005
EPA 6010		Beryllium	NELAP	PA	12/12/2005
EPA 6010		Boron	NELAP	PA	12/12/2005
EPA 6010		Cadmium	NELAP	PA	12/12/2005
EPA 6010		Calcium	NELAP	PA	12/12/2005
EPA 6010		Chromium	NELAP	PA	12/12/2005
EPA 6010		Cobalt	NELAP	PA	12/12/2005
EPA 6010		Copper	NELAP	PA	12/12/2005
EPA 6010		Iron	NELAP	PA	12/12/2005
EPA 6010		Lead	NELAP	PA	12/12/2005
EPA 6010		Lithium	NELAP	PA	1/18/2011
EPA 6010		Magnesium	NELAP	PA	12/12/2005
EPA 6010		Manganese	NELAP	PA	12/12/2005
EPA 6010	C	Metals by ICP/AES	NELAP	PA	3/26/2012
EPA 6010	B	Metals by ICP/AES	NELAP	PA	3/26/2012
EPA 6010		Molybdenum	NELAP	PA	12/12/2005
EPA 6010		Nickel	NELAP	PA	12/12/2005
EPA 6010		Potassium	NELAP	PA	12/12/2005
EPA 6010		Selenium	NELAP	PA	12/12/2005
EPA 6010		Silver	NELAP	PA	12/12/2005
EPA 6010		Sodium	NELAP	PA	12/12/2005
EPA 6010		Strontium	NELAP	PA	12/12/2005
EPA 6010		Sulfur	NELAP	PA	12/19/2011
EPA 6010		Thallium	NELAP	PA	12/12/2005
EPA 6010		Tin	NELAP	PA	12/12/2005
EPA 6010		Titanium	NELAP	PA	12/12/2005
EPA 6010		Vanadium	NELAP	PA	12/12/2005
EPA 6010		Zinc	NELAP	PA	12/12/2005
EPA 602		Benzene	NELAP	PA	1/19/2005
EPA 602		Ethylbenzene	NELAP	PA	1/19/2005
EPA 602		Methyl tert-butyl ether (MTBE)	NELAP	PA	1/19/2005
EPA 602		Naphthalene	NELAP	PA	1/18/2011
EPA 602		Styrene	NELAP	PA	6/24/2008
EPA 602		Toluene	NELAP	PA	1/19/2005
EPA 602		Xylenes, total	NELAP	PA	1/19/2005
EPA 602		m+p-Xylene	NELAP	PA	1/18/2011

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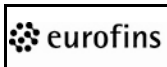
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Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DBP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 602		o-Xylene	NELAP	PA	1/18/2011
EPA 6020		Aluminum	NELAP	PA	1/7/2010
EPA 6020		Antimony	NELAP	PA	12/12/2005
EPA 6020		Arsenic	NELAP	PA	12/12/2005
EPA 6020		Barium	NELAP	PA	12/12/2005
EPA 6020		Beryllium	NELAP	PA	12/12/2005
EPA 6020		Boron	NELAP	PA	1/11/2012
EPA 6020		Cadmium	NELAP	PA	12/12/2005
EPA 6020		Calcium	NELAP	PA	1/7/2010
EPA 6020		Chromium	NELAP	PA	12/12/2005
EPA 6020		Cobalt	NELAP	PA	11/23/2010
EPA 6020		Copper	NELAP	PA	12/12/2005
EPA 6020		Iron	NELAP	PA	11/23/2010
EPA 6020		Lead	NELAP	PA	12/12/2005
EPA 6020		Magnesium	NELAP	PA	1/7/2010
EPA 6020		Manganese	NELAP	PA	11/23/2010
EPA 6020	A	Metals by ICP/MS	NELAP	PA	3/26/2012
EPA 6020		Molybdenum	NELAP	PA	1/7/2010
EPA 6020		Nickel	NELAP	PA	7/23/2008
EPA 6020		Potassium	NELAP	PA	1/7/2010
EPA 6020		Selenium	NELAP	PA	12/12/2005
EPA 6020		Silver	NELAP	PA	1/12/2007
EPA 6020		Sodium	NELAP	PA	1/7/2010
EPA 6020		Strontium	NELAP	PA	1/7/2010
EPA 6020		Thallium	NELAP	PA	12/12/2005
EPA 6020		Tin	NELAP	PA	1/7/2010
EPA 6020		Titanium	NELAP	PA	1/7/2010
EPA 6020		Vanadium	NELAP	PA	1/7/2010
EPA 6020		Zinc	NELAP	PA	1/18/2011
EPA 608		4,4'-DDD	NELAP	PA	1/19/2005
EPA 608		4,4'-DDE	NELAP	PA	1/19/2005
EPA 608		4,4'-DDT	NELAP	PA	1/19/2005
EPA 608		Aldrin (HHDN)	NELAP	PA	1/19/2005
EPA 608		Aroclor-1016 (PCB-1016)	NELAP	PA	12/11/2006
EPA 608		Aroclor-1221 (PCB-1221)	NELAP	PA	12/11/2006
EPA 608		Aroclor-1232 (PCB-1232)	NELAP	PA	12/11/2006
EPA 608		Aroclor-1242 (PCB-1242)	NELAP	PA	12/11/2006
EPA 608		Aroclor-1248 (PCB-1248)	NELAP	PA	12/11/2006
EPA 608		Aroclor-1254 (PCB-1254)	NELAP	PA	12/11/2006
EPA 608		Aroclor-1260 (PCB-1260)	NELAP	PA	12/11/2006
EPA 608		Aroclor-1268 (PCB-1268)	NELAP	PA	11/13/2012
EPA 608		Chlordane (tech.)	NELAP	PA	1/19/2005
EPA 608		Dieldrin	NELAP	PA	1/19/2005
EPA 608		Endosulfan I	NELAP	PA	1/19/2005
EPA 608		Endosulfan II	NELAP	PA	1/19/2005

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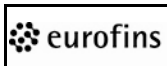
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Laboratory Scope of Accreditation



Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 608		Endosulfan sulfate	NELAP	PA	1/19/2005
EPA 608		Endrin	NELAP	PA	1/19/2005
EPA 608		Endrin aldehyde	NELAP	PA	1/19/2005
EPA 608		Heptachlor	NELAP	PA	1/19/2005
EPA 608		Heptachlor epoxide	NELAP	PA	1/19/2005
EPA 608		Methoxychlor	NELAP	PA	5/2/2006
EPA 608		Mirex	NELAP	PA	11/13/2012
EPA 608		Toxaphene (Chlorinated camphene)	NELAP	PA	1/19/2005
EPA 608		alpha-BHC (alpha-Hexachlorocyclohexane)	NELAP	PA	1/19/2005
EPA 608		beta-BHC (beta-Hexachlorocyclohexane)	NELAP	PA	1/19/2005
EPA 608		delta-BHC (delta-Hexachlorocyclohexane)	NELAP	PA	1/19/2005
EPA 608		gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	NELAP	PA	1/19/2005
EPA 622		Azinphos-methyl (Guthion)	NELAP	PA	6/15/2009
EPA 622		Bolstar (Sulprofos)	NELAP	PA	6/15/2009
EPA 622		Carbophenothion (Triphion)	NELAP	PA	4/28/2010
EPA 622		Chlorpyrifos	NELAP	PA	6/15/2009
EPA 622		Coumaphos	NELAP	PA	6/15/2009
EPA 622		Demeton-O	NELAP	PA	6/15/2009
EPA 622		Demeton-S	NELAP	PA	6/15/2009
EPA 622		Diazinon (Spectracide)	NELAP	PA	6/15/2009
EPA 622		Dichlorovos (DDVP, Dichtarvos)	NELAP	PA	6/15/2009
EPA 622		Disulfoton	NELAP	PA	6/15/2009
EPA 622		EPN (Sentox)	NELAP	PA	6/15/2009
EPA 622		Ethion	NELAP	PA	6/15/2009
EPA 622		Ethoprop (Prophos)	NELAP	PA	6/15/2009
EPA 622		Pamphur	NELAP	PA	6/15/2009
EPA 622		Pensulfathion	NELAP	PA	6/15/2009
EPA 622		Permethrin	NELAP	PA	6/15/2009
EPA 622		Malathion	NELAP	PA	6/15/2009
EPA 622		Morphos	NELAP	PA	6/15/2009
EPA 622		Methyl parathion (Parathion, methyl)	NELAP	PA	6/15/2009
EPA 622		Mevinphos	NELAP	PA	6/15/2009
EPA 622		Naled	NELAP	PA	6/15/2009
EPA 622		Parathion, ethyl (Ethyl parathion, Parathion)	NELAP	PA	6/15/2009
EPA 622		Phorate (Thimet)	NELAP	PA	6/15/2009
EPA 622		Ronnel	NELAP	PA	6/15/2009
EPA 622		Stirophos (Tetrachlorovinphos)	NELAP	PA	6/15/2009
EPA 622		Tokuthion (Prothiophos)	NELAP	PA	6/15/2009
EPA 622		Trichloronate	NELAP	PA	6/15/2009
EPA 624		1,1,1,2-Tetrachloroethane	NELAP	PA	1/19/2005
EPA 624		1,1,1-Trichloroethane	NELAP	PA	1/19/2005
EPA 624		1,1,2,2-Tetrachloroethane	NELAP	PA	1/19/2005
EPA 624		1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	NELAP	PA	7/3/2007
EPA 624		1,1,2-Trichloroethane	NELAP	PA	1/19/2005

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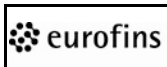
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Laboratory Scope of Accreditation

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DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 624		1,1-Dichloroethane	NELAP	PA	1/19/2005
EPA 624		1,1-Dichloroethene (1,1-Dichloroethylene)	NELAP	PA	1/19/2005
EPA 624		1,1-Dichloropropane	NELAP	PA	7/3/2007
EPA 624		1,2,3-Trichlorobenzene	NELAP	PA	7/3/2007
EPA 624		1,2,3-Trichloropropane (1,2,3-TCP)	NELAP	PA	7/3/2007
EPA 624		1,2,3-Trimethylbenzene	NELAP	PA	7/3/2007
EPA 624		1,2,4-Trichlorobenzene	NELAP	PA	7/3/2007
EPA 624		1,2,4-Trimethylbenzene	NELAP	PA	7/3/2007
EPA 624		1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	NELAP	PA	7/3/2007
EPA 624		1,2-Dibromoethane (EDB, Ethylene dibromide)	NELAP	PA	7/3/2007
EPA 624		1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 624		1,2-Dichloroethane	NELAP	PA	1/19/2005
EPA 624		1,2-Dichloropropane	NELAP	PA	1/19/2005
EPA 624		1,3,5-Trimethylbenzene	NELAP	PA	7/3/2007
EPA 624		1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 624		1,3-Dichloropropane	NELAP	PA	7/3/2007
EPA 624		1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 624		1,4-Dioxane (1,4-Dioxolene oxide)	NELAP	PA	7/3/2007
EPA 624		2,2-Dichloropropane	NELAP	PA	7/3/2007
EPA 624		2-Butanone (Methyl ethyl ketone, MEK)	NELAP	PA	7/3/2007
EPA 624		2-Chloroethyl vinyl ether	NELAP	PA	1/19/2005
EPA 624		2-Chlorotoluene	NELAP	PA	7/3/2007
EPA 624		2-Hexanone	NELAP	PA	7/3/2007
EPA 624		4-Chloro-2-nitrophenol	NELAP	PA	7/3/2007
EPA 624		4-Chlorotoluene	NELAP	PA	7/3/2007
EPA 624		4-Methyl-2-pentanone (MIBK)	NELAP	PA	5/2/2006
EPA 624		Acetone	NELAP	PA	7/3/2007
EPA 624		Acetonitrile	NELAP	PA	7/3/2007
EPA 624		Acrolein (Propenal)	NELAP	PA	1/19/2005
EPA 624		Acrylonitrile	NELAP	PA	1/19/2005
EPA 624		Allyl chloride (3-Chloropropene)	NELAP	PA	7/3/2007
EPA 624		Benzene	NELAP	PA	1/19/2005
EPA 624		Bromobenzene	NELAP	PA	7/3/2007
EPA 624		Bromochloromethane	NELAP	PA	5/2/2006
EPA 624		Bromodichloromethane	NELAP	PA	1/19/2005
EPA 624		Bromoform	NELAP	PA	1/19/2005
EPA 624		Carbon disulfide	NELAP	PA	7/3/2007
EPA 624		Carbon tetrachloride	NELAP	PA	1/19/2005
EPA 624		Chlorobenzene	NELAP	PA	1/19/2005
EPA 624		Chloroethane	NELAP	PA	1/19/2005
EPA 624		Chloroform	NELAP	PA	1/19/2005
EPA 624		Chloroprene (2-Chloro-1,3-butadiene)	NELAP	PA	6/12/2009
EPA 624		Cyclohexane	NELAP	PA	7/3/2007
EPA 624		Dibromochloromethane	NELAP	PA	4/4/2005

Raven Alger

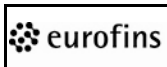
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 <p>Lancaster Laboratories Environmental</p>	<p>Document Title: NELAP Scope of Testing</p>	<p>Eurofins Document Reference: 1-P-QM-GDL-9015386</p>
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Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 624		Dibromomethane	NELAP	PA	7/3/2007
EPA 624		Dichlorodifluoromethane (Freon 12)	NELAP	PA	7/3/2007
EPA 624		Diisopropyl ether (DIPE)	NELAP	PA	5/2/2006
EPA 624		Ethyl acetate	NELAP	PA	1/20/2012
EPA 624		Ethyl methacrylate	NELAP	PA	7/3/2007
EPA 624		Ethylbenzene	NELAP	PA	1/19/2005
EPA 624		Freon 113 (1,1,2-Trichloro-1,2,2-trifluoroethane)	NELAP	PA	2/1/2011
EPA 624		Freon-123A	NELAP	PA	2/1/2011
EPA 624		Isobutyl alcohol (2-Methyl-1-propanol)	NELAP	PA	7/3/2007
EPA 624		Isopropylbenzene (Cumene)	NELAP	PA	5/2/2006
EPA 624		Methacrylonitrile	NELAP	PA	7/3/2007
EPA 624		Methyl bromide (Bromomethane)	NELAP	PA	1/19/2005
EPA 624		Methyl chloride (Chloromethane)	NELAP	PA	1/19/2005
EPA 624		Methyl iodide (Iodomethane)	NELAP	PA	7/3/2007
EPA 624		Methyl tert-butyl ether (MTBE)	NELAP	PA	12/12/2005
EPA 624		Methylene chloride (Dichloromethane)	NELAP	PA	1/19/2005
EPA 624		Methylmethacrylate	NELAP	PA	7/3/2007
EPA 624		Naphthalene	NELAP	PA	7/3/2007
EPA 624		Pentachloroethane	NELAP	PA	7/3/2007
EPA 624		Propionitrile (Ethyl cyanide)	NELAP	PA	7/3/2007
EPA 624		Styrene	NELAP	PA	5/2/2006
EPA 624		Tetrachloroethene (PCE, Perchloroethylene)	NELAP	PA	1/19/2005
EPA 624		Tetrahydrofuran (THF)	NELAP	PA	7/3/2007
EPA 624		Toluene	NELAP	PA	1/19/2005
EPA 624		Trichloroethene (TCE, Trichloroethylene)	NELAP	PA	1/19/2005
EPA 624		Trichlorofluoromethane (Freon 11)	NELAP	PA	1/19/2005
EPA 624		Vinyl acetate	NELAP	PA	7/3/2007
EPA 624		Vinyl chloride (Chloroethene)	NELAP	PA	1/19/2005
EPA 624		Xylenes, total	NELAP	PA	1/19/2005
EPA 624		cis-1,2-Dichloroethene	NELAP	PA	6/12/2009
EPA 624		cis-1,3-Dichloropropene	NELAP	PA	1/19/2005
EPA 624		n-Butylbenzene	NELAP	PA	7/3/2007
EPA 624		n-Heptane	NELAP	PA	7/3/2007
EPA 624		n-Hexane	NELAP	PA	7/3/2007
EPA 624		n-Propylbenzene	NELAP	PA	7/3/2007
EPA 624		p-Isopropyltoluene (4-Isopropyltoluene)	NELAP	PA	7/3/2007
EPA 624		sec-Butylbenzene	NELAP	PA	7/3/2007
EPA 624		tert-Amyl methyl ether (TAME)	NELAP	PA	5/2/2006
EPA 624		tert-Butyl alcohol (2-Methyl-2-propanol)	NELAP	PA	5/2/2006
EPA 624		tert-Butyl ethyl ether	NELAP	PA	5/2/2006
EPA 624		tert-Butylbenzene	NELAP	PA	7/3/2007
EPA 624		trans-1,2-Dichloroethene	NELAP	PA	1/19/2005
EPA 624		trans-1,3-Dichloropropene	NELAP	PA	1/19/2005
EPA 625		1,1'-Biphenyl (Biphenyl, Lemonene)	NELAP	PA	7/3/2007
EPA 625		1,2,4,5-Tetrachlorobenzene	NELAP	PA	5/2/2006

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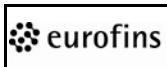
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Issue Date: 04/23/2014

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 <p>Lancaster Laboratories Environmental</p>	<p>Document Title: NELAP Scope of Testing</p>	<p>Eurofins Document Reference: 1-P-QM-GDL-9015386</p>
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Laboratory Scope of Accreditation



Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037
PADWIS ID: 36037

EPA Lab Code: PA00009

TNI Code: (717) 656-2300

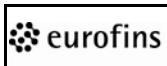
Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 625		1,2,4-Trichlorobenzene	NELAP	PA	1/19/2005
EPA 625		1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 625		1,2-Diphenylhydrazine	NELAP	PA	5/2/2006
EPA 625		1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 625		1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 625		1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	7/3/2007
EPA 625		1-Methylphenanthrene	NELAP	PA	5/2/2006
EPA 625		2,3,4,6-Tetrachlorophenol	NELAP	PA	7/3/2007
EPA 625		2,3-Dichloroaniline	NELAP	PA	5/2/2006
EPA 625		2,3-Dinitrotoluene	NELAP	PA	7/3/2007
EPA 625		2,4,5-Trichlorophenol	NELAP	PA	7/3/2007
EPA 625		2,4,6-Trichlorophenol	NELAP	PA	1/19/2005
EPA 625		2,4-Dichlorophenol	NELAP	PA	1/19/2005
EPA 625		2,4-Dimethylphenol	NELAP	PA	1/19/2005
EPA 625		2,4-Dinitrophenol	NELAP	PA	1/19/2005
EPA 625		2,4-Dinitrotoluene (2,4-DNT)	NELAP	PA	1/19/2005
EPA 625		2,6-Dichlorophenol	NELAP	PA	7/3/2007
EPA 625		2,6-Dinitrotoluene (2,6-DNT)	NELAP	PA	1/19/2005
EPA 625		2-Chloronaphthalene	NELAP	PA	1/19/2005
EPA 625		2-Chlorophenol	NELAP	PA	1/19/2005
EPA 625		2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	NELAP	PA	1/19/2005
EPA 625		2-Methylnaphthalene	NELAP	PA	7/3/2007
EPA 625		2-Methylphenol (o-Cresol)	NELAP	PA	7/3/2007
EPA 625		2-Nitroaniline	NELAP	PA	7/3/2007
EPA 625		2-Nitrophenol	NELAP	PA	1/19/2005
EPA 625		3,4-Methylphenol (m-p-Cresol)	NELAP	PA	7/3/2007
EPA 625		3,3'-Dichlorobenzidine	NELAP	PA	1/19/2005
EPA 625		3-Nitroaniline	NELAP	PA	7/3/2007
EPA 625		4-Bromophenyl phenyl ether	NELAP	PA	1/19/2005
EPA 625		4-Chloro-3-methylphenol	NELAP	PA	1/19/2005
EPA 625		4-Chloroaniline	NELAP	PA	7/3/2007
EPA 625		4-Chlorophenyl phenyl ether	NELAP	PA	1/19/2005
EPA 625		4-Nitroaniline	NELAP	PA	7/3/2007
EPA 625		4-Nitrophenol	NELAP	PA	1/19/2005
EPA 625		Acenaphthene	NELAP	PA	1/19/2005
EPA 625		Acenaphthylene	NELAP	PA	1/19/2005
EPA 625		Acetophenone	NELAP	PA	5/2/2006
EPA 625		Aniline	NELAP	PA	5/2/2006
EPA 625		Anthracene	NELAP	PA	4/4/2005
EPA 625		Benazidine	NELAP	PA	1/19/2005
EPA 625		Benzo[a]anthracene	NELAP	PA	1/19/2005
EPA 625		Benzo[a]pyrene	NELAP	PA	1/19/2005
EPA 625		Benzo[b]fluoranthene	NELAP	PA	1/19/2005
EPA 625		Benzo[ghi]perylene	NELAP	PA	1/19/2005
EPA 625		Benzo[k]fluoranthene	NELAP	PA	1/19/2005

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 <p>Lancaster Laboratories Environmental</p>	<p>Document Title: NELAP Scope of Testing</p>	<p>Eurofins Document Reference: 1-P-QM-GDL-9015386</p>
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Laboratory Scope of Accreditation



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DBP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 625		Benzoic acid	NELAP	PA	5/2/2006
EPA 625		Benzyl alcohol	NELAP	PA	7/3/2007
EPA 625		Butyl benzyl phthalate (Benzyl butyl phthalate)	NELAP	PA	1/19/2005
EPA 625		Carbazole	NELAP	PA	5/2/2006
EPA 625		Chrysene (Benzo[a]phenanthrene)	NELAP	PA	1/19/2005
EPA 625		Di-n-butyl phthalate	NELAP	PA	1/19/2005
EPA 625		Di-n-octyl phthalate	NELAP	PA	1/19/2005
EPA 625		Dibenzofuran	NELAP	PA	1/19/2005
EPA 625		Dibenzofuran	NELAP	PA	7/3/2007
EPA 625		Diethyl phthalate	NELAP	PA	1/19/2005
EPA 625		Dimethyl phthalate	NELAP	PA	1/19/2005
EPA 625		Diphenyl ether	NELAP	PA	7/3/2007
EPA 625		Fluoranthene	NELAP	PA	1/19/2005
EPA 625		Fluorene	NELAP	PA	1/19/2005
EPA 625		Hexachlorobenzene	NELAP	PA	1/19/2005
EPA 625		Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	1/19/2005
EPA 625		Hexachlorocyclopentadiene	NELAP	PA	1/19/2005
EPA 625		Hexachloroethane	NELAP	PA	1/19/2005
EPA 625		Indeno(1,2,3-cd)pyrene	NELAP	PA	1/19/2005
EPA 625		Isophorone	NELAP	PA	1/19/2005
EPA 625		N-Nitrosodimethylamine	NELAP	PA	5/2/2006
EPA 625		N-Nitrosodiphenylamine	NELAP	PA	1/19/2005
EPA 625		N-Nitrosodipropylamine	NELAP	PA	1/19/2005
EPA 625		N-Nitrosodimethylamine	NELAP	PA	5/2/2006
EPA 625		N-Nitrosodimethylamine	NELAP	PA	1/19/2005
EPA 625		N-Nitrosodiphenylamine	NELAP	PA	1/19/2005
EPA 625		N-Nitrosopyrrolidine	NELAP	PA	5/2/2006
EPA 625		Naphthalene	NELAP	PA	1/19/2005
EPA 625		Nitrobenzene	NELAP	PA	1/19/2005
EPA 625		Pentachlorobenzene	NELAP	PA	7/3/2007
EPA 625		Pentachlorophenol (PCP)	NELAP	PA	1/19/2005
EPA 625		Phenanthrene	NELAP	PA	1/19/2005
EPA 625		Phenol	NELAP	PA	1/19/2005
EPA 625		Pyrene	NELAP	PA	1/19/2005
EPA 625		Pyridine	NELAP	PA	5/2/2006
EPA 625		alpha-Terpinol	NELAP	PA	5/2/2006
EPA 625		bis(2-Chloroethoxy)methane	NELAP	PA	1/19/2005
EPA 625		bis(2-Chloroethyl) ether	NELAP	PA	1/19/2005
EPA 625		bis(2-Chloroisopropyl) ether	NELAP	PA	1/19/2005
EPA 625		bis(2-Ethylhexyl) phthalate (DEHP)	NELAP	PA	1/19/2005
EPA 625		n-Decane	NELAP	PA	5/2/2006
EPA 625		n-Docosane	NELAP	PA	5/2/2006
EPA 625		n-Dodecane	NELAP	PA	5/2/2006
EPA 625		n-Eicosane	NELAP	PA	5/2/2006
EPA 625		n-Hexadecane	NELAP	PA	5/2/2006

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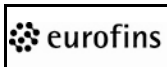
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Issue Date: 04/23/2014

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 <p>Lancaster Laboratories Environmental</p>	<p>Document Title: NELAP Scope of Testing</p>	<p>Eurofins Document Reference: 1-P-QM-GDL-9015386</p>
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Laboratory Scope of Accreditation

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DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 625		n-Octadecane	NELAP	PA	5/2/2006
EPA 625		n-Tetradecane	NELAP	PA	5/2/2006
EPA 625		o-Toluidine (2-Toluidine, 2-Methylaniline)	NELAP	PA	7/3/2007
EPA 6850		Perchlorate	NELAP	PA	1/19/2011
EPA 7196	A	Chromium VI	NELAP	PA	4/6/2006
EPA 7199		Chromium VI	NELAP	PA	1/4/2006
EPA 7470		Mercury	NELAP	PA	11/21/2005
EPA 8011		1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	NELAP	PA	5/2/2006
EPA 8011		1,2-Dibromoethane (EDB, Ethylene dibromide)	NELAP	PA	12/12/2005
EPA 8015		2-Methyl-propanoic acid (Isobutyric acid)	NELAP	PA	12/14/2012
EPA 8015		Acetic acid (Ethanoic acid)	NELAP	PA	12/14/2012
EPA 8015		Butanedioic acid (Succinic acid)	NELAP	PA	12/14/2012
EPA 8015		Butyric acid	NELAP	PA	12/14/2012
EPA 8015		Citric acid	NELAP	PA	12/14/2012
EPA 8015		Diethyl-range organics (DRO)	NELAP	PA	12/12/2005
EPA 8015		Diethylene glycol	NELAP	PA	1/20/2012
EPA 8015		Ethane	NELAP	PA	12/4/2007
EPA 8015		Ethanol	NELAP	PA	12/4/2007
EPA 8015		Ethene	NELAP	PA	12/4/2007
EPA 8015		Ethylene glycol	NELAP	PA	12/4/2007
EPA 8015		Formic acid	NELAP	PA	12/14/2012
EPA 8015		Gasoline-range organics (GRO)	NELAP	PA	12/12/2005
EPA 8015		Isobutyl alcohol (2-Methyl-1-propanol)	NELAP	PA	2/7/2012
EPA 8015		Isopropyl alcohol (2-Propanol)	NELAP	PA	12/4/2007
EPA 8015		Lactic acid	NELAP	PA	12/14/2012
EPA 8015		Methane	NELAP	PA	12/4/2007
EPA 8015		Methanol	NELAP	PA	12/4/2007
EPA 8015	C	Nonhalogenated organics by GC/FID	NELAP	PA	3/26/2012
EPA 8015	B	Nonhalogenated organics by GC/FID	NELAP	PA	3/26/2012
EPA 8015		Oxalic acid	NELAP	PA	12/14/2012
EPA 8015		Propane	NELAP	PA	12/4/2007
EPA 8015		Propionic acid	NELAP	PA	12/14/2012
EPA 8015		Propylene glycol	NELAP	PA	1/20/2012
EPA 8015		Pyruvic acid	NELAP	PA	12/14/2012
EPA 8015		Quinic acid	NELAP	PA	12/21/2012
EPA 8015		Tartaric acid	NELAP	PA	12/14/2012
EPA 8015		Tetraethylene glycol	NELAP	PA	1/20/2012
EPA 8015		Total petroleum hydrocarbons (TPH)	NELAP	PA	1/24/2007
EPA 8015		Triethylene glycol	NELAP	PA	1/20/2012
EPA 8015		n-Butyl alcohol (n-Butanol, 1-Butanol)	NELAP	PA	2/7/2012
EPA 8015		n-Propanol (1-Propanol)	NELAP	PA	2/7/2012
EPA 8021		Benzene	NELAP	PA	12/12/2005
EPA 8021		Ethylbenzene	NELAP	PA	12/12/2005
EPA 8021		Isopropylbenzene (Cumene)	NELAP	PA	12/12/2005

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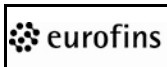
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Issue Date: 04/23/2014

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 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Laboratory Scope of Accreditation

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DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

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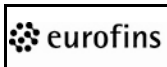
Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8021		Methyl tert-butyl ether (MTBE)	NELAP	PA	2/11/2011
EPA 8021		Naphthalene	NELAP	PA	6/24/2008
EPA 8021		Toluene	NELAP	PA	12/12/2005
EPA 8021	B	VOCs by GC/PID/ELCD	NELAP	PA	3/26/2012
EPA 8021		Xylenes, total	NELAP	PA	12/12/2005
EPA 8021		m-Xylene	NELAP	PA	11/23/2009
EPA 8021		o-Xylene	NELAP	PA	11/23/2009
EPA 8021		p-Xylene	NELAP	PA	11/23/2009
EPA 8081		4,4'-DDD	NELAP	PA	2/10/2006
EPA 8081		4,4'-DDE	NELAP	PA	12/12/2005
EPA 8081		4,4'-DDT	NELAP	PA	12/12/2005
EPA 8081		Aldrin (HHDN)	NELAP	PA	12/12/2005
EPA 8081		Chlordane (tech.)	NELAP	PA	12/12/2005
EPA 8081		Dieldrin	NELAP	PA	12/12/2005
EPA 8081		Endosulfan I	NELAP	PA	2/10/2006
EPA 8081		Endosulfan II	NELAP	PA	12/12/2005
EPA 8081		Endosulfan sulfate	NELAP	PA	12/12/2005
EPA 8081		Endrin	NELAP	PA	12/12/2005
EPA 8081		Endrin aldehyde	NELAP	PA	12/12/2005
EPA 8081		Endrin ketone	NELAP	PA	2/10/2006
EPA 8081		Heptachlor	NELAP	PA	12/12/2005
EPA 8081		Heptachlor epoxide	NELAP	PA	12/12/2005
EPA 8081		Kepone	NELAP	PA	5/2/2006
EPA 8081		Methoxychlor	NELAP	PA	12/12/2005
EPA 8081		Mirex	NELAP	PA	12/12/2005
EPA 8081	B	Organochlorine pesticides by GC/ECD	NELAP	PA	1/1/2013
EPA 8081	A	Organochlorine pesticides by GC/ECD	NELAP	PA	3/26/2012
EPA 8081		Toxaphene (Chlorinated camphene)	NELAP	PA	12/12/2005
EPA 8081		alpha-BHC (alpha-Hexachlorocyclohexane)	NELAP	PA	2/10/2006
EPA 8081		alpha-Chlordane	NELAP	PA	2/10/2006
EPA 8081		beta-BHC (beta-Hexachlorocyclohexane)	NELAP	PA	2/10/2006
EPA 8081		delta-BHC (delta-Hexachlorocyclohexane)	NELAP	PA	2/10/2006
EPA 8081		gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	NELAP	PA	2/10/2006
EPA 8081		gamma-Chlordane	NELAP	PA	2/10/2006
EPA 8082		Aroclor-1016 (PCB-1016)	NELAP	PA	12/11/2006
EPA 8082		Aroclor-1221 (PCB-1221)	NELAP	PA	12/11/2006
EPA 8082		Aroclor-1232 (PCB-1232)	NELAP	PA	12/11/2006
EPA 8082		Aroclor-1242 (PCB-1242)	NELAP	PA	12/11/2006
EPA 8082		Aroclor-1248 (PCB-1248)	NELAP	PA	12/11/2006
EPA 8082		Aroclor-1254 (PCB-1254)	NELAP	PA	12/11/2006
EPA 8082		Aroclor-1260 (PCB-1260)	NELAP	PA	12/11/2006
EPA 8082		Aroclor-1262 (PCB-1262)	NELAP	PA	7/23/2008
EPA 8082		Aroclor-1268 (PCB-1268)	NELAP	PA	7/23/2008
EPA 8082		Decachlorobiphenyl	NELAP	PA	12/17/2012
EPA 8082	A	PCBs by GC/ECD	NELAP	PA	3/26/2012

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 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Laboratory Scope of Accreditation

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DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

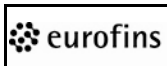
Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8141		Alachlor (Lasso)	NELAP	PA	1/21/2009
EPA 8141		Atrazine	NELAP	PA	12/12/2005
EPA 8141		Azinphos-methyl (Guthion)	NELAP	PA	12/12/2005
EPA 8141		Bolstar (Sulprofos)	NELAP	PA	12/12/2005
EPA 8141		Carbophenothion (Trithion)	NELAP	PA	11/9/2012
EPA 8141		Chlorpyrifos	NELAP	PA	12/12/2005
EPA 8141		Coumaphos	NELAP	PA	12/12/2005
EPA 8141		Demeton-O	NELAP	PA	12/12/2005
EPA 8141		Demeton-S	NELAP	PA	12/12/2005
EPA 8141		Diazinon (Spectracide)	NELAP	PA	12/12/2005
EPA 8141		Dichlorovos (DDVP, Dichlorvos)	NELAP	PA	12/12/2005
EPA 8141		Disulfoton	NELAP	PA	12/12/2005
EPA 8141		EPN (Santox)	NELAP	PA	12/12/2005
EPA 8141		Ethion	NELAP	PA	12/12/2005
EPA 8141		Ethoprop (Prophos)	NELAP	PA	12/12/2005
EPA 8141		Famphur	NELAP	PA	12/12/2005
EPA 8141		Fensulfothion	NELAP	PA	12/12/2005
EPA 8141		Fenthion	NELAP	PA	12/12/2005
EPA 8141		Malathion	NELAP	PA	12/12/2005
EPA 8141		Merphos	NELAP	PA	12/12/2005
EPA 8141		Methyl parathion (Parathion, methyl)	NELAP	PA	12/12/2005
EPA 8141		Metolachlor	NELAP	PA	1/24/2007
EPA 8141		Mevinphos	NELAP	PA	12/12/2005
EPA 8141		Naled	NELAP	PA	12/12/2005
EPA 8141	B	Organophosphorus compounds by GC/NPD	NELAP	PA	3/26/2012
EPA 8141	A	Organophosphorus compounds by GC/NPD	NELAP	PA	3/26/2012
EPA 8141		Parathion, ethyl (Ethyl parathion, Parathion)	NELAP	PA	12/12/2005
EPA 8141		Phorate (Thimet)	NELAP	PA	12/12/2005
EPA 8141		Ronnel	NELAP	PA	12/12/2005
EPA 8141		Simazine	NELAP	PA	12/12/2005
EPA 8141		Stirophos (Tetrachlorovinphos)	NELAP	PA	5/2/2006
EPA 8141		Tokuthion (Prothiophos)	NELAP	PA	12/12/2005
EPA 8141		Trichloronate	NELAP	PA	5/2/2006
EPA 8151		2,4,5-T	NELAP	PA	12/12/2005
EPA 8151		2,4,5-TP (Silvex)	NELAP	PA	12/12/2005
EPA 8151		2,4-D	NELAP	PA	12/12/2005
EPA 8151		2,4-DB (Butoxon)	NELAP	PA	12/12/2005
EPA 8151	A	Chlorinated herbicides by GC/ECD	NELAP	PA	3/26/2012
EPA 8151		Dalapon (2,2-Dichloropropionic acid)	NELAP	PA	12/12/2005
EPA 8151		Dicamba	NELAP	PA	12/12/2005
EPA 8151		Dichloroprop (Dichlorprop)	NELAP	PA	1/24/2007
EPA 8151		Dinoseb (2-sec-Butyl-4,6-dinitrophenol, DNBP)	NELAP	PA	12/12/2005
EPA 8151		MCFA	NELAP	PA	12/12/2005
EPA 8151		MCPP (Mecoprop)	NELAP	PA	12/12/2005
EPA 8151		Pentachlorophenol (PCP)	NELAP	PA	12/12/2005

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Revision: 3	Effective date: Aug 8, 2014	Page 27 of 101
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 <p>Lancaster Laboratories Environmental</p>	<p>Document Title: NELAP Scope of Testing</p>	<p>Eurofins Document Reference: 1-P-QM-GDL-9015386</p>
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Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

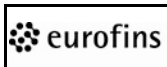
Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8151		Picloram (4-Amino-3,5,6-trichloro-2-pyridinecarboxylic acid)	NELAP	PA	12/12/2005
EPA 8260		1,1,1,2-Tetrachloroethane	NELAP	PA	12/12/2005
EPA 8260		1,1,1-Trichloroethane	NELAP	PA	12/12/2005
EPA 8260		1,1,2,2-Tetrachloroethane	NELAP	PA	12/12/2005
EPA 8260		1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	NELAP	PA	12/12/2005
EPA 8260		1,1,2-Trichloroethane	NELAP	PA	12/12/2005
EPA 8260		1,1-Dichloroethane	NELAP	PA	12/12/2005
EPA 8260		1,1-Dichloroethene (1,1-Dichloroethylene)	NELAP	PA	12/12/2005
EPA 8260		1,1-Dichloropropene	NELAP	PA	12/12/2005
EPA 8260		1,2,3-Trichlorobenzene	NELAP	PA	12/12/2005
EPA 8260		1,2,3-Trichloropropane (1,2,3-TCP)	NELAP	PA	12/12/2005
EPA 8260		1,2,4-Trichlorobenzene	NELAP	PA	12/12/2005
EPA 8260		1,2,4-Trimethylbenzene	NELAP	PA	12/12/2005
EPA 8260		1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	NELAP	PA	12/12/2005
EPA 8260		1,2-Dibromoethane (EDB, Ethylene dibromide)	NELAP	PA	12/12/2005
EPA 8260		1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	12/12/2005
EPA 8260		1,2-Dichloroethane	NELAP	PA	12/12/2005
EPA 8260		1,2-Dichloropropane	NELAP	PA	12/12/2005
EPA 8260		1,3,5-Trimethylbenzene	NELAP	PA	12/12/2005
EPA 8260		1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	12/12/2005
EPA 8260		1,3-Dichloropropane	NELAP	PA	12/12/2005
EPA 8260		1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	12/12/2005
EPA 8260		1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	12/12/2005
EPA 8260		2,2-Dichloropropane	NELAP	PA	5/2/2006
EPA 8260		2-Butanone (Methyl ethyl ketone, MEK)	NELAP	PA	5/2/2006
EPA 8260		2-Chloroethyl vinyl ether	NELAP	PA	12/12/2005
EPA 8260		2-Chlorotoluene	NELAP	PA	12/12/2005
EPA 8260		2-Hexanone	NELAP	PA	12/12/2005
EPA 8260		2-Nitropropane	NELAP	PA	1/19/2011
EPA 8260		3,3'-Dimethyl-1-butanol	NELAP	PA	4/17/2009
EPA 8260		4-Chlorotoluene	NELAP	PA	12/12/2005
EPA 8260		4-Methyl-2-pentanone (MIBK)	NELAP	PA	12/12/2005
EPA 8260		Acetone	NELAP	PA	12/12/2005
EPA 8260		Acetonitrile	NELAP	PA	12/12/2005
EPA 8260		Acrolein (Propenal)	NELAP	PA	12/12/2005
EPA 8260		Acrylonitrile	NELAP	PA	12/12/2005
EPA 8260		Allyl chloride (3-Chloropropene)	NELAP	PA	12/12/2005
EPA 8260		Benzene	NELAP	PA	12/12/2005
EPA 8260		Benzyl chloride	NELAP	PA	7/3/2007
EPA 8260		Bromobenzene	NELAP	PA	12/12/2005
EPA 8260		Bromochloromethane	NELAP	PA	12/12/2005
EPA 8260		Bromodichloromethane	NELAP	PA	12/12/2005

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 <p>Lancaster Laboratories Environmental</p>	<p>Document Title: NELAP Scope of Testing</p>	<p>Eurofins Document Reference: 1-P-QM-GDL-9015386</p>
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Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037

BPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8260		Bromoform	NELAP	PA	12/12/2005
EPA 8260		Carbon disulfide	NELAP	PA	12/12/2005
EPA 8260		Carbon tetrachloride	NELAP	PA	12/12/2005
EPA 8260		Chlorobenzene	NELAP	PA	12/12/2005
EPA 8260		Chloroethane	NELAP	PA	12/12/2005
EPA 8260		Chloroform	NELAP	PA	12/12/2005
EPA 8260		Chloroprene (2-Chloro-1,3-butadiene)	NELAP	PA	7/3/2007
EPA 8260		Cyclohexane	NELAP	PA	7/3/2007
EPA 8260		Cyclohexanone	NELAP	PA	6/7/2012
EPA 8260		Dibromochloromethane	NELAP	PA	12/12/2005
EPA 8260		Dibromomethane	NELAP	PA	5/2/2006
EPA 8260		Dichlorodifluoromethane (Freon 12)	NELAP	PA	12/12/2005
EPA 8260		Diethyl ether (Ethyl ether)	NELAP	PA	2/1/2011
EPA 8260		Diisopropyl ether (DIPPE)	NELAP	PA	7/3/2007
EPA 8260		Dimethyl ether	NELAP	PA	6/7/2012
EPA 8260		Epichlorohydrin (1-Chloro-2,3-epoxypropane)	NELAP	PA	4/17/2009
EPA 8260		Ethanol	NELAP	PA	1/24/2007
EPA 8260		Ethyl acetate	NELAP	PA	1/24/2007
EPA 8260		Ethyl methacrylate	NELAP	PA	1/24/2007
EPA 8260		Ethyl tert-butyl ether (ETBE)	NELAP	PA	1/24/2007
EPA 8260		Ethylbenzene	NELAP	PA	12/12/2005
EPA 8260		Gasoline-range organics (GRO)	NELAP	PA	6/8/2006
EPA 8260		Heptane	NELAP	PA	1/20/2012
EPA 8260		Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	12/12/2005
EPA 8260		Hexachloroethane	NELAP	PA	5/23/2012
EPA 8260		Isobutyl alcohol (2-Methyl-1-propanol)	NELAP	PA	7/3/2007
EPA 8260		Isopropyl alcohol (2-Propanol)	NELAP	PA	1/18/2011
EPA 8260		Isopropylbenzene (Cumene)	NELAP	PA	5/2/2006
EPA 8260		Methacrylonitrile	NELAP	PA	7/3/2007
EPA 8260		Methyl acetate	NELAP	PA	1/24/2007
EPA 8260		Methyl bromide (Bromomethane)	NELAP	PA	12/12/2005
EPA 8260		Methyl chloride (Chloromethane)	NELAP	PA	12/12/2005
EPA 8260		Methyl iodide (Iodomethane)	NELAP	PA	5/25/2007
EPA 8260		Methyl tert-butyl ether (MTBE)	NELAP	PA	12/12/2005
EPA 8260		Methyleyclohexane	NELAP	PA	1/21/2009
EPA 8260		Methylene chloride (Dichloromethane)	NELAP	PA	12/12/2005
EPA 8260		Methylmethacrylate	NELAP	PA	5/25/2007
EPA 8260		Naphthalene	NELAP	PA	12/12/2005
EPA 8260		Pentachloroethane	NELAP	PA	1/24/2007
EPA 8260		Propionitrile (Ethyl cyanide)	NELAP	PA	12/12/2005
EPA 8260		Styrene	NELAP	PA	12/12/2005
EPA 8260		Tetrachloroethene (PCE, Perchloroethylene)	NELAP	PA	12/12/2005
EPA 8260		Tetrahydrofuran (THF)	NELAP	PA	1/18/2011
EPA 8260		Toluene	NELAP	PA	12/12/2005

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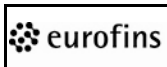
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Issue Date: 04/23/2014

Revision: 3	Effective date: Aug 8, 2014	Page 29 of 101
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 <p>Lancaster Laboratories Environmental</p>	<p>Document Title: NELAP Scope of Testing</p>	<p>Eurofins Document Reference: 1-P-QM-GDL-9015386</p>
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Laboratory Scope of Accreditation

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DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8260		Trichloroethene (TCE, Trichloroethylene)	NELAP	PA	12/12/2005
EPA 8260		Trichlorofluoromethane (Freon 11)	NELAP	PA	12/12/2005
EPA 8260	B	VOCs by GC/MS	NELAP	PA	3/26/2012
EPA 8260	C	VOCs by GC/MS	NELAP	PA	3/26/2012
EPA 8260		Vinyl acetate	NELAP	PA	12/12/2005
EPA 8260		Vinyl chloride (Chloroethene)	NELAP	PA	12/12/2005
EPA 8260		Xylenes, total	NELAP	PA	12/12/2005
EPA 8260		cis-1,2-Dichloroethene	NELAP	PA	12/12/2005
EPA 8260		cis-1,3-Dichloropropene	NELAP	PA	12/12/2005
EPA 8260		m+p-Xylene	NELAP	PA	4/17/2009
EPA 8260		n-Butyl alcohol (n-Butanol, 1-Butanol)	NELAP	PA	4/17/2009
EPA 8260		n-Butylbenzene	NELAP	PA	12/12/2005
EPA 8260		n-Hexane	NELAP	PA	1/20/2012
EPA 8260		n-Propylamine	NELAP	PA	12/12/2005
EPA 8260		n-Propylbenzene	NELAP	PA	1/24/2007
EPA 8260		o-Xylene	NELAP	PA	4/17/2009
EPA 8260		p-Isopropyltoluene (4-Isopropyltoluene)	NELAP	PA	1/24/2007
EPA 8260		sec-Butylbenzene	NELAP	PA	12/12/2005
EPA 8260		tert-Amyl alcohol (2-Methyl-2-butanol)	NELAP	PA	4/17/2009
EPA 8260		tert-Amyl methyl ether (TAME)	NELAP	PA	1/24/2007
EPA 8260		tert-Butyl alcohol (2-Methyl-2-propanol)	NELAP	PA	12/12/2005
EPA 8260		tert-Butyl formate	NELAP	PA	4/17/2009
EPA 8260		tert-Butylbenzene	NELAP	PA	12/12/2005
EPA 8260		trans-1,2-Dichloroethene	NELAP	PA	12/12/2005
EPA 8260		trans-1,3-Dichloropropene	NELAP	PA	12/12/2005
EPA 8260		trans-1,4-Dichloro-2-butene	NELAP	PA	7/3/2007
EPA 8260 SIM		1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	12/4/2007
EPA 8270		1,1'-Biphenyl (Biphenyl, Lemonene)	NELAP	PA	4/17/2009
EPA 8270		1,2,3,4-Tetrachlorobenzene	NELAP	PA	7/3/2007
EPA 8270		1,2,3,4-Tetrahydronaphthalene	NELAP	PA	4/17/2009
EPA 8270		1,2,3,5-Tetrachlorobenzene	NELAP	PA	7/3/2007
EPA 8270		1,2,4,5-Tetrachlorobenzene	NELAP	PA	12/12/2005
EPA 8270		1,2,4-Trichlorobenzene	NELAP	PA	12/12/2005
EPA 8270		1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	12/12/2005
EPA 8270		1,2-Diphenylhydrazine	NELAP	PA	12/12/2005
EPA 8270		1,3,5-Trinitrobenzene (1,3,5-TNB)	NELAP	PA	12/12/2005
EPA 8270		1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	12/12/2005
EPA 8270		1,3-Dinitrobenzene (1,3-DNB)	NELAP	PA	12/12/2005
EPA 8270		1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	12/12/2005
EPA 8270		1,4-Dinitrobenzene (1,4-DNB)	NELAP	PA	4/17/2009
EPA 8270		1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	4/17/2009
EPA 8270		1,4-Naphthoquinone	NELAP	PA	12/12/2005
EPA 8270		1,4-Phenylenediamine	NELAP	PA	12/12/2005
EPA 8270		1-Chloronaphthalene	NELAP	PA	12/12/2005
EPA 8270		1-Methylnaphthalene	NELAP	PA	4/17/2009

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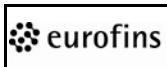
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Issue Date: 04/23/2014

Revision: 3	Effective date: Aug 8, 2014	Page 30 of 101
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 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037
PADWIS ID: 36037

EPA Lab Code: PA00009

TNI Code: (717) 656-2300

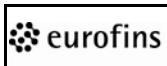
Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270		1-Naphthylamine (alpha-Naphthylamine)	NELAP	PA	12/12/2005
EPA 8270		2,2'-Oxybis(1-chloropropane) (bis(2-Chloro-1-methylethyl) ether)	NELAP	PA	1/19/2011
EPA 8270		2,3,4,6-Tetrachlorophenol	NELAP	PA	12/12/2005
EPA 8270		2,4,5-Trichlorophenol	NELAP	PA	12/12/2005
EPA 8270		2,4,6-Trichlorophenol	NELAP	PA	12/12/2005
EPA 8270		2,4-Dichlorophenol	NELAP	PA	12/12/2005
EPA 8270		2,4-Dimethylphenol	NELAP	PA	12/12/2005
EPA 8270		2,4-Dinitrophenol	NELAP	PA	12/12/2005
EPA 8270		2,4-Dinitrotoluene (2,4-DNT)	NELAP	PA	12/12/2005
EPA 8270		2,6-Dichlorophenol	NELAP	PA	12/12/2005
EPA 8270		2,6-Dinitrotoluene (2,6-DNT)	NELAP	PA	12/12/2005
EPA 8270		2-Acetylaminofluorene	NELAP	PA	12/12/2005
EPA 8270		2-Butoxyethanol	NELAP	PA	2/7/2012
EPA 8270		2-Chloronaphthalene	NELAP	PA	12/12/2005
EPA 8270		2-Chlorophenol	NELAP	PA	12/12/2005
EPA 8270		2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	NELAP	PA	12/12/2005
EPA 8270		2-Methylnaphthalene	NELAP	PA	12/12/2005
EPA 8270		2-Methylphenol (o-Cresol)	NELAP	PA	12/12/2005
EPA 8270		2-Naphthylamine (beta-Naphthylamine)	NELAP	PA	12/12/2005
EPA 8270		2-Nitroaniline	NELAP	PA	12/12/2005
EPA 8270		2-Nitrophenol	NELAP	PA	12/12/2005
EPA 8270		2-Picoline (2-Methylpyridine)	NELAP	PA	5/2/2006
EPA 8270		3,4-Methylphenol (m+p-Cresol)	NELAP	PA	12/12/2005
EPA 8270		3,3'-Dichlorobenzidine	NELAP	PA	12/12/2005
EPA 8270		3,3'-Dimethylbenzidine	NELAP	PA	7/3/2007
EPA 8270		3-Methylcholanthrene	NELAP	PA	12/12/2005
EPA 8270		3-Nitroaniline	NELAP	PA	12/12/2005
EPA 8270		4,4'-Methylenebis(2-chloroaniline)	NELAP	PA	12/12/2005
EPA 8270		4-Aminobiphenyl	NELAP	PA	12/12/2005
EPA 8270		4-Bromophenyl phenyl ether	NELAP	PA	12/12/2005
EPA 8270		4-Chloro-3-methylphenol	NELAP	PA	12/12/2005
EPA 8270		4-Chloroaniline	NELAP	PA	12/12/2005
EPA 8270		4-Chlorophenyl phenyl ether	NELAP	PA	12/12/2005
EPA 8270		4-Nitroaniline	NELAP	PA	12/12/2005
EPA 8270		4-Nitrophenol	NELAP	PA	12/12/2005
EPA 8270		4-Nitroquinoline-1-oxide	NELAP	PA	7/3/2007
EPA 8270		5-Nitro-o-toluidine	NELAP	PA	12/12/2005
EPA 8270		6-Methylchrysene	NELAP	PA	1/19/2011
EPA 8270		7,12-Dimethylbenz(a)anthracene	NELAP	PA	12/12/2005
EPA 8270		Acenaphthene	NELAP	PA	12/12/2005
EPA 8270		Acenaphthylene	NELAP	PA	12/12/2005
EPA 8270		Acetophenone	NELAP	PA	12/12/2005
EPA 8270		Aniline	NELAP	PA	12/12/2005
EPA 8270		Anthracene	NELAP	PA	12/12/2005

Ramon Alger

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Revision: 3	Effective date: Aug 8, 2014	Page 31 of 101
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Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270		Aramite	NELAP	PA	12/12/2005
EPA 8270		Atrazine	NELAP	PA	1/22/2007
EPA 8270		Benzaldehyde	NELAP	PA	4/17/2009
EPA 8270		Benzenethiol	NELAP	PA	4/17/2009
EPA 8270		Benzidine	NELAP	PA	12/12/2005
EPA 8270		Benzo[a]anthracene	NELAP	PA	12/12/2005
EPA 8270		Benzo[a]pyrene	NELAP	PA	12/12/2005
EPA 8270		Benzo[b]fluoranthene	NELAP	PA	12/12/2005
EPA 8270		Benzo[ghi]perylene	NELAP	PA	12/12/2005
EPA 8270		Benzo[k]fluoranthene	NELAP	PA	12/12/2005
EPA 8270		Benzoic acid	NELAP	PA	12/12/2005
EPA 8270		Benzyl alcohol	NELAP	PA	12/12/2005
EPA 8270		Butyl benzyl phthalate (Benzyl butyl phthalate)	NELAP	PA	12/12/2005
EPA 8270		Caprolactam	NELAP	PA	4/17/2009
EPA 8270		Carbazole	NELAP	PA	12/12/2005
EPA 8270		Chlorobenzilate	NELAP	PA	12/12/2005
EPA 8270		Chrysene (Benzo[a]phenanthrene)	NELAP	PA	12/12/2005
EPA 8270		Di-n-butyl phthalate	NELAP	PA	12/12/2005
EPA 8270		Di-n-octyl phthalate	NELAP	PA	12/12/2005
EPA 8270		Diallate (cis or trans)	NELAP	PA	12/12/2005
EPA 8270		Dibenz[a,h]acridine	NELAP	PA	4/17/2009
EPA 8270		Dibenz[a,j]acridine	NELAP	PA	12/12/2005
EPA 8270		Dibenzo[a,i]anthracene	NELAP	PA	12/12/2005
EPA 8270		Dibenzofuran	NELAP	PA	12/12/2005
EPA 8270		Diethyl phthalate	NELAP	PA	12/12/2005
EPA 8270		Dimethione	NELAP	PA	12/12/2005
EPA 8270		Dimethyl phthalate	NELAP	PA	12/12/2005
EPA 8270		Dimethylaminoazobenzene (4-Dimethylaminoazobenzene)	NELAP	PA	5/2/2006
EPA 8270		Dinoseb (2-sec-Butyl-4,6-dinitrophenol, DNBP)	NELAP	PA	12/12/2005
EPA 8270		Diphenylamine	NELAP	PA	12/12/2005
EPA 8270		Disulfoton	NELAP	PA	12/12/2005
EPA 8270		Ethyl methanesulfonate	NELAP	PA	12/12/2005
EPA 8270		Famphur	NELAP	PA	12/12/2005
EPA 8270		Fluoranthene	NELAP	PA	12/12/2005
EPA 8270		Fluorene	NELAP	PA	12/12/2005
EPA 8270		Hexachlorobenzene	NELAP	PA	12/12/2005
EPA 8270		Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	12/12/2005
EPA 8270		Hexachlorocyclopentadiene	NELAP	PA	12/12/2005
EPA 8270		Hexachloroethane	NELAP	PA	12/12/2005
EPA 8270		Hexachloropropene	NELAP	PA	12/12/2005
EPA 8270		Indene	NELAP	PA	4/17/2009
EPA 8270		Indeno(1,2,3-cd)pyrene	NELAP	PA	12/12/2005

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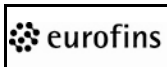
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Issue Date: 04/23/2014

Revision: 3	Effective date: Aug 8, 2014	Page 32 of 101
COMPANY CONFIDENTIAL		

 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

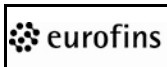
Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270		Isodrin	NELAP	PA	12/12/2005
EPA 8270		Isophorone	NELAP	PA	12/12/2005
EPA 8270		Isosafrole	NELAP	PA	12/12/2005
EPA 8270		Kepone	NELAP	PA	12/12/2005
EPA 8270		Methapyrilene	NELAP	PA	12/12/2005
EPA 8270		Methyl methanesulfonate	NELAP	PA	12/12/2005
EPA 8270		Methyl parathion (Parathion, methyl)	NELAP	PA	5/25/2007
EPA 8270		N,N-Dimethylacetamide	NELAP	PA	4/17/2009
EPA 8270		N,N-Dimethylformamide	NELAP	PA	4/17/2009
EPA 8270		N-Nitrosodi-n-butylamine	NELAP	PA	12/12/2005
EPA 8270		N-Nitrosodi-n-propylamine	NELAP	PA	12/12/2005
EPA 8270		N-Nitrosodiethylamine	NELAP	PA	12/12/2005
EPA 8270		N-Nitrosodimethylamine	NELAP	PA	12/12/2005
EPA 8270		N-Nitrosodiphenylamine	NELAP	PA	12/12/2005
EPA 8270		N-Nitrosomethylethylamine	NELAP	PA	12/12/2005
EPA 8270		N-Nitrosomorpholine	NELAP	PA	12/12/2005
EPA 8270		N-Nitrosopiperidine	NELAP	PA	12/12/2005
EPA 8270		N-Nitrosopyrrolidine	NELAP	PA	12/12/2005
EPA 8270		Naphthalene	NELAP	PA	12/12/2005
EPA 8270		Nitrobenzene	NELAP	PA	12/12/2005
EPA 8270		O,O,O-Triethyl phosphorothioate	NELAP	PA	12/12/2005
EPA 8270		Parathion, ethyl (Ethyl parathion, Parathion)	NELAP	PA	5/25/2007
EPA 8270		Pentachlorobenzene	NELAP	PA	12/12/2005
EPA 8270		Pentachloronitrobenzene (PCNB)	NELAP	PA	12/12/2005
EPA 8270		Pentachlorophenol (PCP)	NELAP	PA	12/12/2005
EPA 8270		Phenacetin	NELAP	PA	12/12/2005
EPA 8270		Phenanthrene	NELAP	PA	12/12/2005
EPA 8270		Phenol	NELAP	PA	12/12/2005
EPA 8270		Phorate (Thimet)	NELAP	PA	12/12/2005
EPA 8270		Phthalic anhydride	NELAP	PA	1/21/2009
EPA 8270		Pronamide (Kerb)	NELAP	PA	12/12/2005
EPA 8270		Pyrene	NELAP	PA	12/12/2005
EPA 8270		Pyridine	NELAP	PA	12/12/2005
EPA 8270		Quinoline	NELAP	PA	4/17/2009
EPA 8270	C	SOCs by GC/MS	NELAP	PA	3/26/2012
EPA 8270	D	SOCs by GC/MS	NELAP	PA	3/26/2012
EPA 8270		Safrole	NELAP	PA	12/12/2005
EPA 8270		Sulfotep (Tetraethyl dithiopyrophosphate)	NELAP	PA	4/17/2009
EPA 8270		Tetraethyl lead	NELAP	PA	3/7/2012
EPA 8270		Thionazine (Thionazin, Zinophos)	NELAP	PA	12/12/2005
EPA 8270		α,α-Dimethylphenethylamine (Phentermine)	NELAP	PA	12/12/2005
EPA 8270		α-Methylstyrene	NELAP	PA	4/17/2009
EPA 8270		bis(2-Chloroethoxy)methane	NELAP	PA	12/12/2005
EPA 8270		bis(2-Chloroethyl) ether	NELAP	PA	12/12/2005
EPA 8270		bis(2-Chloroisopropyl) ether	NELAP	PA	12/12/2005

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Revision: 3	Effective date: Aug 8, 2014	Page 33 of 101
COMPANY CONFIDENTIAL		

 <p>Lancaster Laboratories Environmental</p>	<p>Document Title: NELAP Scope of Testing</p>	<p>Eurofins Document Reference: 1-P-QM-GDL-9015386</p>
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Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270		bis(2-Chloromethyl) ether	NELAP	PA	1/21/2009
EPA 8270		bis(2-Ethylhexyl) phthalate (DEHP)	NELAP	PA	12/12/2005
EPA 8270		o-Toluidine (2-Toluidine, 2-Methylaniline)	NELAP	PA	12/12/2005
EPA 8270		p-(Dimethylamino)azobenzene	NELAP	PA	4/17/2009
EPA 8270		tris-(2,3-Dibromopropyl) phosphate (tris-BP)	NELAP	PA	4/17/2009
EPA 8270 SIM		1-Methylnaphthalene	NELAP	PA	7/25/2011
EPA 8270 SIM		2-Methylnaphthalene	NELAP	PA	5/23/2012
EPA 8270 SIM		Acenaphthene	NELAP	PA	12/4/2007
EPA 8270 SIM		Acenaphthylene	NELAP	PA	12/4/2007
EPA 8270 SIM		Anthracene	NELAP	PA	12/4/2007
EPA 8270 SIM		Benzo[a]anthracene	NELAP	PA	12/4/2007
EPA 8270 SIM		Benzo[a]pyrene	NELAP	PA	12/4/2007
EPA 8270 SIM		Benzo[b]fluoranthene	NELAP	PA	12/4/2007
EPA 8270 SIM		Benzo[k]fluoranthene	NELAP	PA	12/4/2007
EPA 8270 SIM		Benzo[k]perylene	NELAP	PA	12/4/2007
EPA 8270 SIM		Chrysene (Benzo[a]phenanthrene)	NELAP	PA	12/4/2007
EPA 8270 SIM		Dibenzo[a,h]anthracene	NELAP	PA	12/4/2007
EPA 8270 SIM		Fluoranthene	NELAP	PA	12/4/2007
EPA 8270 SIM		Fluorene	NELAP	PA	12/4/2007
EPA 8270 SIM		Indeno(1,2,3-cd)pyrene	NELAP	PA	12/4/2007
EPA 8270 SIM		Naphthalene	NELAP	PA	12/4/2007
EPA 8270 SIM		Phenanthrene	NELAP	PA	12/4/2007
EPA 8270 SIM		Pyrene	NELAP	PA	12/4/2007
EPA 8290		1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	NELAP	PA	6/30/2010
EPA 8290		1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	NELAP	PA	6/30/2010
EPA 8290		1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpCDF)	NELAP	PA	6/30/2010
EPA 8290		1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpCDF)	NELAP	PA	6/30/2010
EPA 8290		1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpCDF)	NELAP	PA	6/30/2010
EPA 8290		1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 8290		1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	8/6/2010
EPA 8290		1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 8290		1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 8290		1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 8290		1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 8290		1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	NELAP	PA	6/30/2010

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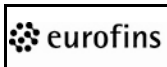
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Issue Date: 04/23/2014

Revision: 3	Effective date: Aug 8, 2014	Page 34 of 101
COMPANY CONFIDENTIAL		

	Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Laboratory Scope of Accreditation

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DEP Laboratory ID: 36-00037
PADWIS ID: 36037

EPA Lab Code: PA00009

TNI Code: (717) 656-2300

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8290		1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	NELAP	PA	6/30/2010
EPA 8290		2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 8290		2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	NELAP	PA	8/6/2010
EPA 8290		2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD)(Dioxin)	NELAP	PA	6/30/2010
EPA 8290		2,3,7,8-Tetrachlorodibenzofuran (TCDF)	NELAP	PA	6/30/2010
EPA 8290		PCDDs and PCDFs by HRGC-HRMS	NELAP	PA	3/26/2012
EPA 8290		Total TCDD	NELAP	PA	6/30/2010
EPA 8290		Total TCDF	NELAP	PA	6/30/2010
EPA 8290		Total heptachlorodibenzo-p-dioxin (HpCDD)	NELAP	PA	6/30/2010
EPA 8290		Total heptachlorodibenzofuran (HpCDF)	NELAP	PA	6/30/2010
EPA 8290		Total hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 8290		Total hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 8290		Total pentachlorodibenzo-p-dioxin (PeCDD)	NELAP	PA	6/30/2010
EPA 8290		Total pentachlorodibenzofuran (PeCDF)	NELAP	PA	6/30/2010
EPA 8315		2,5-Dimethylbenzaldehyde	NELAP	PA	12/12/2005
EPA 8315		Acetaldehyde	NELAP	PA	12/12/2005
EPA 8315		Benzaldehyde	NELAP	PA	12/12/2005
EPA 8315		Butanal (Butyraldehyde)	NELAP	PA	5/2/2006
EPA 8315	A	Carbonyl compounds by HPLC	NELAP	PA	3/26/2012
EPA 8315		Crotonaldehyde	NELAP	PA	12/12/2005
EPA 8315		Formaldehyde	NELAP	PA	12/12/2005
EPA 8315		Hexanal (Hexanaldehyde)	NELAP	PA	1/21/2009
EPA 8315		Isovaleraldehyde	NELAP	PA	12/12/2005
EPA 8315		Pentanal (Valeraldehyde)	NELAP	PA	12/12/2005
EPA 8315		Propanal (Propionaldehyde)	NELAP	PA	1/21/2009
EPA 8315		m-Tolualdehyde (1,3-Tolualdehyde)	NELAP	PA	5/2/2006
EPA 8315		o-Tolualdehyde (1,2-Tolualdehyde)	NELAP	PA	1/24/2007
EPA 8315		p-Tolualdehyde (1,4-Tolualdehyde)	NELAP	PA	1/24/2007
EPA 8330		1,3,5-Trinitrobenzene (1,3,5-TNB)	NELAP	PA	12/12/2005
EPA 8330		1,3-Dinitrobenzene (1,3-DNB)	NELAP	PA	12/12/2005
EPA 8330		2,4,6-Trinitrotoluene (2,4,6-TNT)	NELAP	PA	12/12/2005
EPA 8330		2,4-Dinitrotoluene (2,4-DNT)	NELAP	PA	6/11/2007
EPA 8330		2,6-Dinitrotoluene (2,6-DNT)	NELAP	PA	6/11/2007
EPA 8330		2-Amino-4,6-dinitrotoluene (2-Am-DNT)	NELAP	PA	12/12/2005
EPA 8330		2-Nitrotoluene	NELAP	PA	12/12/2005
EPA 8330		3-Nitrotoluene	NELAP	PA	12/12/2005
EPA 8330		4-Amino-2,6-dinitrotoluene (4-Am-DNT)	NELAP	PA	12/12/2005
EPA 8330		4-Nitrotoluene	NELAP	PA	12/12/2005
EPA 8330		Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	NELAP	PA	12/12/2005
EPA 8330	A	Nitroaromatics and nitramines by HPLC/UV	NELAP	PA	3/26/2012
EPA 8330		Nitroaromatics and nitramines by HPLC/UV	NELAP	PA	3/26/2012
EPA 8330		Nitrobenzene	NELAP	PA	6/11/2007

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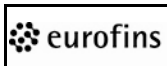
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Issue Date: 04/23/2014

Revision: 3	Effective date: Aug 8, 2014	Page 35 of 101
COMPANY CONFIDENTIAL		

	Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Laboratory Scope of Accreditation



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DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8330		Nitroglycerin	NELAP	PA	1/24/2007
EPA 8330		Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	NELAP	PA	12/12/2005
EPA 8330		Pentaerythritol tetranitrate (PETN)	NELAP	PA	5/2/2006
EPA 8330		RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	NELAP	PA	12/12/2005
EPA 8332		Nitroglycerin	NELAP	PA	12/12/2005
EPA 9012		Total cyanide	NELAP	PA	12/12/2005
EPA 9040		pH	NELAP	PA	12/12/2005
EPA 9050	A	Conductivity	NELAP	PA	1/27/2014
EPA 9050		Conductivity	NELAP	PA	12/12/2005
EPA 9056		Bromide	NELAP	PA	12/12/2005
EPA 9056		Chloride	NELAP	PA	12/12/2005
EPA 9056		Fluoride	NELAP	PA	12/12/2005
EPA 9056		Nitrate as N	NELAP	PA	12/12/2005
EPA 9056		Nitrite as N	NELAP	PA	1/19/2005
EPA 9056		Sulfate	NELAP	PA	12/12/2005
EPA 9060		Total organic carbon (TOC)	NELAP	PA	12/12/2005
EPA 9066		Total phenolics	NELAP	PA	12/12/2005
FL-PRO		Total petroleum hydrocarbons (TPH)	NELAP	PA	12/12/2005
MA DEP EPH	1.1	C11-C22 Aromatics	NELAP	PA	7/15/2013
MA DEP EPH	1.1	C19-C36 Aliphatics	NELAP	PA	7/15/2013
MA DEP EPH	1.1	C9-C18 Aliphatics	NELAP	PA	7/15/2013
MA DEP VPH	1.1	C5-C8 Aliphatics	NELAP	PA	7/15/2013
MA DEP VPH	1.1	C9-C12 Aliphatics	NELAP	PA	7/15/2013
NWTPH-Dx		Diesel-range organics (DRO)	NELAP	PA	12/12/2005
NWTPH-Gx		Gasoline-range organics (GRO)	NELAP	PA	12/12/2005
NWTPH-HCID		GRO/DRO/HRO Screen	NELAP	PA	10/16/2008
OIA 1677		Available cyanide	NELAP	PA	10/9/2013
OIA 1677		Free cyanide	NELAP	PA	10/9/2013
PA-DEP 3686		Acetylene (Ethyne)	NELAP	PA	2/1/2013
PA-DEP 3686		Ethane	NELAP	PA	2/1/2013
PA-DEP 3686		Ethene	NELAP	PA	2/1/2013
PA-DEP 3686		Methane	NELAP	PA	2/1/2013
PA-DEP 3686		Propane	NELAP	PA	2/1/2013
PA-DEP 3686		n-Butane	NELAP	PA	2/1/2013
RSK-175		Acetylene (Ethyne)	NELAP	PA	1/20/2012
RSK-175		Ethane	NELAP	PA	6/29/2010
RSK-175		Ethene	NELAP	PA	6/29/2010
RSK-175		Methane	NELAP	PA	6/29/2010
RSK-175		Propane	NELAP	PA	6/29/2010
RSK-175		n-Butane	NELAP	PA	12/22/2011
SM 2120 B		Color	NELAP	PA	4/17/2007
SM 2310 B		Acidity as CaCO3	NELAP	PA	4/17/2007
SM 2320 B		Alkalinity as CaCO3	NELAP	PA	1/19/2005
SM 2340 C		Total hardness as CaCO3	NELAP	PA	4/17/2007

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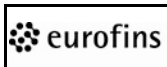
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Issue Date: 04/23/2014

Revision: 3	Effective date: Aug 8, 2014	Page 36 of 101
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Laboratory Scope of Accreditation

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DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
SM 2510 B		Conductivity	NELAP	PA	12/12/2005
SM 2540 B		Residue, total	NELAP	PA	4/17/2007
SM 2540 C		Residue, filterable (TDS)	NELAP	PA	4/17/2007
SM 2540 D		Residue, nonfilterable (TSS)	NELAP	PA	4/17/2007
SM 2540 F		Residue, settleable	NELAP	PA	4/17/2007
SM 3500-Cr B	20-22	Chromium VI	NELAP	PA	5/24/2007
SM 3500-Fe B	20/21	Ferrous iron	NELAP	PA	6/15/2009
SM 4500-CN- G		Amenable cyanide	NELAP	PA	5/24/2007
SM 4500-Cl F		Total residual chlorine	NELAP	PA	1/11/2012
SM 4500-Cl- C		Chloride	NELAP	PA	4/17/2007
SM 4500-F- B		Preliminary distillation of fluoride	NELAP	PA	4/28/2010
SM 4500-F- C		Fluoride	NELAP	PA	1/19/2005
SM 4500-H+ B		pH	NELAP	PA	4/17/2007
SM 4500-NH3 B		Ammonia distillation	NELAP	PA	4/17/2007
SM 4500-NH3 C		Ammonia as N	NELAP	PA	4/17/2007
SM 4500-NH3 D		Ammonia as N	NELAP	PA	4/17/2007
SM 4500-O G		Oxygen (dissolved)	NELAP	PA	4/17/2007
SM 4500-P B		Phosphorus, total	NELAP	PA	4/28/2010
SM 4500-P F		Orthophosphate as P	NELAP	PA	12/12/2005
SM 4500-P F		Phosphorus, total	NELAP	PA	4/28/2010
SM 4500-S D		Sulfide	NELAP	PA	4/17/2007
SM 4500-S F		Sulfide	NELAP	PA	4/17/2007
SM 4500-SO3 B		Sulfite, SO3	NELAP	PA	4/17/2007
SM 4500-SiO2 C	20-22	Silica, as SiO2	NELAP	PA	5/25/2007
SM 4500-SiO2 C	20-22	Silica, dissolved	NELAP	PA	5/24/2007
SM 5210 B		Biochemical oxygen demand (BOD)	NELAP	PA	4/4/2005
SM 5210 B		Carbonaceous BOD (CBOD)	NELAP	PA	1/19/2005
SM 5310 B		Total organic carbon (TOC)	NELAP	PA	4/17/2007
SM 5310 C		Total organic carbon (TOC)	NELAP	PA	5/24/2007
SM 5540 C		Surfactants as MBAS	NELAP	PA	4/17/2007
SM 9222 D		Fecal coliforms	NELAP	PA	7/6/2007
TX1005 (TNRCC)		Total petroleum hydrocarbons (TPH)	NELAP	PA	12/12/2005
TX1006 (TNRCC)		Total petroleum hydrocarbons (TPH)	NELAP	PA	12/12/2005
WA-EPH		Diesel-range organics (DRO)	NELAP	PA	12/12/2005
WA-VPH		Gasoline-range organics (GRO)	NELAP	PA	12/12/2005
WI-DRO		Diesel-range organics (DRO)	NELAP	PA	12/12/2005
WI-GRO		Gasoline-range organics (GRO)	NELAP	PA	12/12/2005

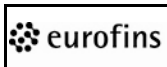
Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
AK-101		Gasoline-range organics (GRO)	NELAP	PA	12/12/2005
AK-102		Diesel-range organics (DRO)	NELAP	PA	12/12/2005
AK-103		Diesel-range organics (DRO)	NELAP	PA	12/12/2005
EPA 1010		Ignitability	NELAP	PA	1/19/2005

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 <p>Lancaster Laboratories Environmental</p>	<p>Document Title: NELAP Scope of Testing</p>	<p>Eurofins Document Reference: 1-P-QM-GDL-9015386</p>
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Laboratory Scope of Accreditation



Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 1311		Toxicity characteristic leaching procedure (TCLP)	NELAP	PA	12/12/2005
EPA 1312		Synthetic precipitation leaching procedure (SPLP)	NELAP	PA	12/12/2005
EPA 1668		2,2',3,3',4,4',5,5',6'-Nonachlorobiphenyl (BZ 206)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,4',5,5',6'-Octachlorobiphenyl (BZ 194)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,4',5,6'-Octachlorobiphenyl (BZ 196)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ 207)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,4',5,6'-Octachlorobiphenyl (BZ 195)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,4',5'-Heptachlorobiphenyl (BZ 170)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,4',6'-Octachlorobiphenyl (BZ 197)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,4',6'-Heptachlorobiphenyl (BZ 171)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,4',4'-Hexachlorobiphenyl (BZ 128)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ 177)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,5',6'-Octachlorobiphenyl (BZ 201)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ 175)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,5'-Hexachlorobiphenyl (BZ 130)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ 199)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,5,5',6'-Nonachlorobiphenyl (BZ 208)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ 198)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ 172)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ 174)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,5,6,6'-Octachlorobiphenyl (BZ 200)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ 173)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,5-Hexachlorobiphenyl (BZ 129)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,6'-Hexachlorobiphenyl (BZ 132)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ 176)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4,6-Hexachlorobiphenyl (BZ 131)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',4-Pentachlorobiphenyl (BZ 82)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',5,5',6'-Octachlorobiphenyl (BZ 202)	NELAP	PA	12/17/2012

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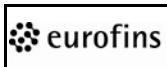
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Issue Date: 04/23/2014

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 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Laboratory Scope of Accreditation



Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 1668		2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ 178)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',5,5'-Hexachlorobiphenyl (BZ 133)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',5,6'-Hexachlorobiphenyl (BZ 135)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',5,6,6'-Heptachlorobiphenyl (BZ 179)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',5,6'-Hexachlorobiphenyl (BZ 134)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',5'-Pentachlorobiphenyl (BZ 83)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',6'-Hexachlorobiphenyl (BZ 136)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3',6-Pentachlorobiphenyl (BZ 84)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,3'-Tetrachlorobiphenyl (BZ 40)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4',5'-Hexachlorobiphenyl (BZ 149)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4',5'-Pentachlorobiphenyl (BZ 97)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ 187)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4',5,5'-Hexachlorobiphenyl (BZ 146)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4',5,6'-Hexachlorobiphenyl (BZ 148)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ 188)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4',5,6'-Hexachlorobiphenyl (BZ 147)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4',5-Pentachlorobiphenyl (BZ 90)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4',6'-Pentachlorobiphenyl (BZ 98)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4',6'-Hexachlorobiphenyl (BZ 150)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4',6-Pentachlorobiphenyl (BZ 91)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4'-Tetrachlorobiphenyl (BZ 42)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4',4',5'-Heptachlorobiphenyl (BZ 183)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4',4',5'-Hexachlorobiphenyl (BZ 138)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ 203)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4',4',5,5'-Heptachlorobiphenyl (BZ 180)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,4',5,6'-Heptachlorobiphenyl (BZ 182)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ 204)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ 181)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,4',5-Hexachlorobiphenyl (BZ 137)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,4',6'-Hexachlorobiphenyl (BZ 140)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ 184)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,4',6-Hexachlorobiphenyl (BZ 139)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,4'-Pentachlorobiphenyl (BZ 85)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,5',6-Hexachlorobiphenyl (BZ 144)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,5'-Pentachlorobiphenyl (BZ 87)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,5,5',6-Heptachlorobiphenyl (BZ 185)	NELAP	PA	12/17/2012

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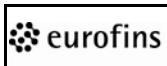
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Issue Date: 04/23/2014

Revision: 3	Effective date: Aug 8, 2014	Page 39 of 101
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 <p>Lancaster Laboratories Environmental</p>	<p>Document Title: NELAP Scope of Testing</p>	<p>Eurofins Document Reference: 1-P-QM-GDL-9015386</p>
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Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

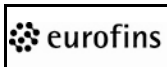
Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 1668		2,2',3,4,5,5'-Hexachlorobiphenyl (BZ 141)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,5,6'-Hexachlorobiphenyl (BZ 143)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ 186)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,5,6'-Hexachlorobiphenyl (BZ 142)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,5-Pentachlorobiphenyl (BZ 86)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,6'-Pentachlorobiphenyl (BZ 89)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,6,6'-Hexachlorobiphenyl (BZ 145)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4,6-Pentachlorobiphenyl (BZ 88)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,4-Tetrachlorobiphenyl (BZ 41)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,5'-Pentachlorobiphenyl (BZ 95)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,5-Tetrachlorobiphenyl (BZ 44)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,5,5'-Hexachlorobiphenyl (BZ 151)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,5,5'-Pentachlorobiphenyl (BZ 92)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,5,6'-Pentachlorobiphenyl (BZ 94)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,5,6,6'-Hexachlorobiphenyl (BZ 152)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,5,6-Pentachlorobiphenyl (BZ 93)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,5-Tetrachlorobiphenyl (BZ 43)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,6'-Tetrachlorobiphenyl (BZ 46)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,6,6'-Pentachlorobiphenyl (BZ 96)	NELAP	PA	12/17/2012
EPA 1668		2,2',3,6-Tetrachlorobiphenyl (BZ 45)	NELAP	PA	12/17/2012
EPA 1668		2,2',3-Trichlorobiphenyl (BZ 16)	NELAP	PA	12/17/2012
EPA 1668		2,2',4,4',5,5'-Hexachlorobiphenyl (BZ 153)	NELAP	PA	12/17/2012
EPA 1668		2,2',4,4',5,6'-Hexachlorobiphenyl (BZ 154)	NELAP	PA	12/17/2012
EPA 1668		2,2',4,4',5-Pentachlorobiphenyl (BZ 99)	NELAP	PA	12/17/2012
EPA 1668		2,2',4,4',6,6'-Hexachlorobiphenyl (BZ 155)	NELAP	PA	12/17/2012
EPA 1668		2,2',4,4',6-Pentachlorobiphenyl (BZ 100)	NELAP	PA	12/17/2012
EPA 1668		2,2',4,4'-Tetrachlorobiphenyl (BZ 47)	NELAP	PA	12/17/2012
EPA 1668		2,2',4,5,6-Pentachlorobiphenyl (BZ 103)	NELAP	PA	12/17/2012
EPA 1668		2,2',4,5-Tetrachlorobiphenyl (BZ 49)	NELAP	PA	12/17/2012
EPA 1668		2,2',4,5,5'-Pentachlorobiphenyl (BZ 101)	NELAP	PA	12/17/2012
EPA 1668		2,2',4,5,6'-Pentachlorobiphenyl (BZ 102)	NELAP	PA	12/17/2012
EPA 1668		2,2',4,5-Tetrachlorobiphenyl (BZ 48)	NELAP	PA	12/17/2012
EPA 1668		2,2',4,6'-Tetrachlorobiphenyl (BZ 51)	NELAP	PA	12/17/2012
EPA 1668		2,2',4,6,6'-Pentachlorobiphenyl (BZ 104)	NELAP	PA	12/17/2012
EPA 1668		2,2',4,6-Tetrachlorobiphenyl (BZ 50)	NELAP	PA	12/17/2012
EPA 1668		2,2',4-Trichlorobiphenyl (BZ 17)	NELAP	PA	12/17/2012
EPA 1668		2,2',5,5'-Tetrachlorobiphenyl (BZ 52)	NELAP	PA	12/17/2012
EPA 1668		2,2',5,6'-Tetrachlorobiphenyl (BZ 53)	NELAP	PA	12/17/2012
EPA 1668		2,2',5-Trichlorobiphenyl (BZ 18)	NELAP	PA	12/17/2012
EPA 1668		2,2',6,6'-Tetrachlorobiphenyl (BZ 54)	NELAP	PA	12/17/2012
EPA 1668		2,2',6-Trichlorobiphenyl (BZ 19)	NELAP	PA	12/17/2012
EPA 1668		2,2'-Dichlorobiphenyl (BZ 4)	NELAP	PA	12/17/2012
EPA 1668		2,3',4',5',6-Pentachlorobiphenyl (BZ 125)	NELAP	PA	12/17/2012
EPA 1668		2,3',4',5'-Tetrachlorobiphenyl (BZ 76)	NELAP	PA	12/17/2012
EPA 1668		2,3',4',5,5'-Pentachlorobiphenyl (BZ 124)	NELAP	PA	12/17/2012

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 <p>Lancaster Laboratories Environmental</p>	<p>Document Title: NELAP Scope of Testing</p>	<p>Eurofins Document Reference: 1-P-QM-GDL-9015386</p>
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Laboratory Scope of Accreditation

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DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 1668		2,3',4',5'-Tetrachlorobiphenyl (BZ 70)	NELAP	PA	12/17/2012
EPA 1668		2,3',4',6'-Tetrachlorobiphenyl (BZ 71)	NELAP	PA	12/17/2012
EPA 1668		2,3',4'-Trichlorobiphenyl (BZ 33)	NELAP	PA	12/17/2012
EPA 1668		2,3',4,4',5',6'-Hexachlorobiphenyl (BZ 168)	NELAP	PA	12/17/2012
EPA 1668		2,3',4,4',5'-Pentachlorobiphenyl (BZ 123)	NELAP	PA	12/17/2012
EPA 1668		2,3',4,4',5,5'-Hexachlorobiphenyl (BZ 167)	NELAP	PA	12/17/2012
EPA 1668		2,3',4,4',5'-Pentachlorobiphenyl (BZ 118)	NELAP	PA	12/17/2012
EPA 1668		2,3',4,4',6'-Pentachlorobiphenyl (BZ 119)	NELAP	PA	12/17/2012
EPA 1668		2,3',4,4'-Tetrachlorobiphenyl (BZ 66)	NELAP	PA	12/17/2012
EPA 1668		2,3',4,5'-Pentachlorobiphenyl (BZ 121)	NELAP	PA	12/17/2012
EPA 1668		2,3',4,5'-Tetrachlorobiphenyl (BZ 68)	NELAP	PA	12/17/2012
EPA 1668		2,3',4,5,5'-Pentachlorobiphenyl (BZ 120)	NELAP	PA	12/17/2012
EPA 1668		2,3',4,5'-Tetrachlorobiphenyl (BZ 67)	NELAP	PA	12/17/2012
EPA 1668		2,3',4,6'-Tetrachlorobiphenyl (BZ 69)	NELAP	PA	12/17/2012
EPA 1668		2,3',4'-Trichlorobiphenyl (BZ 25)	NELAP	PA	12/17/2012
EPA 1668		2,3',5',6'-Tetrachlorobiphenyl (BZ 73)	NELAP	PA	12/17/2012
EPA 1668		2,3',5'-Trichlorobiphenyl (BZ 34)	NELAP	PA	12/17/2012
EPA 1668		2,3',5,5'-Tetrachlorobiphenyl (BZ 72)	NELAP	PA	12/17/2012
EPA 1668		2,3',5'-Trichlorobiphenyl (BZ 26)	NELAP	PA	12/17/2012
EPA 1668		2,3',6'-Trichlorobiphenyl (BZ 27)	NELAP	PA	12/17/2012
EPA 1668		2,3'-Dichlorobiphenyl (BZ 6)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4',5',6'-Hexachlorobiphenyl (BZ 164)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4',5'-Pentachlorobiphenyl (BZ 122)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4',5,5',6'-Heptachlorobiphenyl (BZ 193)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4',5,5'-Hexachlorobiphenyl (BZ 162)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4',5,6'-Hexachlorobiphenyl (BZ 163)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4',5'-Pentachlorobiphenyl (BZ 107)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4',6'-Pentachlorobiphenyl (BZ 110)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4'-Tetrachlorobiphenyl (BZ 56)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4,4',5',6'-Heptachlorobiphenyl (BZ 191)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4,4',5'-Hexachlorobiphenyl (BZ 157)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4,4',5,5',6'-Octachlorobiphenyl (BZ 205)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ 189)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4,4',5,6'-Heptachlorobiphenyl (BZ 190)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4,4',5'-Hexachlorobiphenyl (BZ 156)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4,4',6'-Hexachlorobiphenyl (BZ 158)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4,4'-Pentachlorobiphenyl (BZ 105)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4,5',6'-Hexachlorobiphenyl (BZ 161)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4,5'-Pentachlorobiphenyl (BZ 108)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4,5,5',6'-Heptachlorobiphenyl (BZ 192)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4,5,5'-Hexachlorobiphenyl (BZ 159)	NELAP	PA	12/17/2012

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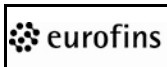
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 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 1668		2,3,3',4,5,6-Hexachlorobiphenyl (BZ 160)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4,5-Pentachlorobiphenyl (BZ 106)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4,6-Pentachlorobiphenyl (BZ 109)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',4-Tetrachlorobiphenyl (BZ 55)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',5,6-Pentachlorobiphenyl (BZ 113)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',5-Tetrachlorobiphenyl (BZ 58)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',5,5'-Hexachlorobiphenyl (BZ 165)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',5,5'-Pentachlorobiphenyl (BZ 111)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',5,6-Pentachlorobiphenyl (BZ 112)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',5-Tetrachlorobiphenyl (BZ 57)	NELAP	PA	12/17/2012
EPA 1668		2,3,3',6-Tetrachlorobiphenyl (BZ 59)	NELAP	PA	12/17/2012
EPA 1668		2,3,3'-Trichlorobiphenyl (BZ 20)	NELAP	PA	12/17/2012
EPA 1668		2,3,4',5,6-Pentachlorobiphenyl (BZ 117)	NELAP	PA	12/17/2012
EPA 1668		2,3,4',5-Tetrachlorobiphenyl (BZ 63)	NELAP	PA	12/17/2012
EPA 1668		2,3,4',6-Tetrachlorobiphenyl (BZ 64)	NELAP	PA	12/17/2012
EPA 1668		2,3,4'-Trichlorobiphenyl (BZ 22)	NELAP	PA	12/17/2012
EPA 1668		2,3,4,4',5,6-Hexachlorobiphenyl (BZ 166)	NELAP	PA	12/17/2012
EPA 1668		2,3,4,4',5-Pentachlorobiphenyl (BZ 114)	NELAP	PA	12/17/2012
EPA 1668		2,3,4,4',6-Pentachlorobiphenyl (BZ 115)	NELAP	PA	12/17/2012
EPA 1668		2,3,4,4'-Tetrachlorobiphenyl (BZ 60)	NELAP	PA	12/17/2012
EPA 1668		2,3,4,5,6-Pentachlorobiphenyl (BZ 116)	NELAP	PA	12/17/2012
EPA 1668		2,3,4,5-Tetrachlorobiphenyl (BZ 61)	NELAP	PA	12/17/2012
EPA 1668		2,3,4,6-Tetrachlorobiphenyl (BZ 62)	NELAP	PA	12/17/2012
EPA 1668		2,3,4'-Trichlorobiphenyl (BZ 21)	NELAP	PA	12/17/2012
EPA 1668		2,3,5,6-Tetrachlorobiphenyl (BZ 65)	NELAP	PA	12/17/2012
EPA 1668		2,3,5-Trichlorobiphenyl (BZ 23)	NELAP	PA	12/17/2012
EPA 1668		2,3,6-Trichlorobiphenyl (BZ 24)	NELAP	PA	12/17/2012
EPA 1668		2,3-Dichlorobiphenyl (BZ 5)	NELAP	PA	12/17/2012
EPA 1668		2,4',5-Trichlorobiphenyl (BZ 31)	NELAP	PA	12/17/2012
EPA 1668		2,4',6-Trichlorobiphenyl (BZ 32)	NELAP	PA	12/17/2012
EPA 1668		2,4'-Dichlorobiphenyl (BZ 8)	NELAP	PA	12/17/2012
EPA 1668		2,4,4',5-Tetrachlorobiphenyl (BZ 74)	NELAP	PA	12/17/2012
EPA 1668		2,4,4',6-Tetrachlorobiphenyl (BZ 75)	NELAP	PA	12/17/2012
EPA 1668		2,4,4'-Trichlorobiphenyl (BZ 28)	NELAP	PA	12/17/2012
EPA 1668		2,4,5-Trichlorobiphenyl (BZ 29)	NELAP	PA	12/17/2012
EPA 1668		2,4,6-Trichlorobiphenyl (BZ 30)	NELAP	PA	12/17/2012
EPA 1668		2,4-Dichlorobiphenyl (BZ 7)	NELAP	PA	12/17/2012
EPA 1668		2,5-Dichlorobiphenyl (BZ 9)	NELAP	PA	12/17/2012
EPA 1668		2,6-Dichlorobiphenyl (BZ 10)	NELAP	PA	12/17/2012
EPA 1668		2-Chlorobiphenyl (BZ 1)	NELAP	PA	12/17/2012
EPA 1668		3,3',4,4',5,5'-Hexachlorobiphenyl (BZ 169)	NELAP	PA	12/17/2012
EPA 1668		3,3',4,4',5-Pentachlorobiphenyl (BZ 126)	NELAP	PA	12/17/2012
EPA 1668		3,3',4,4'-Tetrachlorobiphenyl (BZ 77)	NELAP	PA	12/17/2012
EPA 1668		3,3',4,5'-Tetrachlorobiphenyl (BZ 79)	NELAP	PA	12/17/2012
EPA 1668		3,3',4,5,5'-Pentachlorobiphenyl (BZ 127)	NELAP	PA	12/17/2012

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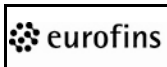
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Issue Date: 04/23/2014

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 <p>Lancaster Laboratories Environmental</p>	<p>Document Title: NELAP Scope of Testing</p>	<p>Eurofins Document Reference: 1-P-QM-GDL-9015386</p>
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Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

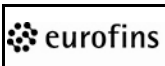
Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 1668		3,3',4,5-Tetrachlorobiphenyl (BZ 78)	NELAP	PA	12/17/2012
EPA 1668		3,3',4-Trichlorobiphenyl (BZ 35)	NELAP	PA	12/17/2012
EPA 1668		3,3',5,5'-Tetrachlorobiphenyl (BZ 80)	NELAP	PA	12/17/2012
EPA 1668		3,3',5-Trichlorobiphenyl (BZ 36)	NELAP	PA	12/17/2012
EPA 1668		3,3'-Dichlorobiphenyl (BZ 11)	NELAP	PA	12/17/2012
EPA 1668		3,4',5-Trichlorobiphenyl (BZ 39)	NELAP	PA	12/17/2012
EPA 1668		3,4'-Dichlorobiphenyl (BZ 13)	NELAP	PA	12/17/2012
EPA 1668		3,4,4',5-Tetrachlorobiphenyl (BZ 81)	NELAP	PA	12/17/2012
EPA 1668		3,4,4'-Trichlorobiphenyl (BZ 37)	NELAP	PA	12/17/2012
EPA 1668		3,4,5-Trichlorobiphenyl (BZ 38)	NELAP	PA	12/17/2012
EPA 1668		3,4-Dichlorobiphenyl (BZ 12)	NELAP	PA	12/17/2012
EPA 1668		3,5-Dichlorobiphenyl (BZ 14)	NELAP	PA	12/17/2012
EPA 1668		3-Chlorobiphenyl (BZ 2)	NELAP	PA	12/17/2012
EPA 1668		4,4'-Dichlorobiphenyl (BZ 15)	NELAP	PA	12/17/2012
EPA 1668		4-Chlorobiphenyl (BZ 3)	NELAP	PA	12/17/2012
EPA 1668		Decachlorobiphenyl	NELAP	PA	12/17/2012
EPA 300.0	2.1	Bromide	NELAP	PA	10/16/2012
EPA 300.0	2.1	Fluoride	NELAP	PA	10/16/2012
EPA 300.0	2.1	Nitrate as N	NELAP	PA	10/16/2012
EPA 300.0	2.1	Nitrite as N	NELAP	PA	10/16/2012
EPA 300.0	2.1	Sulfate	NELAP	PA	10/16/2012
EPA 3050	B	Acid digestion of solids	NELAP	PA	4/4/2005
EPA 3060	A	Alkaline digestion of Cr(VI)	NELAP	PA	4/4/2005
EPA 3510	C	Separatory funnel liquid-liquid extraction	NELAP	PA	4/4/2005
EPA 3540	C	Soxhlet extraction	NELAP	PA	4/4/2005
EPA 3546		Microwave extraction	NELAP	PA	9/25/2009
EPA 3550		Ultrasonic extraction	NELAP	PA	4/4/2005
EPA 3620	B	Florisil cleanup	NELAP	PA	4/4/2005
EPA 3630	C	Silica gel cleanup	NELAP	PA	4/4/2005
EPA 3640	A	Gel permeation cleanup (GPC)	NELAP	PA	4/4/2005
EPA 3660	B	Sulfur cleanup	NELAP	PA	4/4/2005
EPA 3665	A	Sulfuric acid/permanaganate clean-up	NELAP	PA	4/4/2005
EPA 5030		Bulk purge-and-trap (methanol)	NELAP	PA	12/4/2007
EPA 5035		Closed-system purge-and-trap (bisulfite option)	NELAP	PA	12/12/2005
EPA 5035		Closed-system purge-and-trap (methanol option)	NELAP	PA	4/4/2005
EPA 5035		Closed-system purge-and-trap (unpreserved)	NELAP	PA	4/4/2005
EPA 6010		Aluminum	NELAP	PA	1/19/2005
EPA 6010		Antimony	NELAP	PA	1/19/2005
EPA 6010		Arsenic	NELAP	PA	1/19/2005
EPA 6010		Barium	NELAP	PA	1/19/2005
EPA 6010		Beryllium	NELAP	PA	1/19/2005
EPA 6010		Boron	NELAP	PA	1/19/2005
EPA 6010		Cadmium	NELAP	PA	1/19/2005
EPA 6010		Calcium	NELAP	PA	1/19/2005

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 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Laboratory Scope of Accreditation



Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 6010		Chromium	NELAP	PA	1/19/2005
EPA 6010		Cobalt	NELAP	PA	1/19/2005
EPA 6010		Copper	NELAP	PA	1/19/2005
EPA 6010		Iron	NELAP	PA	1/19/2005
EPA 6010		Lead	NELAP	PA	1/19/2005
EPA 6010		Lithium	NELAP	PA	1/20/2012
EPA 6010		Magnesium	NELAP	PA	1/19/2005
EPA 6010		Manganese	NELAP	PA	1/19/2005
EPA 6010	C	Metals by ICP/AES	NELAP	PA	3/26/2012
EPA 6010	B	Metals by ICP/AES	NELAP	PA	3/26/2012
EPA 6010		Molybdenum	NELAP	PA	1/19/2005
EPA 6010		Nickel	NELAP	PA	1/19/2005
EPA 6010		Potassium	NELAP	PA	1/19/2005
EPA 6010		Selenium	NELAP	PA	1/19/2005
EPA 6010		Silica, as SiO ₂	NELAP	PA	1/20/2012
EPA 6010		Silver	NELAP	PA	1/19/2005
EPA 6010		Sodium	NELAP	PA	1/19/2005
EPA 6010		Strontium	NELAP	PA	1/19/2005
EPA 6010		Sulfur	NELAP	PA	12/19/2011
EPA 6010		Thallium	NELAP	PA	1/19/2005
EPA 6010		Tin	NELAP	PA	1/19/2005
EPA 6010		Titanium	NELAP	PA	1/19/2005
EPA 6010		Vanadium	NELAP	PA	1/19/2005
EPA 6010		Zinc	NELAP	PA	1/19/2005
EPA 6020		Aluminum	NELAP	PA	4/29/2010
EPA 6020		Antimony	NELAP	PA	1/19/2005
EPA 6020		Arsenic	NELAP	PA	1/19/2005
EPA 6020		Barium	NELAP	PA	1/20/2012
EPA 6020		Beryllium	NELAP	PA	1/19/2005
EPA 6020		Boron	NELAP	PA	4/29/2010
EPA 6020		Cadmium	NELAP	PA	1/19/2005
EPA 6020		Calcium	NELAP	PA	4/29/2010
EPA 6020		Chromium	NELAP	PA	1/19/2005
EPA 6020		Cobalt	NELAP	PA	4/29/2010
EPA 6020		Copper	NELAP	PA	1/19/2005
EPA 6020		Iron	NELAP	PA	4/29/2010
EPA 6020		Lead	NELAP	PA	1/19/2005
EPA 6020		Magnesium	NELAP	PA	4/29/2010
EPA 6020		Manganese	NELAP	PA	4/29/2010
EPA 6020	A	Metals by ICP/MS	NELAP	PA	3/26/2012
EPA 6020		Molybdenum	NELAP	PA	7/25/2011
EPA 6020		Nickel	NELAP	PA	4/4/2005
EPA 6020		Potassium	NELAP	PA	4/29/2010
EPA 6020		Selenium	NELAP	PA	4/4/2005
EPA 6020		Silver	NELAP	PA	2/23/2010

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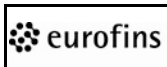
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Issue Date: 04/23/2014

Revision: 3	Effective date: Aug 8, 2014	Page 44 of 101
COMPANY CONFIDENTIAL		

 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Laboratory Scope of Accreditation



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DEP Laboratory ID: 36-00037
PADWIS ID: 36037

EPA Lab Code: PA00009

TNI Code: (717) 656-2300

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 6020		Sodium	NELAP	PA	4/29/2010
EPA 6020		Strontium	NELAP	PA	4/29/2010
EPA 6020		Thallium	NELAP	PA	1/19/2005
EPA 6020		Tin	NELAP	PA	4/29/2010
EPA 6020		Titanium	NELAP	PA	4/29/2010
EPA 6020		Vanadium	NELAP	PA	1/7/2010
EPA 6020		Zinc	NELAP	PA	2/1/2011
EPA 6850		Perchlorate	NELAP	PA	1/19/2011
EPA 7.3.3.2		Reactive cyanide	NELAP	PA	12/12/2005
EPA 7.3.4.2		Reactive sulfide	NELAP	PA	12/12/2005
EPA 7196		Chromium VI	NELAP	PA	1/19/2005
EPA 7199		Chromium VI	NELAP	PA	5/2/2006
EPA 7471		Mercury	NELAP	PA	10/17/2007
EPA 8015		Diesel-range organics (DRO)	NELAP	PA	4/4/2005
EPA 8015		Ethanol	NELAP	PA	1/19/2005
EPA 8015		Ethylene glycol	NELAP	PA	12/4/2007
EPA 8015		Gasoline-range organics (GRO)	NELAP	PA	4/4/2005
EPA 8015		Isopropyl alcohol (2-Propanol)	NELAP	PA	12/4/2007
EPA 8015		Methanol	NELAP	PA	1/19/2005
EPA 8015	C	Nonhalogenated organics by GC/FID	NELAP	PA	3/26/2012
EPA 8015	B	Nonhalogenated organics by GC/FID	NELAP	PA	3/26/2012
EPA 8021		Benzene	NELAP	PA	1/19/2005
EPA 8021		Ethylbenzene	NELAP	PA	1/19/2005
EPA 8021		Isopropylbenzene (Cumene)	NELAP	PA	1/24/2007
EPA 8021		Methyl tert-butyl ether (MTBE)	NELAP	PA	5/2/2006
EPA 8021		Naphthalene	NELAP	PA	12/4/2007
EPA 8021		Toluene	NELAP	PA	1/19/2005
EPA 8021	B	VOCs by GC/FID/ELCD	NELAP	PA	3/26/2012
EPA 8021		Xylenes, total	NELAP	PA	1/19/2005
EPA 8021		m-Xylene	NELAP	PA	1/24/2007
EPA 8021		o-Xylene	NELAP	PA	1/24/2007
EPA 8021		p-Xylene	NELAP	PA	1/24/2007
EPA 8081		4,4'-DDDD	NELAP	PA	1/19/2005
EPA 8081		4,4'-DDE	NELAP	PA	1/19/2005
EPA 8081		4,4'-DDT	NELAP	PA	1/19/2005
EPA 8081		Aldrin (HHDN)	NELAP	PA	1/19/2005
EPA 8081		Chlordane (tech.)	NELAP	PA	1/19/2005
EPA 8081		Dieldrin	NELAP	PA	1/19/2005
EPA 8081		Endosulfan I	NELAP	PA	1/19/2005
EPA 8081		Endosulfan II	NELAP	PA	1/19/2005
EPA 8081		Endosulfan sulfate	NELAP	PA	1/19/2005
EPA 8081		Endrin	NELAP	PA	1/19/2005
EPA 8081		Endrin aldehyde	NELAP	PA	1/19/2005
EPA 8081		Endrin ketone	NELAP	PA	1/19/2005
EPA 8081		Heptachlor	NELAP	PA	1/19/2005

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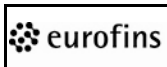
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Issue Date: 04/23/2014

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	Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Laboratory Scope of Accreditation

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DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8081		Heptachlor epoxide	NELAP	PA	1/19/2005
EPA 8081		Kepone	NELAP	PA	1/19/2005
EPA 8081		Methoxychlor	NELAP	PA	1/19/2005
EPA 8081		Mirex	NELAP	PA	1/19/2005
EPA 8081	A	Organochlorine pesticides by GC/ECD	NELAP	PA	3/26/2012
EPA 8081	B	Organochlorine pesticides by GC/ECD	NELAP	PA	1/1/2013
EPA 8081		Toxaphene (Chlorinated camphene)	NELAP	PA	1/19/2005
EPA 8081		alpha-BHC (alpha-Hexachlorocyclohexane)	NELAP	PA	1/19/2005
EPA 8081		alpha-Chlordane	NELAP	PA	4/4/2005
EPA 8081		beta-BHC (beta-Hexachlorocyclohexane)	NELAP	PA	1/19/2005
EPA 8081		delta-BHC (delta-Hexachlorocyclohexane)	NELAP	PA	1/19/2005
EPA 8081		gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	NELAP	PA	1/19/2005
EPA 8081		gamma-Chlordane	NELAP	PA	4/4/2005
EPA 8082		Aroclor-1016 (PCB-1016)	NELAP	PA	1/2/2007
EPA 8082		Aroclor-1016 (in oil)	NELAP	PA	5/24/2011
EPA 8082		Aroclor-1221 (PCB-1221)	NELAP	PA	1/2/2007
EPA 8082		Aroclor-1221 (in oil)	NELAP	PA	5/24/2011
EPA 8082		Aroclor-1232 (PCB-1232)	NELAP	PA	1/2/2007
EPA 8082		Aroclor-1232 (in oil)	NELAP	PA	5/24/2011
EPA 8082		Aroclor-1242 (PCB-1242)	NELAP	PA	1/2/2007
EPA 8082		Aroclor-1242 (in oil)	NELAP	PA	5/24/2011
EPA 8082		Aroclor-1248 (PCB-1248)	NELAP	PA	1/2/2007
EPA 8082		Aroclor-1248 (in oil)	NELAP	PA	5/24/2011
EPA 8082		Aroclor-1254 (PCB-1254)	NELAP	PA	1/2/2007
EPA 8082		Aroclor-1254 (in oil)	NELAP	PA	5/24/2011
EPA 8082		Aroclor-1260 (PCB-1260)	NELAP	PA	1/2/2007
EPA 8082		Aroclor-1260 (in oil)	NELAP	PA	5/24/2011
EPA 8082		Aroclor-1262 (PCB-1262)	NELAP	PA	7/23/2008
EPA 8082		Aroclor-1268 (PCB-1268)	NELAP	PA	7/23/2008
EPA 8082		Decachlorobiphenyl	NELAP	PA	12/17/2012
EPA 8082	A	PCBs by GC/ECD	NELAP	PA	3/26/2012
EPA 8141		Alachlor (Lasso)	NELAP	PA	1/21/2009
EPA 8141		Atrazine	NELAP	PA	1/19/2005
EPA 8141		Azinphos-methyl (Guthion)	NELAP	PA	4/4/2005
EPA 8141		Bolstar (Sulprofos)	NELAP	PA	1/19/2005
EPA 8141		Carbophenothion (Trihion)	NELAP	PA	11/9/2012
EPA 8141		Chlorpyrifos	NELAP	PA	4/4/2005
EPA 8141		Coumaphos	NELAP	PA	1/19/2005
EPA 8141		Demeton-O	NELAP	PA	1/19/2005
EPA 8141		Demeton-S	NELAP	PA	1/19/2005
EPA 8141		Diazinon (Spectracide)	NELAP	PA	1/19/2005
EPA 8141		Dichlorovos (DDVP, Dichlorvos)	NELAP	PA	1/19/2005
EPA 8141		Disulfoton	NELAP	PA	1/19/2005
EPA 8141		EPN (Santox)	NELAP	PA	1/19/2005
EPA 8141		Ethion	NELAP	PA	1/19/2005

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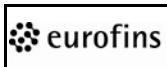
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Issue Date: 04/23/2014

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 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Laboratory Scope of Accreditation



Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes

should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8141		Ethoprop (Prophos)	NELAP	PA	1/19/2005
EPA 8141		Famphur	NELAP	PA	1/19/2005
EPA 8141		Fensulfathion	NELAP	PA	1/19/2005
EPA 8141		Fenthion	NELAP	PA	4/4/2005
EPA 8141		Malathion	NELAP	PA	1/19/2005
EPA 8141		Mephos	NELAP	PA	1/19/2005
EPA 8141		Methyl parathion (Parathion, methyl)	NELAP	PA	5/25/2005
EPA 8141		Mevinphos	NELAP	PA	1/19/2005
EPA 8141		Naled	NELAP	PA	1/19/2005
EPA 8141	B	Organophosphorus compounds by GC/NPD	NELAP	PA	3/26/2012
EPA 8141	A	Organophosphorus compounds by GC/NPD	NELAP	PA	3/26/2012
EPA 8141		Parathion, ethyl (Ethyl parathion, Parathion)	NELAP	PA	1/19/2005
EPA 8141		Phorate (Thimet)	NELAP	PA	1/19/2005
EPA 8141		Rommel	NELAP	PA	1/19/2005
EPA 8141		Simazine	NELAP	PA	1/4/2006
EPA 8141		Stirophos (Tetrachlorovinphos)	NELAP	PA	1/19/2005
EPA 8141		Tokuthion (Prothiophos)	NELAP	PA	1/19/2005
EPA 8141		Trichloronate	NELAP	PA	1/19/2005
EPA 8151		2,4,5-T	NELAP	PA	1/19/2005
EPA 8151		2,4,5-TP (Silvex)	NELAP	PA	1/19/2005
EPA 8151		2,4-D	NELAP	PA	1/19/2005
EPA 8151		2,4-DB (Butoxon)	NELAP	PA	4/4/2005
EPA 8151	A	Chlorinated herbicides by GC/ECD	NELAP	PA	3/26/2012
EPA 8151		Dalapon (2,2-Dichloropropionic acid)	NELAP	PA	1/19/2005
EPA 8151		Dicamba	NELAP	PA	1/19/2005
EPA 8151		Dichloroprop (Dichloroprop)	NELAP	PA	1/19/2005
EPA 8151		Dinosch (2-sec-Butyl-4,6-dinitrophenol, DNBP)	NELAP	PA	1/19/2005
EPA 8151		MCPA	NELAP	PA	1/19/2005
EPA 8151		MCPP (Mecoprop)	NELAP	PA	5/2/2006
EPA 8151		Pentachlorophenol (PCP)	NELAP	PA	1/19/2005
EPA 8151		Picloram (4-Amino-3,5,6-trichloro-2-pyridinecarboxylic acid)	NELAP	PA	1/19/2005
EPA 8260		1,1,1,2-Tetrachloroethane	NELAP	PA	1/19/2005
EPA 8260		1,1,1-Trichloroethane	NELAP	PA	1/19/2005
EPA 8260		1,1,2,2-Tetrachloroethane	NELAP	PA	1/19/2005
EPA 8260		1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	NELAP	PA	5/2/2006
EPA 8260		1,1,2-Trichloroethane	NELAP	PA	1/19/2005
EPA 8260		1,1-Dichloroethane	NELAP	PA	1/19/2005
EPA 8260		1,1-Dichloroethane (1,1-Dichloroethylene)	NELAP	PA	1/19/2005
EPA 8260		1,1-Dichloropropene	NELAP	PA	1/19/2005
EPA 8260		1,2,3-Trichlorobenzene	NELAP	PA	1/19/2005
EPA 8260		1,2,3-Trichloropropane (1,2,3-TCP)	NELAP	PA	1/19/2005
EPA 8260		1,2,4-Trichlorobenzene	NELAP	PA	1/19/2005
EPA 8260		1,2,4-Trimethylbenzene	NELAP	PA	1/19/2005

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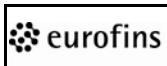
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Issue Date: 04/23/2014

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 <p>Lancaster Laboratories Environmental</p>	<p>Document Title: NELAP Scope of Testing</p>	<p>Eurofins Document Reference: 1-P-QM-GDL-9015386</p>
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Laboratory Scope of Accreditation



Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8260		1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	NELAP	PA	1/19/2005
EPA 8260		1,2-Dibromoethane (EDB, Ethylene dibromide)	NELAP	PA	1/19/2005
EPA 8260		1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 8260		1,2-Dichloroethane	NELAP	PA	1/19/2005
EPA 8260		1,2-Dichloropropane	NELAP	PA	1/19/2005
EPA 8260		1,3,5-Trimethylbenzene	NELAP	PA	1/19/2005
EPA 8260		1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 8260		1,3-Dichloropropane	NELAP	PA	1/19/2005
EPA 8260		1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 8260		1,4-Dioxane (1,4-Dioxolene oxide)	NELAP	PA	1/19/2005
EPA 8260		2,2-Dichloropropane	NELAP	PA	1/19/2005
EPA 8260		2-Butanone (Methyl ethyl ketone, MEK)	NELAP	PA	1/19/2005
EPA 8260		2-Chloroethyl vinyl ether	NELAP	PA	1/19/2005
EPA 8260		2-Chlorotoluene	NELAP	PA	5/2/2006
EPA 8260		2-Hexanone	NELAP	PA	1/19/2005
EPA 8260		2-Nitropropane	NELAP	PA	12/17/2012
EPA 8260		3,3'-Dimethyl-1-butanol	NELAP	PA	4/17/2009
EPA 8260		4-Chloro-2-nitrophenol	NELAP	PA	5/2/2006
EPA 8260		4-Chlorotoluene	NELAP	PA	1/19/2005
EPA 8260		4-Methyl-2-pentanone (MIBK)	NELAP	PA	1/19/2005
EPA 8260		Acetone	NELAP	PA	1/19/2005
EPA 8260		Acetonitrile	NELAP	PA	1/4/2006
EPA 8260		Acrolein (Propenal)	NELAP	PA	1/19/2005
EPA 8260		Acrylonitrile	NELAP	PA	1/19/2005
EPA 8260		Allyl chloride (3-Chloropropene)	NELAP	PA	1/19/2005
EPA 8260		Benzene	NELAP	PA	1/19/2005
EPA 8260		Benzyl chloride	NELAP	PA	1/4/2006
EPA 8260		Bromobenzene	NELAP	PA	1/19/2005
EPA 8260		Bromochloromethane	NELAP	PA	1/19/2005
EPA 8260		Bromodichloromethane	NELAP	PA	1/19/2005
EPA 8260		Bromoform	NELAP	PA	1/19/2005
EPA 8260		Carbon disulfide	NELAP	PA	1/19/2005
EPA 8260		Carbon tetrachloride	NELAP	PA	1/19/2005
EPA 8260		Chlorobenzene	NELAP	PA	1/19/2005
EPA 8260		Chloroethane	NELAP	PA	1/19/2005
EPA 8260		Chloroform	NELAP	PA	1/19/2005
EPA 8260		Chloroprene (2-Chloro-1,3-butadiene)	NELAP	PA	4/17/2009
EPA 8260		Cyclohexane	NELAP	PA	6/29/2010
EPA 8260		Cyclohexanone	NELAP	PA	7/3/2007
EPA 8260		Dibromochloromethane	NELAP	PA	1/19/2005
EPA 8260		Dibromomethane	NELAP	PA	1/19/2005
EPA 8260		Dichlorodifluoromethane (Freon 12)	NELAP	PA	1/19/2005
EPA 8260		Diisopropyl ether (DIPE)	NELAP	PA	7/3/2007

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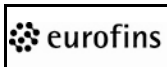
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Issue Date: 04/23/2014

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	Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Laboratory Scope of Accreditation



Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037
PADWIS ID: 36037

EPA Lab Code: PA00009

TNI Code: (717) 656-2300

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8260		Epichlorohydrin (1-Chloro-2,3-epoxypropane)	NELAP	PA	1/4/2006
EPA 8260		Ethanol	NELAP	PA	1/4/2006
EPA 8260		Ethyl acetate	NELAP	PA	1/4/2006
EPA 8260		Ethyl methacrylate	NELAP	PA	1/4/2006
EPA 8260		Ethyl tert-butyl ether (ETBE)	NELAP	PA	7/3/2007
EPA 8260		Ethylbenzene	NELAP	PA	1/19/2005
EPA 8260		Gasoline-range organics (GRO)	NELAP	PA	6/8/2006
EPA 8260		Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	1/19/2005
EPA 8260		Isobutyl alcohol (2-Methyl-1-propanol)	NELAP	PA	7/3/2007
EPA 8260		Isopropyl alcohol (2-Propanol)	NELAP	PA	1/19/2005
EPA 8260		Isopropylbenzene (Cumene)	NELAP	PA	8/7/2005
EPA 8260		Methacrylonitrile	NELAP	PA	1/24/2007
EPA 8260		Methyl acetate	NELAP	PA	6/29/2010
EPA 8260		Methyl bromide (Bromomethane)	NELAP	PA	1/19/2005
EPA 8260		Methyl chloride (Chloromethane)	NELAP	PA	1/19/2005
EPA 8260		Methyl iodide (Iodomethane)	NELAP	PA	5/2/2006
EPA 8260		Methyl tert-butyl ether (MTBE)	NELAP	PA	1/19/2005
EPA 8260		Methylcyclohexane	NELAP	PA	1/21/2009
EPA 8260		Methylene chloride (Dichloromethane)	NELAP	PA	1/19/2005
EPA 8260		Methylmethacrylate	NELAP	PA	5/2/2006
EPA 8260		Naphthalene	NELAP	PA	1/19/2005
EPA 8260		Pentachloroethane	NELAP	PA	1/24/2007
EPA 8260		Propionitrile (Ethyl cyanide)	NELAP	PA	1/24/2007
EPA 8260		Styrene	NELAP	PA	1/19/2005
EPA 8260		Tetrachloroethene (PCE, Perchloroethylene)	NELAP	PA	1/19/2005
EPA 8260		Tetrahydrofuran (THF)	NELAP	PA	6/7/2012
EPA 8260		Toluene	NELAP	PA	1/19/2005
EPA 8260		Trichloroethene (TCE, Trichloroethylene)	NELAP	PA	1/19/2005
EPA 8260		Trichlorofluoromethane (Freon 11)	NELAP	PA	1/19/2005
EPA 8260	B	VOCs by GC/MS	NELAP	PA	3/26/2012
EPA 8260	C	VOCs by GC/MS	NELAP	PA	3/26/2012
EPA 8260		Vinyl acetate	NELAP	PA	1/19/2005
EPA 8260		Vinyl chloride (Chloroethene)	NELAP	PA	1/19/2005
EPA 8260		Xylenes, total	NELAP	PA	1/19/2005
EPA 8260		cis-1,2-Dichloroethene	NELAP	PA	1/19/2005
EPA 8260		cis-1,3-Dichloropropene	NELAP	PA	1/19/2005
EPA 8260		m+p-Xylene	NELAP	PA	1/24/2007
EPA 8260		n-Butyl alcohol (n-Butanol, 1-Butanol)	NELAP	PA	1/19/2005
EPA 8260		n-Butylbenzene	NELAP	PA	1/19/2005
EPA 8260		n-Propylbenzene	NELAP	PA	1/4/2006
EPA 8260		o-Xylene	NELAP	PA	1/24/2007
EPA 8260		p-Isopropyltoluene (4-Isopropyltoluene)	NELAP	PA	1/24/2007
EPA 8260		sec-Butylbenzene	NELAP	PA	1/19/2005
EPA 8260		tert-Amyl alcohol (2-Methyl-2-butanol)	NELAP	PA	4/17/2009

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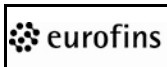
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Issue Date: 04/23/2014

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 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Laboratory Scope of Accreditation

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DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

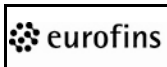
Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8260		tert-Amyl methyl ether (TAME)	NELAP	PA	7/3/2007
EPA 8260		tert-Butyl alcohol (2-Methyl-2-propanol)	NELAP	PA	1/19/2005
EPA 8260		tert-Butyl ethyl ether	NELAP	PA	5/25/2007
EPA 8260		tert-Butyl formate	NELAP	PA	4/17/2009
EPA 8260		tert-Butylbenzene	NELAP	PA	1/19/2005
EPA 8260		trans-1,2-Dichloroethene	NELAP	PA	1/19/2005
EPA 8260		trans-1,3-Dichloropropene	NELAP	PA	1/19/2005
EPA 8260		trans-1,4-Dichloro-2-butene	NELAP	PA	7/3/2007
EPA 8260 SIM		1,4-Dioxane (1,4-Diethylenecoxide)	NELAP	PA	4/17/2009
EPA 8270		1,1'-Biphenyl (Biphenyl, Lemonene)	NELAP	PA	12/4/2007
EPA 8270		1,2,3,4-Tetrachlorobenzene	NELAP	PA	7/3/2007
EPA 8270		1,2,3,4-Tetrahydronaphthalene	NELAP	PA	12/4/2007
EPA 8270		1,2,3,5-Tetrachlorobenzene	NELAP	PA	7/3/2007
EPA 8270		1,2,4,5-Tetrachlorobenzene	NELAP	PA	4/4/2005
EPA 8270		1,2,4-Trichlorobenzene	NELAP	PA	1/19/2005
EPA 8270		1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 8270		1,2-Dinitrobenzene (1,2-DNB)	NELAP	PA	1/19/2005
EPA 8270		1,2-Diphenylhydrazine	NELAP	PA	5/2/2006
EPA 8270		1,3,5-Trinitrobenzene (1,3,5-TNB)	NELAP	PA	1/4/2006
EPA 8270		1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 8270		1,3-Dinitrobenzene (1,3-DNB)	NELAP	PA	1/19/2005
EPA 8270		1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	1/19/2005
EPA 8270		1,4-Dinitrobenzene (1,4-DNB)	NELAP	PA	5/2/2006
EPA 8270		1,4-Dioxane (1,4-Diethylenecoxide)	NELAP	PA	12/4/2007
EPA 8270		1,4-Naphthoquinone	NELAP	PA	1/19/2005
EPA 8270		1,4-Phenylenediamine	NELAP	PA	1/19/2005
EPA 8270		1-Chloronaphthalene	NELAP	PA	1/4/2006
EPA 8270		1-Methylnaphthalene	NELAP	PA	12/4/2007
EPA 8270		1-Naphthylamine (alpha-Naphthylamine)	NELAP	PA	4/4/2005
EPA 8270		2,3,4,6-Tetrachlorophenol	NELAP	PA	1/19/2005
EPA 8270		2,4,5-Trichlorophenol	NELAP	PA	1/19/2005
EPA 8270		2,4,6-Trichlorophenol	NELAP	PA	1/19/2005
EPA 8270		2,4-Dichlorophenol	NELAP	PA	1/19/2005
EPA 8270		2,4-Dimethylphenol	NELAP	PA	1/19/2005
EPA 8270		2,4-Dinitrophenol	NELAP	PA	1/19/2005
EPA 8270		2,4-Dinitrotoluene (2,4-DNT)	NELAP	PA	1/19/2005
EPA 8270		2,6-Dichlorophenol	NELAP	PA	1/19/2005
EPA 8270		2,6-Dinitrotoluene (2,6-DNT)	NELAP	PA	1/19/2005
EPA 8270		2-Acetylanilino fluorene	NELAP	PA	1/19/2005
EPA 8270		2-Chloronaphthalene	NELAP	PA	1/19/2005
EPA 8270		2-Chlorophenol	NELAP	PA	1/19/2005
EPA 8270		2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	NELAP	PA	1/19/2005
EPA 8270		2-Methylnaphthalene	NELAP	PA	1/19/2005
EPA 8270		2-Methylphenol (o-Cresol)	NELAP	PA	1/19/2005
EPA 8270		2-Naphthylamine (beta-Naphthylamine)	NELAP	PA	5/17/2005

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Laboratory Scope of Accreditation



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DEP Laboratory ID: 36-00037
PADWIS ID: 36037

EPA Lab Code: PA00009

TNI Code: (717) 656-2300

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270		2-Nitroaniline	NELAP	PA	4/4/2005
EPA 8270		2-Nitrophenol	NELAP	PA	1/19/2005
EPA 8270		2-Picoline (2-Methylpyridine)	NELAP	PA	1/19/2005
EPA 8270		3+4-Methylphenol (m+p-Cresol)	NELAP	PA	1/19/2005
EPA 8270		3,3'-Dichlorobenzidine	NELAP	PA	1/19/2005
EPA 8270		3,3'-Dimethoxybenzidine	NELAP	PA	4/17/2009
EPA 8270		3,3'-Dimethylbenzidine	NELAP	PA	1/19/2005
EPA 8270		3-Methylcholanthrene	NELAP	PA	1/19/2005
EPA 8270		3-Nitroaniline	NELAP	PA	1/19/2005
EPA 8270		4,4'-Methylenebis(2-chloroaniline)	NELAP	PA	1/19/2005
EPA 8270		4-Aminobiphenyl	NELAP	PA	1/19/2005
EPA 8270		4-Bromophenyl phenyl ether	NELAP	PA	1/19/2005
EPA 8270		4-Chloro-3-methylphenol	NELAP	PA	1/19/2005
EPA 8270		4-Chloroaniline	NELAP	PA	1/19/2005
EPA 8270		4-Chlorophenyl phenyl ether	NELAP	PA	1/19/2005
EPA 8270		4-Nitroaniline	NELAP	PA	4/4/2005
EPA 8270		4-Nitrophenol	NELAP	PA	1/19/2005
EPA 8270		4-Nitroquinoline-1-oxide	NELAP	PA	7/3/2007
EPA 8270		5-Nitro-o-toluidine	NELAP	PA	4/4/2005
EPA 8270		6-Methylchrysene	NELAP	PA	12/4/2007
EPA 8270		7,12-Dimethylbenz(a)anthracene	NELAP	PA	1/19/2005
EPA 8270		Acenaphthene	NELAP	PA	1/19/2005
EPA 8270		Acenaphthylene	NELAP	PA	1/19/2005
EPA 8270		Acetophenone	NELAP	PA	1/19/2005
EPA 8270		Acrylamide	NELAP	PA	1/21/2009
EPA 8270		Aniline	NELAP	PA	1/19/2005
EPA 8270		Anthracene	NELAP	PA	1/19/2005
EPA 8270		Aramite	NELAP	PA	5/17/2005
EPA 8270		Atrazine	NELAP	PA	1/12/2007
EPA 8270		Benzaldehyde	NELAP	PA	12/4/2007
EPA 8270		Benzeneethiol	NELAP	PA	12/4/2007
EPA 8270		Benzidine	NELAP	PA	1/19/2005
EPA 8270		Benzo(a)anthracene	NELAP	PA	1/19/2005
EPA 8270		Benzo(a)pyrene	NELAP	PA	1/19/2005
EPA 8270		Benzo(b)fluoranthene	NELAP	PA	1/19/2005
EPA 8270		Benzo(g,h,i)perylene	NELAP	PA	1/19/2005
EPA 8270		Benzo(k)fluoranthene	NELAP	PA	1/19/2005
EPA 8270		Benzoic acid	NELAP	PA	1/19/2005
EPA 8270		Benzyl alcohol	NELAP	PA	1/19/2005
EPA 8270		Butyl benzyl phthalate (Benzyl butyl phthalate)	NELAP	PA	5/17/2005
EPA 8270		Caprolactam	NELAP	PA	12/4/2007
EPA 8270		Carbazole	NELAP	PA	1/19/2005
EPA 8270		Chlorobenzilate	NELAP	PA	5/2/2006
EPA 8270		Chrysene (Benzo(a)phenanthrene)	NELAP	PA	1/19/2005
EPA 8270		Di-n-butyl phthalate	NELAP	PA	1/19/2005

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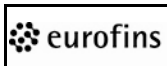
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Issue Date: 04/23/2014

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 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Laboratory Scope of Accreditation



Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270		Di-n-octyl phthalate	NELAP	PA	1/19/2005
EPA 8270		Diallylate (cis or trans)	NELAP	PA	5/2/2006
EPA 8270		Dibenz[a,h]acridine	NELAP	PA	12/4/2007
EPA 8270		Dibenz[a,j]acridine	NELAP	PA	5/17/2005
EPA 8270		Dibenzo[a,h]anthracene	NELAP	PA	1/19/2005
EPA 8270		Dibenzofuran	NELAP	PA	1/19/2005
EPA 8270		Diethyl phthalate	NELAP	PA	1/19/2005
EPA 8270		Dimethoate	NELAP	PA	5/2/2006
EPA 8270		Dimethyl phthalate	NELAP	PA	1/19/2005
EPA 8270		Diphenylamine	NELAP	PA	5/2/2006
EPA 8270		Disulfoton	NELAP	PA	7/1/2007
EPA 8270		Ethyl methanesulfonate	NELAP	PA	1/19/2005
EPA 8270		Famphur	NELAP	PA	5/2/2006
EPA 8270		Fluoranthene	NELAP	PA	1/19/2005
EPA 8270		Fluorene	NELAP	PA	1/19/2005
EPA 8270		Hexachlorobenzene	NELAP	PA	1/19/2005
EPA 8270		Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	1/19/2005
EPA 8270		Hexachlorocyclopentadiene	NELAP	PA	1/19/2005
EPA 8270		Hexachloroethane	NELAP	PA	1/19/2005
EPA 8270		Hexachloropropene	NELAP	PA	1/19/2005
EPA 8270		Indene	NELAP	PA	12/4/2007
EPA 8270		Indeno(1,2,3-cd)pyrene	NELAP	PA	1/19/2005
EPA 8270		Isodrin	NELAP	PA	5/2/2006
EPA 8270		Izophorone	NELAP	PA	1/19/2005
EPA 8270		Isosafrole	NELAP	PA	1/19/2005
EPA 8270		Kepone	NELAP	PA	5/2/2006
EPA 8270		Malononitrile	NELAP	PA	5/23/2013
EPA 8270		Methapyrilene	NELAP	PA	1/19/2005
EPA 8270		Methyl methanesulfonate	NELAP	PA	1/19/2005
EPA 8270		Methyl parathion (Parathion, methyl)	NELAP	PA	5/25/2007
EPA 8270		N,N-Dimethylacetamide	NELAP	PA	12/4/2007
EPA 8270		N,N-Dimethylformamide	NELAP	PA	12/4/2007
EPA 8270		N-Nitrosodi-n-butylamine	NELAP	PA	1/19/2005
EPA 8270		N-Nitrosodi-n-propylamine	NELAP	PA	1/19/2005
EPA 8270		N-Nitrosodiethylamine	NELAP	PA	1/19/2005
EPA 8270		N-Nitrosodimethylamine	NELAP	PA	1/19/2005
EPA 8270		N-Nitrosodiphenylamine	NELAP	PA	1/19/2005
EPA 8270		N-Nitrosomethylethylamine	NELAP	PA	1/19/2005
EPA 8270		N-Nitrosomorpholine	NELAP	PA	1/19/2005
EPA 8270		N-Nitrosopiperidine	NELAP	PA	1/19/2005
EPA 8270		N-Nitrosopyrrolidine	NELAP	PA	1/19/2005
EPA 8270		Naphthalene	NELAP	PA	1/19/2005
EPA 8270		Nitrobenzene	NELAP	PA	1/4/2006
EPA 8270		O,O,O-Triethyl phosphorothioate	NELAP	PA	5/2/2006
EPA 8270		Parathion, ethyl (Ethyl parathion, Parathion)	NELAP	PA	5/25/2007

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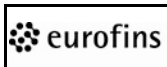
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Issue Date: 04/23/2014

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 <p>Lancaster Laboratories Environmental</p>	<p>Document Title: NELAP Scope of Testing</p>	<p>Eurofins Document Reference: 1-P-QM-GDL-9015386</p>
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Laboratory Scope of Accreditation



Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037
PADWIS ID: 36037

EPA Lab Code: PA00009

TNI Code: (717) 656-2300

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270		Pentachlorobenzene	NELAP	PA	1/19/2005
EPA 8270		Pentachloronitrobenzene (PCNB)	NELAP	PA	1/19/2005
EPA 8270		Pentachlorophenol (PCP)	NELAP	PA	1/19/2005
EPA 8270		Phenacetin	NELAP	PA	1/19/2005
EPA 8270		Phenanthrene	NELAP	PA	1/19/2005
EPA 8270		Phenol	NELAP	PA	1/19/2005
EPA 8270		Phorate (Thimet)	NELAP	PA	5/2/2006
EPA 8270		Phthalic anhydride	NELAP	PA	1/21/2009
EPA 8270		Pronamide (Kerb)	NELAP	PA	1/19/2005
EPA 8270		Pyrene	NELAP	PA	1/19/2005
EPA 8270		Pyridine	NELAP	PA	4/4/2005
EPA 8270		Quinoline	NELAP	PA	12/4/2007
EPA 8270	D	SOCs by GC/MS	NELAP	PA	3/26/2012
EPA 8270	C	SOCs by GC/MS	NELAP	PA	3/26/2012
EPA 8270		Safrole	NELAP	PA	1/19/2005
EPA 8270		Sulfotep (Tetraethyl dithiopyrophosphate)	NELAP	PA	12/4/2007
EPA 8270		Tetraethyl lead	NELAP	PA	3/7/2012
EPA 8270		Thionazine (Thionazin, Zinophos)	NELAP	PA	5/2/2006
EPA 8270		a,a-Dimethylphenethylamine (Phentermine)	NELAP	PA	5/2/2006
EPA 8270		bis(2-Chloroethoxy)methane	NELAP	PA	1/19/2005
EPA 8270		bis(2-Chloroethyl) ether	NELAP	PA	1/19/2005
EPA 8270		bis(2-Chloroisopropyl) ether	NELAP	PA	1/4/2006
EPA 8270		bis(2-Chloromethyl) ether	NELAP	PA	1/21/2009
EPA 8270		bis(2-Ethylhexyl) adipate (di(2-Ethylhexyl) adipate)	NELAP	PA	1/21/2009
EPA 8270		bis(2-Ethylhexyl) phthalate (DEHP)	NELAP	PA	1/19/2005
EPA 8270		o-Toluidine (2-Toluidine, 2-Methylaminol)	NELAP	PA	1/19/2005
EPA 8270		p-(Dimethylamino)azobenzene	NELAP	PA	5/2/2006
EPA 8270		p-Chloronitrobenzene	NELAP	PA	1/21/2009
EPA 8270		tris-(2,3-Dibromopropyl) phosphate (tris-BP)	NELAP	PA	12/4/2007
EPA 8270 SIM		1-Methylnaphthalene	NELAP	PA	7/25/2011
EPA 8270 SIM		2-Methylnaphthalene	NELAP	PA	5/23/2012
EPA 8270 SIM		Acenaphthene	NELAP	PA	12/4/2007
EPA 8270 SIM		Acenaphthylene	NELAP	PA	12/4/2007
EPA 8270 SIM		Anthracene	NELAP	PA	12/4/2007
EPA 8270 SIM		Benzo[a]anthracene	NELAP	PA	12/4/2007
EPA 8270 SIM		Benzo[a]pyrene	NELAP	PA	12/4/2007
EPA 8270 SIM		Benzo[b]fluoranthene	NELAP	PA	12/4/2007
EPA 8270 SIM		Benzo[ghi]perylene	NELAP	PA	12/4/2007
EPA 8270 SIM		Benzo[k]fluoranthene	NELAP	PA	12/4/2007
EPA 8270 SIM		Chrysene (Benzo[a]phenanthrene)	NELAP	PA	12/4/2007
EPA 8270 SIM		Dibenzo[a,h]anthracene	NELAP	PA	12/4/2007
EPA 8270 SIM		Fluoranthene	NELAP	PA	12/4/2007
EPA 8270 SIM		Fluorene	NELAP	PA	12/4/2007
EPA 8270 SIM		Indeno(1,2,3-cd)pyrene	NELAP	PA	12/4/2007

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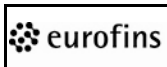
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Issue Date: 04/23/2014

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 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

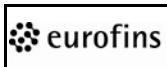
Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270 SIM		Naphthalene	NELAP	PA	12/4/2007
EPA 8270 SIM		Phenanthrene	NELAP	PA	12/4/2007
EPA 8270 SIM		Pyrene	NELAP	PA	12/4/2007
EPA 8290		1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	NELAP	PA	6/30/2010
EPA 8290		1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	NELAP	PA	6/30/2010
EPA 8290		1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	NELAP	PA	6/30/2010
EPA 8290		1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	NELAP	PA	6/30/2010
EPA 8290		1,2,3,4,7,8-Heptachlorodibenzofuran (1,2,3,4,7,8-hpcdf)	NELAP	PA	6/30/2010
EPA 8290		1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 8290		1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	8/6/2010
EPA 8290		1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 8290		1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 8290		1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 8290		1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 8290		1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	NELAP	PA	6/30/2010
EPA 8290		1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	NELAP	PA	6/30/2010
EPA 8290		2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 8290		2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	NELAP	PA	8/6/2010
EPA 8290		2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD)(Dioxin)	NELAP	PA	6/30/2010
EPA 8290		2,3,7,8-Tetrachlorodibenzofuran (TCDF)	NELAP	PA	6/30/2010
EPA 8290		PCDDs and PCDFs by HRGC-HRMS	NELAP	PA	3/26/2012
EPA 8290		Total TCDD	NELAP	PA	6/30/2010
EPA 8290		Total TCDF	NELAP	PA	6/30/2010
EPA 8290		Total heptachlorodibenzo-p-dioxin (HpCDD)	NELAP	PA	6/30/2010
EPA 8290		Total heptachlorodibenzofuran (HpCDF)	NELAP	PA	6/30/2010
EPA 8290		Total hexachlorodibenzo-p-dioxin (HxCDD)	NELAP	PA	6/30/2010
EPA 8290		Total hexachlorodibenzofuran (HxCDF)	NELAP	PA	6/30/2010
EPA 8290		Total pentachlorodibenzo-p-dioxin (PeCDD)	NELAP	PA	6/30/2010
EPA 8290		Total pentachlorodibenzofuran (PeCDF)	NELAP	PA	6/30/2010
EPA 8315		2,5-Dimethylbenzaldehyde	NELAP	PA	1/21/2009
EPA 8315		Acetaldehyde	NELAP	PA	1/21/2009
EPA 8315		Benzaldehyde	NELAP	PA	1/21/2009
EPA 8315		Butanal (Butyraldehyde)	NELAP	PA	1/21/2009

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Laboratory Scope of Accreditation



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DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 8315	A	Carbonyl compounds by HPLC	NELAP	PA	3/26/2012
EPA 8315		Crotonaldehyde	NELAP	PA	1/21/2009
EPA 8315		Formaldehyde	NELAP	PA	1/19/2005
EPA 8315		Hexanal (Hexaldehyde)	NELAP	PA	1/21/2009
EPA 8315		Isovaleraldehyde	NELAP	PA	1/21/2009
EPA 8315		Pentanal (Valeraldehyde)	NELAP	PA	1/21/2009
EPA 8315		Propanal (Propionaldehyde)	NELAP	PA	1/21/2009
EPA 8315		m-Tolualdehyde (1,3-Tolualdehyde)	NELAP	PA	1/21/2009
EPA 8315		o-Tolualdehyde (1,2-Tolualdehyde)	NELAP	PA	1/21/2009
EPA 8315		p-Tolualdehyde (1,4-Tolualdehyde)	NELAP	PA	1/21/2009
EPA 8318		3-Hydroxycarbofuran	NELAP	PA	4/4/2005
EPA 8318		Aldicarb (Temik)	NELAP	PA	4/4/2005
EPA 8318		Aldicarb sulfone	NELAP	PA	4/4/2005
EPA 8318		Aldicarb sulfoxide	NELAP	PA	12/12/2005
EPA 8318		Carbaryl (Sevin)	NELAP	PA	4/4/2005
EPA 8318		Carbofuran (Furaden)	NELAP	PA	4/4/2005
EPA 8318		Methiocarb (Mesuro)	NELAP	PA	4/4/2005
EPA 8318		Methomyl (Lannate)	NELAP	PA	4/4/2005
EPA 8318		N-Methylcarbamates by HPLC	NELAP	PA	10/15/2012
EPA 8318		Oxamyl (Vydate)	NELAP	PA	12/12/2005
EPA 8318		Propoxur (Baygon)	NELAP	PA	4/4/2005
EPA 8330	A	1,3,5-Trinitrobenzene (1,3,5-TNB)	NELAP	PA	1/19/2005
EPA 8330		1,3-Dinitrobenzene (1,3-DNB)	NELAP	PA	1/19/2005
EPA 8330		2,4,6-Trinitrotoluene (2,4,6-TNT)	NELAP	PA	1/19/2005
EPA 8330		2,4-Dinitrotoluene (2,4-DNT)	NELAP	PA	1/19/2005
EPA 8330		2,6-Dinitrotoluene (2,6-DNT)	NELAP	PA	1/19/2005
EPA 8330		2-Amino-4,6-dinitrotoluene (2-Am-DNT)	NELAP	PA	1/19/2005
EPA 8330		2-Nitrotoluene	NELAP	PA	1/19/2005
EPA 8330		3-Nitrotoluene	NELAP	PA	1/19/2005
EPA 8330		4-Amino-2,6-dinitrotoluene (4-Am-DNT)	NELAP	PA	1/19/2005
EPA 8330		4-Nitrotoluene	NELAP	PA	1/19/2005
EPA 8330		Methyl-2,4,6-trinitrophenylhydrazine (Fetrel)	NELAP	PA	1/19/2005
EPA 8330		Nitroaromatics and nitranines by HPLC/UV	NELAP	PA	3/26/2012
EPA 8330		Nitroaromatics and nitranines by HPLC/UV	NELAP	PA	3/26/2012
EPA 8330		Nitrobenzene	NELAP	PA	1/19/2005
EPA 8330		Nitroglycerin	NELAP	PA	10/9/2013
EPA 8330		Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	NELAP	PA	1/24/2006
EPA 8330	A	Pentaerythritol tetranitrate (PETN)	NELAP	PA	11/21/2005
EPA 8330		RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	NELAP	PA	1/19/2005
EPA 9012	A	Total cyanide	NELAP	PA	4/18/2013
EPA 9045		pH	NELAP	PA	11/19/2008
EPA 9050		Conductivity	NELAP	PA	1/27/2014
EPA 9050		Conductivity	NELAP	PA	5/17/2005

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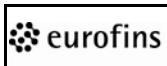
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Laboratory Scope of Accreditation

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DEP Laboratory ID: 36-00037

EPA Lab Code: PA00009

TNI Code:

(717) 656-2300

PADWIS ID: 36037

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 9060		Total organic carbon (TOC)	NELAP	PA	1/19/2005
EPA 9066		Total phenolics	NELAP	PA	4/4/2005
EPA 9071	B	Oil and grease	NELAP	PA	1/19/2005
EPA 9081		Cation exchange capacity of soils (Ammonium acetate)	NELAP	PA	5/25/2005
EPA 9095	A	Paint filter liquids test	NELAP	PA	1/24/2007
EPA Lloyd Kahn Method		Total organic carbon (TOC)	NELAP	PA	10/9/2013
FL-PRO		Total petroleum hydrocarbons (TPH)	NELAP	PA	12/12/2005
MA DEP EPH	1.1	C11-C22 Aromatics	NELAP	PA	7/15/2013
MA DEP EPH	1.1	C19-C36 Aliphatics	NELAP	PA	7/15/2013
MA DEP EPH	1.1	C9-C18 Aliphatics	NELAP	PA	7/15/2013
MA DEP VPH	1.1	C5-C8 Aliphatics	NELAP	PA	7/15/2013
MA DEP VPH	1.1	C9-C10 Aromatics	NELAP	PA	7/15/2013
MA DEP VPH	1.1	C9-C12 Aliphatics	NELAP	PA	7/15/2013
NWTPH-Dx		Diesel-range organics (DRO)	NELAP	PA	12/12/2005
NWTPH-Gx		Gasoline-range organics (GRO)	NELAP	PA	12/12/2005
NWTPH-HCID		GRO/DRO/HRO Screen	NELAP	PA	10/16/2008
SM 2540 G		Residue, total	NELAP	PA	2/25/2014
SM 5310 B		Total organic carbon (TOC)	NELAP	PA	10/9/2013
TX1005 (TNRCC)		Total petroleum hydrocarbons (TPH)	NELAP	PA	12/12/2005
TX1006 (TNRCC)		Total petroleum hydrocarbons (TPH)	NELAP	PA	12/12/2005
WA-EPH		Diesel-range organics (DRO)	NELAP	PA	12/12/2005
WA-VPH		Gasoline-range organics (GRO)	NELAP	PA	12/12/2005
WI-DRO		Diesel-range organics (DRO)	NELAP	PA	12/12/2005
WI-GRO		Gasoline-range organics (GRO)	NELAP	PA	12/12/2005

Aaron Alger

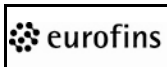
The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.

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Issue Date: 04/23/2014

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 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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STATE OF LOUISIANA
DEPARTMENT OF ENVIRONMENTAL QUALITY
Issue Date: July 1, 2014

Eurofins Lancaster Laboratory Environmental LLC
AI Number: 30729
Expiration Date: June 30, 2015

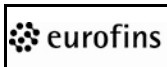
2425 New Holland Pike, Lancaster, Pennsylvania 17601-5994

Certificate Number: 02055

Air Emissions				
Analyte	Method Name	Method Code	Scope	AB
4385 - Bromobenzene	EPA TO-15 (extended)	2368	NELAP	LA
4577 - Chlorodifluoromethane (Freon-22)	EPA TO-15 (extended)	2368	NELAP	LA
4627 - Dichlorodifluoromethane (Freon 21)	EPA TO-15 (extended)	2368	NELAP	LA
4645 - cis-1,2-Dichloroethylene	EPA TO-15 (extended)	2368	NELAP	LA
5027 - n-Octane	EPA TO-15 (extended)	2368	NELAP	LA
5028 - n-Pentane	EPA TO-15 (extended)	2368	NELAP	LA
100170 - Gaseous Organic Compound Emissions	EPA 18	10246636	NELAP	LA
100077 - Gaseous Nonmethane Organic Emissions	EPA Method 25	10246738	NELAP	LA
5105 - 1,1,1,2-Tetrachloroethane	EPA TO-15	10248803	NELAP	LA
5160 - 1,1,1-Trichloroethane	EPA TO-15	10248803	NELAP	LA
5110 - 1,1,2,2-Tetrachloroethane	EPA TO-15	10248803	NELAP	LA
5195 - 1,1,2-Trichloro-1,2,2-trifluoroethane	EPA TO-15	10248803	NELAP	LA
5165 - 1,1,2-Trichloroethane	EPA TO-15	10248803	NELAP	LA
4630 - 1,1-Dichloroethane	EPA TO-15	10248803	NELAP	LA
4640 - 1,1-Dichloroethylene	EPA TO-15	10248803	NELAP	LA
5155 - 1,2,4-Trichlorobenzene	EPA TO-15	10248803	NELAP	LA
5210 - 1,2,4-Trimethylbenzene	EPA TO-15	10248803	NELAP	LA
4570 - 1,2-Dibromo-3-chloropropane (DBCP)	EPA TO-15	10248803	NELAP	LA
4585 - 1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA TO-15	10248803	NELAP	LA
4695 - 1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon-114)	EPA TO-15	10248803	NELAP	LA
4610 - 1,2-Dichlorobenzene	EPA TO-15	10248803	NELAP	LA
4635 - 1,2-Dichloroethane (Ethylene dichloride)	EPA TO-15	10248803	NELAP	LA
4655 - 1,2-Dichloropropane	EPA TO-15	10248803	NELAP	LA
5215 - 1,3,5-Trimethylbenzene	EPA TO-15	10248803	NELAP	LA
9318 - 1,3-Butadiene	EPA TO-15	10248803	NELAP	LA
4615 - 1,3-Dichlorobenzene	EPA TO-15	10248803	NELAP	LA
4620 - 1,4-Dichlorobenzene	EPA TO-15	10248803	NELAP	LA
4735 - 1,4-Dioxane (1,4-Diethyleneoxide)	EPA TO-15	10248803	NELAP	LA
5220 - 2,2,4-Trimethylpentane (Isooctane)	EPA TO-15	10248803	NELAP	LA
4410 - 2-Butanone (Methyl ethyl ketone, MEK)	EPA TO-15	10248803	NELAP	LA
4535 - 2-Chlorotoluene	EPA TO-15	10248803	NELAP	LA
4860 - 2-Hexanone	EPA TO-15	10248803	NELAP	LA
4542 - 4-Ethyltoluene	EPA TO-15	10248803	NELAP	LA
4995 - 4-Methyl-2-pentanone (MIBK)	EPA TO-15	10248803	NELAP	LA
4315 - Acetone	EPA TO-15	10248803	NELAP	LA
4320 - Acetonitrile	EPA TO-15	10248803	NELAP	LA
4325 - Acrolein (Propenal)	EPA TO-15	10248803	NELAP	LA
4340 - Acrylonitrile	EPA TO-15	10248803	NELAP	LA
4355 - Allyl chloride (3-Chloropropene)	EPA TO-15	10248803	NELAP	LA
4375 - Benzene	EPA TO-15	10248803	NELAP	LA
5635 - Benzyl chloride	EPA TO-15	10248803	NELAP	LA
4395 - Bromodichloromethane	EPA TO-15	10248803	NELAP	LA
4400 - Bromoform	EPA TO-15	10248803	NELAP	LA

Clients and Customers are urged to verify the laboratory's current certification status with the Louisiana Environmental Laboratory Accreditation Program.

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 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Air Emissions					
Analyte	Method Name	Method Code	Type	AB	
4450 - Carbon disulfide	EPA TO-15	10248803	NELAP	LA	
4455 - Carbon tetrachloride	EPA TO-15	10248803	NELAP	LA	
4475 - Chlorobenzene	EPA TO-15	10248803	NELAP	LA	
4575 - Chlorodibromomethane	EPA TO-15	10248803	NELAP	LA	
4485 - Chloroethane (Ethyl chloride)	EPA TO-15	10248803	NELAP	LA	
4505 - Chloroform	EPA TO-15	10248803	NELAP	LA	
4555 - Cyclohexane	EPA TO-15	10248803	NELAP	LA	
9375 - Di-isopropylether (DIPE) (Isopropyl ether)	EPA TO-15	10248803	NELAP	LA	
4595 - Dibromomethane (Methylene bromide)	EPA TO-15	10248803	NELAP	LA	
4625 - Dichlorodifluoromethane (Freon-12)	EPA TO-15	10248803	NELAP	LA	
4750 - Ethanol	EPA TO-15	10248803	NELAP	LA	
4755 - Ethyl acetate	EPA TO-15	10248803	NELAP	LA	
4760 - Ethyl acrylate	EPA TO-15	10248803	NELAP	LA	
4810 - Ethyl methacrylate	EPA TO-15	10248803	NELAP	LA	
4770 - Ethyl-t-butyl ether (ETBE) (2-Ethoxy-2-methylpropane)	EPA TO-15	10248803	NELAP	LA	
4765 - Ethylbenzene	EPA TO-15	10248803	NELAP	LA	
4835 - Hexachlorobutadiene	EPA TO-15	10248803	NELAP	LA	
4840 - Hexachloroethane	EPA TO-15	10248803	NELAP	LA	
4870 - Iodomethane (Methyl iodide)	EPA TO-15	10248803	NELAP	LA	
4900 - Isopropylbenzene	EPA TO-15	10248803	NELAP	LA	
4945 - Methyl acrylate	EPA TO-15	10248803	NELAP	LA	
4950 - Methyl bromide (Bromomethane)	EPA TO-15	10248803	NELAP	LA	
4960 - Methyl chloride (Chloromethane)	EPA TO-15	10248803	NELAP	LA	
100201 - Methyl isobutyl ketone (Hexanone)	EPA TO-15	10248803	NELAP	LA	
4990 - Methyl methacrylate	EPA TO-15	10248803	NELAP	LA	
5000 - Methyl tert-butyl ether (MTBE)	EPA TO-15	10248803	NELAP	LA	
4975 - Methylene chloride (Dichloromethane)	EPA TO-15	10248803	NELAP	LA	
5005 - Naphthalene	EPA TO-15	10248803	NELAP	LA	
4836 - Propylene	EPA TO-15	10248803	NELAP	LA	
5100 - Styrene	EPA TO-15	10248803	NELAP	LA	
4370 - T-amylmethylether (TAME)	EPA TO-15	10248803	NELAP	LA	
5115 - Tetrachloroethylene (Perchloroethylene)	EPA TO-15	10248803	NELAP	LA	
5120 - Tetrahydrofuran (THF)	EPA TO-15	10248803	NELAP	LA	
5140 - Toluene	EPA TO-15	10248803	NELAP	LA	
5170 - Trichloroethene (Trichloroethylene)	EPA TO-15	10248803	NELAP	LA	
5175 - Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	EPA TO-15	10248803	NELAP	LA	
5225 - Vinyl acetate	EPA TO-15	10248803	NELAP	LA	
5230 - Vinyl bromide (Bromoethane)	EPA TO-15	10248803	NELAP	LA	
5235 - Vinyl chloride	EPA TO-15	10248803	NELAP	LA	
5260 - Xylene (total)	EPA TO-15	10248803	NELAP	LA	
4705 - cis & trans-1,2-Dichloroethene	EPA TO-15	10248803	NELAP	LA	
4645 - cis-1,2-Dichloroethylene	EPA TO-15	10248803	NELAP	LA	
4680 - cis-1,3-Dichloropropene	EPA TO-15	10248803	NELAP	LA	
5240 - m+p-xylene	EPA TO-15	10248803	NELAP	LA	
5245 - m-Xylene	EPA TO-15	10248803	NELAP	LA	
4435 - n-Butylbenzene	EPA TO-15	10248803	NELAP	LA	
4825 - n-Heptane	EPA TO-15	10248803	NELAP	LA	
4855 - n-Hexane	EPA TO-15	10248803	NELAP	LA	
5090 - n-Propylbenzene	EPA TO-15	10248803	NELAP	LA	

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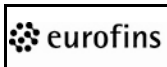
Certificate Number: 02055

AI Number: 30729
Expiration Date: June 30, 2015

Clients and Customers are urged to verify the laboratory's current certification status with the Louisiana Environmental Laboratory Accreditation Program.

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 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Air Emissions

Analyte	Method Name	Method Code	Type	AB
5250 - o-Xylene	EPA TO-15	10248803	NELAP	LA
5255 - p-Xylene	EPA TO-15	10248803	NELAP	LA
4440 - sec-Butylbenzene	EPA TO-15	10248803	NELAP	LA
4420 - tert-Butyl alcohol	EPA TO-15	10248803	NELAP	LA
4445 - tert-Butylbenzene	EPA TO-15	10248803	NELAP	LA
4700 - trans-1,2-Dichloroethylene	EPA TO-15	10248803	NELAP	LA
4685 - trans-1,3-Dichloropropylene	EPA TO-15	10248803	NELAP	LA
5105 - 1,1,1,2-Tetrachloroethane	EPA TO-14A, Rev.2	10312002	NELAP	LA
5160 - 1,1,1-Trichloroethane	EPA TO-14A, Rev.2	10312002	NELAP	LA
5110 - 1,1,2,2-Tetrachloroethane	EPA TO-14A, Rev.2	10312002	NELAP	LA
5195 - 1,1,2-Trichloro-1,2,2-trifluoroethane	EPA TO-14A, Rev.2	10312002	NELAP	LA
5165 - 1,1,2-Trichloroethane	EPA TO-14A, Rev.2	10312002	NELAP	LA
4630 - 1,1-Dichloroethane	EPA TO-14A, Rev.2	10312002	NELAP	LA
4640 - 1,1-Dichloroethylene	EPA TO-14A, Rev.2	10312002	NELAP	LA
5180 - 1,2,3-Trichloropropane	EPA TO-14A, Rev.2	10312002	NELAP	LA
5155 - 1,2,4-Trichlorobenzene	EPA TO-14A, Rev.2	10312002	NELAP	LA
5210 - 1,2,4-Trimethylbenzene	EPA TO-14A, Rev.2	10312002	NELAP	LA
4585 - 1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA TO-14A, Rev.2	10312002	NELAP	LA
4695 - 1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon-114)	EPA TO-14A, Rev.2	10312002	NELAP	LA
4610 - 1,2-Dichlorobenzene	EPA TO-14A, Rev.2	10312002	NELAP	LA
4635 - 1,2-Dichloroethane (Ethylene dichloride)	EPA TO-14A, Rev.2	10312002	NELAP	LA
4655 - 1,2-Dichloropropane	EPA TO-14A, Rev.2	10312002	NELAP	LA
5215 - 1,3,5-Trimethylbenzene	EPA TO-14A, Rev.2	10312002	NELAP	LA
4615 - 1,3-Dichlorobenzene	EPA TO-14A, Rev.2	10312002	NELAP	LA
4835 - 1,3-Hexachlorobutadiene	EPA TO-14A, Rev.2	10312002	NELAP	LA
4620 - 1,4-Dichlorobenzene	EPA TO-14A, Rev.2	10312002	NELAP	LA
4735 - 1,4-Dioxane (1,4-Diethyleneoxide)	EPA TO-14A, Rev.2	10312002	NELAP	LA
5220 - 2,2,4-Trimethylpentane (Isooctane)	EPA TO-14A, Rev.2	10312002	NELAP	LA
4410 - 2-Butanone (Methyl ethyl ketone, MEK)	EPA TO-14A, Rev.2	10312002	NELAP	LA
4860 - 2-Hexanone	EPA TO-14A, Rev.2	10312002	NELAP	LA
4542 - 4-Ethyltoluene	EPA TO-14A, Rev.2	10312002	NELAP	LA
4995 - 4-Methyl-2-pentanone (MIBK)	EPA TO-14A, Rev.2	10312002	NELAP	LA
4315 - Acetone	EPA TO-14A, Rev.2	10312002	NELAP	LA
4375 - Benzene	EPA TO-14A, Rev.2	10312002	NELAP	LA
5635 - Benzyl chloride	EPA TO-14A, Rev.2	10312002	NELAP	LA
4385 - Bromobenzene	EPA TO-14A, Rev.2	10312002	NELAP	LA
4395 - Bromodichloromethane	EPA TO-14A, Rev.2	10312002	NELAP	LA
4400 - Bromoform	EPA TO-14A, Rev.2	10312002	NELAP	LA
4450 - Carbon disulfide	EPA TO-14A, Rev.2	10312002	NELAP	LA
4455 - Carbon tetrachloride	EPA TO-14A, Rev.2	10312002	NELAP	LA
4475 - Chlorobenzene	EPA TO-14A, Rev.2	10312002	NELAP	LA
4485 - Chloroethane (Ethyl chloride)	EPA TO-14A, Rev.2	10312002	NELAP	LA
4505 - Chloroform	EPA TO-14A, Rev.2	10312002	NELAP	LA
4555 - Cyclohexane	EPA TO-14A, Rev.2	10312002	NELAP	LA
4625 - Dichlorodifluoromethane (Freon-12)	EPA TO-14A, Rev.2	10312002	NELAP	LA
4755 - Ethyl acetate	EPA TO-14A, Rev.2	10312002	NELAP	LA
4765 - Ethylbenzene	EPA TO-14A, Rev.2	10312002	NELAP	LA
4835 - Hexachlorobutadiene	EPA TO-14A, Rev.2	10312002	NELAP	LA
4950 - Methyl bromide (Bromomethane)	EPA TO-14A, Rev.2	10312002	NELAP	LA
4960 - Methyl chloride (Chloromethane)	EPA TO-14A, Rev.2	10312002	NELAP	LA
4990 - Methyl methacrylate	EPA TO-14A, Rev.2	10312002	NELAP	LA
5000 - Methyl tert-butyl ether (MTBE)	EPA TO-14A, Rev.2	10312002	NELAP	LA

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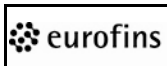
Certificate Number: 02055

AI Number: 30729
Expiration Date: June 30, 2015

Clients and Customers are urged to verify the laboratory's current certification status with the Louisiana Environmental Laboratory Accreditation Program.

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 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Air Emissions					
Analyte	Method Name	Method Code	Type	AB	
4975 - Methylene chloride (Dichloromethane)	EPA TO-14A, Rev.2	10312002	NELAP	LA	
5100 - Styrene	EPA TO-14A, Rev.2	10312002	NELAP	LA	
5115 - Tetrachloroethylene (Perchloroethylene)	EPA TO-14A, Rev.2	10312002	NELAP	LA	
5140 - Toluene	EPA TO-14A, Rev.2	10312002	NELAP	LA	
5170 - Trichloroethene (Trichloroethylene)	EPA TO-14A, Rev.2	10312002	NELAP	LA	
5175 - Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	EPA TO-14A, Rev.2	10312002	NELAP	LA	
5225 - Vinyl acetate	EPA TO-14A, Rev.2	10312002	NELAP	LA	
5235 - Vinyl chloride	EPA TO-14A, Rev.2	10312002	NELAP	LA	
5260 - Xylene (total)	EPA TO-14A, Rev.2	10312002	NELAP	LA	
4645 - cis-1,2-Dichloroethylene	EPA TO-14A, Rev.2	10312002	NELAP	LA	
4680 - cis-1,3-Dichloropropene	EPA TO-14A, Rev.2	10312002	NELAP	LA	
5240 - m+p-xylene	EPA TO-14A, Rev.2	10312002	NELAP	LA	
5027 - n-Octane	EPA TO-14A, Rev.2	10312002	NELAP	LA	
5028 - n-Pentane	EPA TO-14A, Rev.2	10312002	NELAP	LA	
5090 - n-Propylbenzene	EPA TO-14A, Rev.2	10312002	NELAP	LA	
5250 - o-Xylene	EPA TO-14A, Rev.2	10312002	NELAP	LA	
4700 - trans-1,2-Dichloroethylene	EPA TO-14A, Rev.2	10312002	NELAP	LA	
4685 - trans-1,3-Dichloropropylene	EPA TO-14A, Rev.2	10312002	NELAP	LA	

Non Potable Water					
Analyte	Method Name	Method Code	Type	AB	
1605 - Color	EPA 110.2	10005400	NELAP	PA	
1755 - Total hardness as CaCO ₃	EPA 120.1	10006209	NELAP	PA	
1610 - Conductivity	EPA 120.1	10006403	NELAP	PA	
1750 - Hardness	EPA 130.2	10007202	NELAP	PA	
1755 - Total hardness as CaCO ₃	EPA 130.2	10007202	NELAP	PA	
1900 - pH	EPA 150.1	10008205	NELAP	PA	
1955 - Residue-filterable (TDS)	EPA 160.1	10009004	NELAP	PA	
1955 - Residue-filterable (TDS)	EPA 160.1	10009208	NELAP	PA	
1960 - Residue-nonfilterable (TSS)	EPA 160.2	10009402	NELAP	PA	
1950 - Residue-total	EPA 160.3	10009800	NELAP	PA	
1970 - Residue-volatile	EPA 160.4	10010205	NELAP	PA	
2030 - Temperature, deg. C	EPA 170.1	10011004	NELAP	PA	
2055 - Turbidity	EPA 180.1	10011402	NELAP	PA	
2055 - Turbidity	EPA 180.1, Rev.2	10011800	NELAP	PA	
1015 - Barium	EPA 200.7	10013408	NELAP	PA	
1000 - Aluminum	EPA 200.7, Rev.4.4	10013806	NELAP	PA	
1005 - Antimony	EPA 200.7, Rev.4.4	10013806	NELAP	PA	
1010 - Arsenic	EPA 200.7, Rev.4.4	10013806	NELAP	PA	
1015 - Barium	EPA 200.7, Rev.4.4	10013806	NELAP	PA	
1020 - Beryllium	EPA 200.7, Rev.4.4	10013806	NELAP	PA	
1025 - Boron	EPA 200.7, Rev.4.4	10013806	NELAP	PA	
1030 - Cadmium	EPA 200.7, Rev.4.4	10013806	NELAP	PA	
1035 - Calcium	EPA 200.7, Rev.4.4	10013806	NELAP	PA	
1040 - Chromium	EPA 200.7, Rev.4.4	10013806	NELAP	PA	
1050 - Cobalt	EPA 200.7, Rev.4.4	10013806	NELAP	PA	
1055 - Copper	EPA 200.7, Rev.4.4	10013806	NELAP	PA	
1070 - Iron	EPA 200.7, Rev.4.4	10013806	NELAP	PA	
1075 - Lead	EPA 200.7, Rev.4.4	10013806	NELAP	PA	
1085 - Magnesium	EPA 200.7, Rev.4.4	10013806	NELAP	PA	
1090 - Manganese	EPA 200.7, Rev.4.4	10013806	NELAP	PA	

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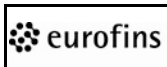
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 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Non Potable Water					
Analyte	Method Name	Method Code	Type	AB	
1100 - Molybdenum	EPA 200.7, Rev.4.4	10013806	NELAP	PA	
1105 - Nickel	EPA 200.7, Rev.4.4	10013806	NELAP	PA	
1125 - Potassium	EPA 200.7, Rev.4.4	10013806	NELAP	PA	
1140 - Selenium	EPA 200.7, Rev.4.4	10013806	NELAP	PA	
1150 - Silver	EPA 200.7, Rev.4.4	10013806	NELAP	PA	
1155 - Sodium	EPA 200.7, Rev.4.4	10013806	NELAP	PA	
1160 - Strontium	EPA 200.7, Rev.4.4	10013806	NELAP	PA	
1165 - Thallium	EPA 200.7, Rev.4.4	10013806	NELAP	PA	
1175 - Tin	EPA 200.7, Rev.4.4	10013806	NELAP	PA	
1180 - Titanium	EPA 200.7, Rev.4.4	10013806	NELAP	PA	
1185 - Vanadium	EPA 200.7, Rev.4.4	10013806	NELAP	PA	
1190 - Zinc	EPA 200.7, Rev.4.4	10013806	NELAP	PA	
1000 - Aluminum	EPA 200.7	10014207	NELAP	PA	
1005 - Antimony	EPA 200.7	10014207	NELAP	PA	
1010 - Arsenic	EPA 200.7	10014207	NELAP	PA	
1015 - Barium	EPA 200.7	10014207	NELAP	PA	
1020 - Beryllium	EPA 200.7	10014207	NELAP	PA	
1025 - Boron	EPA 200.7	10014207	NELAP	PA	
1030 - Cadmium	EPA 200.7	10014207	NELAP	PA	
1035 - Calcium	EPA 200.7	10014207	NELAP	PA	
1040 - Chromium	EPA 200.7	10014207	NELAP	PA	
1050 - Cobalt	EPA 200.7	10014207	NELAP	PA	
1055 - Copper	EPA 200.7	10014207	NELAP	PA	
1070 - Iron	EPA 200.7	10014207	NELAP	PA	
1075 - Lead	EPA 200.7	10014207	NELAP	PA	
1085 - Magnesium	EPA 200.7	10014207	NELAP	PA	
1090 - Manganese	EPA 200.7	10014207	NELAP	PA	
1100 - Molybdenum	EPA 200.7	10014207	NELAP	PA	
1105 - Nickel	EPA 200.7	10014207	NELAP	PA	
1125 - Potassium	EPA 200.7	10014207	NELAP	PA	
1140 - Selenium	EPA 200.7	10014207	NELAP	PA	
1150 - Silver	EPA 200.7	10014207	NELAP	PA	
1155 - Sodium	EPA 200.7	10014207	NELAP	PA	
1165 - Thallium	EPA 200.7	10014207	NELAP	PA	
1175 - Tin	EPA 200.7	10014207	NELAP	PA	
1185 - Vanadium	EPA 200.7	10014207	NELAP	PA	
1190 - Zinc	EPA 200.7	10014207	NELAP	PA	
1000 - Aluminum	EPA 200.8, Rev.5.4	10014605	NELAP	PA	
1005 - Antimony	EPA 200.8, Rev.5.4	10014605	NELAP	PA	
1010 - Arsenic	EPA 200.8, Rev.5.4	10014605	NELAP	PA	
1015 - Barium	EPA 200.8, Rev.5.4	10014605	NELAP	PA	
1020 - Beryllium	EPA 200.8, Rev.5.4	10014605	NELAP	PA	
1025 - Boron	EPA 200.8, Rev.5.4	10014605	NELAP	PA	
1030 - Cadmium	EPA 200.8, Rev.5.4	10014605	NELAP	PA	
1035 - Calcium	EPA 200.8, Rev.5.4	10014605	NELAP	PA	
1040 - Chromium	EPA 200.8, Rev.5.4	10014605	NELAP	PA	
1050 - Cobalt	EPA 200.8, Rev.5.4	10014605	NELAP	PA	
1055 - Copper	EPA 200.8, Rev.5.4	10014605	NELAP	PA	
1070 - Iron	EPA 200.8, Rev.5.4	10014605	NELAP	PA	
1075 - Lead	EPA 200.8, Rev.5.4	10014605	NELAP	PA	
1085 - Magnesium	EPA 200.8, Rev.5.4	10014605	NELAP	PA	
1090 - Manganese	EPA 200.8, Rev.5.4	10014605	NELAP	PA	
1100 - Molybdenum	EPA 200.8, Rev.5.4	10014605	NELAP	PA	
1105 - Nickel	EPA 200.8, Rev.5.4	10014605	NELAP	PA	
1125 - Potassium	EPA 200.8, Rev.5.4	10014605	NELAP	PA	
1140 - Selenium	EPA 200.8, Rev.5.4	10014605	NELAP	PA	

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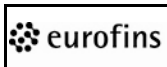
Certificate Number: 02055

AI Number: 30729
Expiration Date: June 30, 2015

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 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Non Potable Water					
Analyte	Method Name	Method Code	Type	AB	
1150 - Silver	EPA 200.8, Rev.5.4	10014605	NELAP	PA	
1155 - Sodium	EPA 200.8, Rev.5.4	10014605	NELAP	PA	
1160 - Strontium	EPA 200.8, Rev.5.4	10014605	NELAP	PA	
1165 - Thallium	EPA 200.8, Rev.5.4	10014605	NELAP	PA	
1175 - Tin	EPA 200.8, Rev.5.4	10014605	NELAP	PA	
1180 - Titanium	EPA 200.8, Rev.5.4	10014605	NELAP	PA	
1185 - Vanadium	EPA 200.8, Rev.5.4	10014605	NELAP	PA	
1190 - Zinc	EPA 200.8, Rev.5.4	10014605	NELAP	PA	
1045 - Chromium VI	EPA 218.6	10027802	NELAP	PA	
1045 - Chromium VI	EPA 218.6, Rev.3.3	10028009	NELAP	PA	
1095 - Mercury	EPA 245.1, Rev.3	10036609	NELAP	PA	
1540 - Bromide	EPA 300.0	10053006	NELAP	PA	
1730 - Fluoride	EPA 300.0	10053006	NELAP	PA	
1810 - Nitrate as N	EPA 300.0	10053006	NELAP	PA	
1540 - Bromide	EPA 300.0, Rev.2.1	10053200	NELAP	PA	
1575 - Chloride	EPA 300.0, Rev.2.1	10053200	NELAP	PA	
1730 - Fluoride	EPA 300.0, Rev.2.1	10053200	NELAP	PA	
1810 - Nitrate as N	EPA 300.0, Rev.2.1	10053200	NELAP	PA	
1835 - Nitrite	EPA 300.0, Rev.2.1	10053200	NELAP	PA	
1840 - Nitrite as N	EPA 300.0, Rev.2.1	10053200	NELAP	PA	
2000 - Sulfate	EPA 300.0, Rev.2.1	10053200	NELAP	PA	
1505 - Alkalinity as CaCO3	EPA 310.1	10054601	NELAP	PA	
1895 - Perchlorate	EPA 314, Rev.1	10055604	NELAP	PA	
1575 - Chloride	EPA 325.3	10057406	NELAP	PA	
1645 - Total Cyanide	EPA 335.4	10061402	NELAP	PA	
1515 - Ammonia as N	EPA 350.2	10063806	NELAP	PA	
1515 - Ammonia as N	EPA 350.3	10064207	NELAP	PA	
1795 - Kjeldahl nitrogen - total	EPA 351.2	10065006	NELAP	PA	
1795 - Kjeldahl nitrogen - total	EPA 351.2, Rev.2	10065404	NELAP	PA	
1840 - Nitrite as N	EPA 353.2	10067206	NELAP	PA	
1825 - Total Nitrate+Nitrite	EPA 353.2	10067206	NELAP	PA	
1810 - Nitrate as N	EPA 353.2, Rev.2	10067604	NELAP	PA	
1820 - Nitrate-Nitrite	EPA 353.2, Rev.2	10067604	NELAP	PA	
1840 - Nitrite as N	EPA 353.2, Rev.2	10067604	NELAP	PA	
1880 - Oxygen, dissolved	EPA 360.1	10069008	NELAP	PA	
1910 - Total Phosphorus	EPA 365.1, Rev.2	10070005	NELAP	PA	
1870 - Orthophosphate as P	EPA 365.3	10070607	NELAP	PA	
2005 - Sulfide	EPA 376.2	10074405	NELAP	PA	
1555 - Carbonaceous BOD, CBOD	EPA 405.1	10075408	NELAP	PA	
1565 - Chemical oxygen demand	EPA 410.4, Rev.2	10077404	NELAP	PA	
1905 - Total Phenolics	EPA 420.4, Rev.1	10080203	NELAP	PA	
2025 - Surfactants - MBAS	EPA 425.1	10080601	NELAP	PA	
4375 - Benzene	EPA 602	10102202	NELAP	PA	
4765 - Ethylbenzene	EPA 602	10102202	NELAP	PA	
5000 - Methyl tert-butyl ether (MTBE)	EPA 602	10102202	NELAP	PA	
5005 - Naphthalene	EPA 602	10102202	NELAP	PA	
5100 - Styrene	EPA 602	10102202	NELAP	PA	
5140 - Toluene	EPA 602	10102202	NELAP	PA	
5260 - Xylene (total)	EPA 602	10102202	NELAP	PA	
5250 - o-Xylene	EPA 602	10102202	NELAP	PA	
5255 - p-Xylene	EPA 602	10102202	NELAP	PA	
7355 - 4,4'-DDD	EPA 608	10103603	NELAP	PA	
7360 - 4,4'-DDE	EPA 608	10103603	NELAP	PA	
7365 - 4,4'-DDT	EPA 608	10103603	NELAP	PA	
7025 - Aldrin	EPA 608	10103603	NELAP	PA	
8880 - Aroclor-1016 (PCB-1016)	EPA 608	10103603	NELAP	PA	

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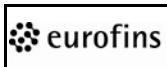
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 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Non Potable Water

Analyte	Method Name	Method Code	Type	AB
8885 - Aroclor-1221 (PCB-1221)	EPA 608	10103603	NELAP	PA
8890 - Aroclor-1232 (PCB-1232)	EPA 608	10103603	NELAP	PA
8895 - Aroclor-1242 (PCB-1242)	EPA 608	10103603	NELAP	PA
8900 - Aroclor-1248 (PCB-1248)	EPA 608	10103603	NELAP	PA
8905 - Aroclor-1254 (PCB-1254)	EPA 608	10103603	NELAP	PA
8910 - Aroclor-1260 (PCB-1260)	EPA 608	10103603	NELAP	PA
7250 - Chlordane (tech.)	EPA 608	10103603	NELAP	PA
7470 - Dieldrin	EPA 608	10103603	NELAP	PA
7510 - Endosulfan I	EPA 608	10103603	NELAP	PA
7515 - Endosulfan II	EPA 608	10103603	NELAP	PA
7520 - Endosulfan sulfate	EPA 608	10103603	NELAP	PA
7540 - Endrin	EPA 608	10103603	NELAP	PA
7530 - Endrin aldehyde	EPA 608	10103603	NELAP	PA
7685 - Heptachlor	EPA 608	10103603	NELAP	PA
7690 - Heptachlor epoxide	EPA 608	10103603	NELAP	PA
8250 - Toxaphene (Chlorinated camphene)	EPA 608	10103603	NELAP	PA
7110 - alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 608	10103603	NELAP	PA
7115 - beta-BHC (beta-Hexachlorocyclohexane)	EPA 608	10103603	NELAP	PA
7120 - gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 608	10103603	NELAP	PA
5160 - 1,1,1-Trichloroethane	EPA 624	10107207	NELAP	PA
5110 - 1,1,2,2-Tetrachloroethane	EPA 624	10107207	NELAP	PA
5165 - 1,1,2-Trichloroethane	EPA 624	10107207	NELAP	PA
4630 - 1,1-Dichloroethane	EPA 624	10107207	NELAP	PA
4640 - 1,1-Dichloroethylene	EPA 624	10107207	NELAP	PA
4610 - 1,2-Dichlorobenzene	EPA 624	10107207	NELAP	PA
4635 - 1,2-Dichloroethane (Ethylene dichloride)	EPA 624	10107207	NELAP	PA
4655 - 1,2-Dichloropropane	EPA 624	10107207	NELAP	PA
4615 - 1,3-Dichlorobenzene	EPA 624	10107207	NELAP	PA
4620 - 1,4-Dichlorobenzene	EPA 624	10107207	NELAP	PA
4500 - 2-Chloroethyl vinyl ether	EPA 624	10107207	NELAP	PA
4325 - Acrolein (Propenal)	EPA 624	10107207	NELAP	PA
4340 - Acrylonitrile	EPA 624	10107207	NELAP	PA
4375 - Benzene	EPA 624	10107207	NELAP	PA
4395 - Bromodichloromethane	EPA 624	10107207	NELAP	PA
4400 - Bromoform	EPA 624	10107207	NELAP	PA
4455 - Carbon tetrachloride	EPA 624	10107207	NELAP	PA
4475 - Chlorobenzene	EPA 624	10107207	NELAP	PA
4485 - Chloroethane (Ethyl chloride)	EPA 624	10107207	NELAP	PA
4505 - Chloroform	EPA 624	10107207	NELAP	PA
4595 - Dibromomethane (Methylene bromide)	EPA 624	10107207	NELAP	PA
4765 - Ethylbenzene	EPA 624	10107207	NELAP	PA
4950 - Methyl bromide (Bromomethane)	EPA 624	10107207	NELAP	PA
4960 - Methyl chloride (Chloromethane)	EPA 624	10107207	NELAP	PA
4975 - Methylene chloride (Dichloromethane)	EPA 624	10107207	NELAP	PA
5115 - Tetrachloroethylene (Perchloroethylene)	EPA 624	10107207	NELAP	PA
5140 - Toluene	EPA 624	10107207	NELAP	PA
5170 - Trichloroethene (Trichloroethylene)	EPA 624	10107207	NELAP	PA
5175 - Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	EPA 624	10107207	NELAP	PA

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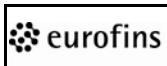
Certificate Number: 02055

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 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Non Potable Water

Analyte	Method Name	Method Code	Type	AB
5235 - Vinyl chloride	EPA 624	10107207	NELAP	PA
5260 - Xylene (total)	EPA 624	10107207	NELAP	PA
4680 - cis-1,3-Dichloropropene	EPA 624	10107207	NELAP	PA
4700 - trans-1,2-Dichloroethylene	EPA 624	10107207	NELAP	PA
4685 - trans-1,3-Dichloropropylene	EPA 624	10107207	NELAP	PA
6715 - 1,2,4,5-Tetrachlorobenzene	EPA 625	10107401	NELAP	PA
5155 - 1,2,4-Trichlorobenzene	EPA 625	10107401	NELAP	PA
4610 - 1,2-Dichlorobenzene	EPA 625	10107401	NELAP	PA
6220 - 1,2-Diphenylhydrazine	EPA 625	10107401	NELAP	PA
4615 - 1,3-Dichlorobenzene	EPA 625	10107401	NELAP	PA
4620 - 1,4-Dichlorobenzene	EPA 625	10107401	NELAP	PA
6380 - 1-Methylnaphthalene	EPA 625	10107401	NELAP	PA
6735 - 2,3,4,6-Tetrachlorophenol	EPA 625	10107401	NELAP	PA
9363 - 2,3-Dichloroaniline	EPA 625	10107401	NELAP	PA
6835 - 2,4,5-Trichlorophenol	EPA 625	10107401	NELAP	PA
6840 - 2,4,6-Trichlorophenol	EPA 625	10107401	NELAP	PA
6000 - 2,4-Dichlorophenol	EPA 625	10107401	NELAP	PA
6130 - 2,4-Dimethylphenol	EPA 625	10107401	NELAP	PA
6175 - 2,4-Dinitrophenol	EPA 625	10107401	NELAP	PA
6185 - 2,4-Dinitrotoluene (2,4-DNT)	EPA 625	10107401	NELAP	PA
6005 - 2,6-Dichlorophenol	EPA 625	10107401	NELAP	PA
6190 - 2,6-Dinitrotoluene (2,6-DNT)	EPA 625	10107401	NELAP	PA
5795 - 2-Chloronaphthalene	EPA 625	10107401	NELAP	PA
5800 - 2-Chlorophenol	EPA 625	10107401	NELAP	PA
6360 - 2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	EPA 625	10107401	NELAP	PA
6400 - 2-Methylphenol (o-Cresol)	EPA 625	10107401	NELAP	PA
6460 - 2-Nitroaniline	EPA 625	10107401	NELAP	PA
6490 - 2-Nitrophenol	EPA 625	10107401	NELAP	PA
5945 - 3,3'-Dichlorobenzidine	EPA 625	10107401	NELAP	PA
6405 - 3-Methylphenol (m-Cresol)	EPA 625	10107401	NELAP	PA
6465 - 3-Nitroaniline	EPA 625	10107401	NELAP	PA
5660 - 4-Bromophenyl phenyl ether	EPA 625	10107401	NELAP	PA
5700 - 4-Chloro-3-methylphenol	EPA 625	10107401	NELAP	PA
5745 - 4-Chloroaniline	EPA 625	10107401	NELAP	PA
5825 - 4-Chlorophenyl phenylether	EPA 625	10107401	NELAP	PA
6410 - 4-Methylphenol (p-Cresol)	EPA 625	10107401	NELAP	PA
6470 - 4-Nitroaniline	EPA 625	10107401	NELAP	PA
6500 - 4-Nitrophenol	EPA 625	10107401	NELAP	PA
5500 - Acenaphthene	EPA 625	10107401	NELAP	PA
5505 - Acenaphthylene	EPA 625	10107401	NELAP	PA
5510 - Acetophenone	EPA 625	10107401	NELAP	PA
5545 - Aniline	EPA 625	10107401	NELAP	PA
5555 - Anthracene	EPA 625	10107401	NELAP	PA
5595 - Benzidine	EPA 625	10107401	NELAP	PA
5575 - Benzo(a)anthracene	EPA 625	10107401	NELAP	PA
5580 - Benzo(a)pyrene	EPA 625	10107401	NELAP	PA
5585 - Benzo(b)fluoranthene	EPA 625	10107401	NELAP	PA
5590 - Benzo(g,h,i)perylene	EPA 625	10107401	NELAP	PA
5600 - Benzo(k)fluoranthene	EPA 625	10107401	NELAP	PA
5610 - Benzoic acid	EPA 625	10107401	NELAP	PA
5630 - Benzyl alcohol	EPA 625	10107401	NELAP	PA
5670 - Butyl benzyl phthalate	EPA 625	10107401	NELAP	PA
5680 - Carbazole	EPA 625	10107401	NELAP	PA
5855 - Chrysene	EPA 625	10107401	NELAP	PA
6065 - Di(2-ethylhexyl) phthalate (bis(2-	EPA 625	10107401	NELAP	LA

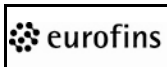
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Non Potable Water

Analyte	Method Name	Method Code	Type	AB
Ethylhexyl)phthalate, DEHP)				
5925 - Di-n-butyl phthalate	EPA 625	10107401	NELAP	PA
6200 - Di-n-octyl phthalate	EPA 625	10107401	NELAP	PA
5895 - Dibenz(a,h) anthracene	EPA 625	10107401	NELAP	PA
5905 - Dibenzofuran	EPA 625	10107401	NELAP	PA
6070 - Diethyl phthalate	EPA 625	10107401	NELAP	PA
6135 - Dimethyl phthalate	EPA 625	10107401	NELAP	PA
6265 - Fluoranthene	EPA 625	10107401	NELAP	PA
6270 - Fluorene	EPA 625	10107401	NELAP	PA
6275 - Hexachlorobenzene	EPA 625	10107401	NELAP	PA
4835 - Hexachlorobutadiene	EPA 625	10107401	NELAP	PA
6285 - Hexachlorocyclopentadiene	EPA 625	10107401	NELAP	PA
4840 - Hexachloroethane	EPA 625	10107401	NELAP	PA
6315 - Indeno(1,2,3-cd) pyrene	EPA 625	10107401	NELAP	PA
6320 - Isophorone	EPA 625	10107401	NELAP	PA
5005 - Naphthalene	EPA 625	10107401	NELAP	PA
5015 - Nitrobenzene	EPA 625	10107401	NELAP	PA
6590 - Pentachlorobenzene	EPA 625	10107401	NELAP	PA
6605 - Pentachlorophenol	EPA 625	10107401	NELAP	PA
6615 - Phenanthrene	EPA 625	10107401	NELAP	PA
6625 - Phenol	EPA 625	10107401	NELAP	PA
6665 - Pyrene	EPA 625	10107401	NELAP	PA
5095 - Pyridine	EPA 625	10107401	NELAP	PA
5760 - bis(2-Chloroethoxy)methane	EPA 625	10107401	NELAP	PA
5765 - bis(2-Chloroethyl) ether	EPA 625	10107401	NELAP	PA
5780 - bis(2-Chloroisopropyl) ether	EPA 625	10107401	NELAP	PA
6062 - bis(2-Ethylhexyl)adipate	EPA 625	10107401	NELAP	PA
6545 - n-Nitrosodi-n-propylamine	EPA 625	10107401	NELAP	PA
6530 - n-Nitrosodimethylamine	EPA 625	10107401	NELAP	PA
6535 - n-Nitrosodiphenylamine	EPA 625	10107401	NELAP	PA
6565 - n-Nitrosopyrrolidine	EPA 625	10107401	NELAP	PA
6580 - n-Octadecane	EPA 625	10107401	NELAP	PA
9519 - 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	EPA 1613B	10120602	NELAP	PA
9516 - 1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	EPA 1613B	10120602	NELAP	PA
9426 - 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	EPA 1613B	10120602	NELAP	PA
9420 - 1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	EPA 1613B	10120602	NELAP	PA
9423 - 1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	EPA 1613B	10120602	NELAP	PA
9453 - 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)	EPA 1613B	10120602	NELAP	PA
9471 - 1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)	EPA 1613B	10120602	NELAP	PA
9456 - 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin(1,2,3,6,7,8-Hxcdd)	EPA 1613B	10120602	NELAP	PA
9474 - 1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)	EPA 1613B	10120602	NELAP	PA
9459 - 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)	EPA 1613B	10120602	NELAP	PA
9477 - 1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)	EPA 1613B	10120602	NELAP	PA

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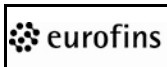
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Non Potable Water

Analyte	Method Name	Method Code	Type	AB
9540 - 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)	EPA 1613B	10120602	NELAP	PA
9543 - 1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)	EPA 1613B	10120602	NELAP	PA
9480 - 2,3,4,6,7,8-Hexachlorodibenzofuran	EPA 1613B	10120602	NELAP	PA
9549 - 2,3,4,7,8-Pentachlorodibenzofuran	EPA 1613B	10120602	NELAP	PA
9612 - 2,3,7,8-Tetrachlorodibenzofuran	EPA 1613B	10120602	NELAP	PA
9438 - Total Hpcdd	EPA 1613B	10120602	NELAP	PA
9444 - Total Hpcdf	EPA 1613B	10120602	NELAP	PA
9468 - Total Hxcdd	EPA 1613B	10120602	NELAP	PA
9483 - Total Hxcdf	EPA 1613B	10120602	NELAP	PA
9555 - Total Pecdd	EPA 1613B	10120602	NELAP	PA
9552 - Total Pecdf	EPA 1613B	10120602	NELAP	PA
9609 - Total TCDD	EPA 1613B	10120602	NELAP	PA
9615 - Total TCDF	EPA 1613B	10120602	NELAP	PA
1860 - Oil & Grease	EPA 1664A	10127409	NELAP	PA
1860 - Oil & Grease	EPA 1664A (HEM)	10127807	NELAP	PA
2050 - Total Petroleum Hydrocarbons (TPH)	EPA 1664A (HEM)	10127807	NELAP	PA
100003 - Acid Digestion of waters for Total Recoverable or Dissolved Metals	EPA 3005A	10133207	NELAP	PA
100004 - Acid Digestion of Aqueous samples and Extracts for Total Metals	EPA 3010A	10133605	NELAP	PA
100642 - Acid Digestion of Aqueous samples and Extracts for Total Metals (HNO3 only)	EPA 3020A	10134404	NELAP	PA
1444 - Separatory Funnel Liquid-liquid extraction	EPA 3510C	10138202	NELAP	PA
1000 - Aluminum	EPA 6010B	10155609	NELAP	PA
1005 - Antimony	EPA 6010B	10155609	NELAP	PA
1010 - Arsenic	EPA 6010B	10155609	NELAP	PA
1015 - Barium	EPA 6010B	10155609	NELAP	PA
1020 - Beryllium	EPA 6010B	10155609	NELAP	PA
1025 - Boron	EPA 6010B	10155609	NELAP	PA
1030 - Cadmium	EPA 6010B	10155609	NELAP	PA
1035 - Calcium	EPA 6010B	10155609	NELAP	PA
1040 - Chromium	EPA 6010B	10155609	NELAP	PA
1050 - Cobalt	EPA 6010B	10155609	NELAP	PA
1055 - Copper	EPA 6010B	10155609	NELAP	PA
1070 - Iron	EPA 6010B	10155609	NELAP	PA
1075 - Lead	EPA 6010B	10155609	NELAP	PA
1080 - Lithium	EPA 6010B	10155609	NELAP	PA
1085 - Magnesium	EPA 6010B	10155609	NELAP	PA
1090 - Manganese	EPA 6010B	10155609	NELAP	PA
1100 - Molybdenum	EPA 6010B	10155609	NELAP	PA
1105 - Nickel	EPA 6010B	10155609	NELAP	PA
1125 - Potassium	EPA 6010B	10155609	NELAP	PA
1140 - Selenium	EPA 6010B	10155609	NELAP	PA
1150 - Silver	EPA 6010B	10155609	NELAP	PA
1155 - Sodium	EPA 6010B	10155609	NELAP	PA
1160 - Strontium	EPA 6010B	10155609	NELAP	PA
1165 - Thallium	EPA 6010B	10155609	NELAP	PA
1175 - Tin	EPA 6010B	10155609	NELAP	PA
1180 - Titanium	EPA 6010B	10155609	NELAP	PA
1185 - Vanadium	EPA 6010B	10155609	NELAP	PA
1190 - Zinc	EPA 6010B	10155609	NELAP	PA

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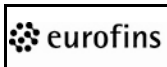
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Non Potable Water					
Analyte	Method Name	Method Code	Type	AB	
1000 - Aluminum	EPA 6010C	10155803	NELAP	PA	
1005 - Antimony	EPA 6010C	10155803	NELAP	PA	
1010 - Arsenic	EPA 6010C	10155803	NELAP	PA	
1015 - Barium	EPA 6010C	10155803	NELAP	PA	
1020 - Beryllium	EPA 6010C	10155803	NELAP	PA	
1025 - Boron	EPA 6010C	10155803	NELAP	PA	
1030 - Cadmium	EPA 6010C	10155803	NELAP	PA	
1035 - Calcium	EPA 6010C	10155803	NELAP	PA	
1040 - Chromium	EPA 6010C	10155803	NELAP	PA	
1050 - Cobalt	EPA 6010C	10155803	NELAP	PA	
1055 - Copper	EPA 6010C	10155803	NELAP	PA	
1070 - Iron	EPA 6010C	10155803	NELAP	PA	
1075 - Lead	EPA 6010C	10155803	NELAP	PA	
1080 - Lithium	EPA 6010C	10155803	NELAP	PA	
1085 - Magnesium	EPA 6010C	10155803	NELAP	PA	
1090 - Manganese	EPA 6010C	10155803	NELAP	PA	
1100 - Molybdenum	EPA 6010C	10155803	NELAP	PA	
1105 - Nickel	EPA 6010C	10155803	NELAP	PA	
1125 - Potassium	EPA 6010C	10155803	NELAP	PA	
1140 - Selenium	EPA 6010C	10155803	NELAP	PA	
1150 - Silver	EPA 6010C	10155803	NELAP	PA	
1155 - Sodium	EPA 6010C	10155803	NELAP	PA	
1160 - Strontium	EPA 6010C	10155803	NELAP	PA	
2017 - Sulfur	EPA 6010C	10155803	NELAP	PA	
1165 - Thallium	EPA 6010C	10155803	NELAP	PA	
1175 - Tin	EPA 6010C	10155803	NELAP	PA	
1180 - Titanium	EPA 6010C	10155803	NELAP	PA	
1185 - Vanadium	EPA 6010C	10155803	NELAP	PA	
1190 - Zinc	EPA 6010C	10155803	NELAP	PA	
1000 - Aluminum	EPA 6020	10156000	NELAP	PA	
1005 - Antimony	EPA 6020	10156000	NELAP	PA	
1010 - Arsenic	EPA 6020	10156000	NELAP	PA	
1015 - Barium	EPA 6020	10156000	NELAP	PA	
1020 - Beryllium	EPA 6020	10156000	NELAP	PA	
1025 - Boron	EPA 6020	10156000	NELAP	PA	
1030 - Cadmium	EPA 6020	10156000	NELAP	PA	
1035 - Calcium	EPA 6020	10156000	NELAP	PA	
1055 - Copper	EPA 6020	10156000	NELAP	PA	
1075 - Lead	EPA 6020	10156000	NELAP	PA	
1085 - Magnesium	EPA 6020	10156000	NELAP	PA	
1090 - Manganese	EPA 6020	10156000	NELAP	PA	
1100 - Molybdenum	EPA 6020	10156000	NELAP	PA	
1105 - Nickel	EPA 6020	10156000	NELAP	PA	
1125 - Potassium	EPA 6020	10156000	NELAP	PA	
1140 - Selenium	EPA 6020	10156000	NELAP	PA	
1150 - Silver	EPA 6020	10156000	NELAP	PA	
1155 - Sodium	EPA 6020	10156000	NELAP	PA	
1160 - Strontium	EPA 6020	10156000	NELAP	PA	
1165 - Thallium	EPA 6020	10156000	NELAP	PA	
1175 - Tin	EPA 6020	10156000	NELAP	PA	
1180 - Titanium	EPA 6020	10156000	NELAP	PA	
1185 - Vanadium	EPA 6020	10156000	NELAP	PA	
1040 - Chromium	EPA 6020	10156204	NELAP	PA	
1050 - Cobalt	EPA 6020	10156204	NELAP	PA	
1070 - Iron	EPA 6020	10156204	NELAP	PA	
1190 - Zinc	EPA 6020	10156204	NELAP	PA	

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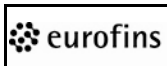
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Non Potable Water					
Analyte	Method Name	Method Code	Type	AB	
1000 - Aluminum	EPA 6020A	10156408	NELAP	PA	
1005 - Antimony	EPA 6020A	10156408	NELAP	PA	
1010 - Arsenic	EPA 6020A	10156408	NELAP	PA	
1015 - Barium	EPA 6020A	10156408	NELAP	PA	
1020 - Beryllium	EPA 6020A	10156408	NELAP	PA	
1025 - Boron	EPA 6020A	10156408	NELAP	PA	
1030 - Cadmium	EPA 6020A	10156408	NELAP	PA	
1035 - Calcium	EPA 6020A	10156408	NELAP	PA	
1040 - Chromium	EPA 6020A	10156408	NELAP	PA	
1050 - Cobalt	EPA 6020A	10156408	NELAP	PA	
1055 - Copper	EPA 6020A	10156408	NELAP	PA	
1070 - Iron	EPA 6020A	10156408	NELAP	PA	
1075 - Lead	EPA 6020A	10156408	NELAP	PA	
1085 - Magnesium	EPA 6020A	10156408	NELAP	PA	
1090 - Manganese	EPA 6020A	10156408	NELAP	PA	
1100 - Molybdenum	EPA 6020A	10156408	NELAP	PA	
1105 - Nickel	EPA 6020A	10156408	NELAP	PA	
1125 - Potassium	EPA 6020A	10156408	NELAP	PA	
1140 - Selenium	EPA 6020A	10156408	NELAP	PA	
1150 - Silver	EPA 6020A	10156408	NELAP	PA	
1155 - Sodium	EPA 6020A	10156408	NELAP	PA	
1160 - Strontium	EPA 6020A	10156408	NELAP	PA	
1165 - Thallium	EPA 6020A	10156408	NELAP	PA	
1175 - Tin	EPA 6020A	10156408	NELAP	PA	
1180 - Titanium	EPA 6020A	10156408	NELAP	PA	
1185 - Vanadium	EPA 6020A	10156408	NELAP	PA	
1190 - Zinc	EPA 6020A	10156408	NELAP	PA	
1045 - Chromium VI	EPA 7196A	10162400	NELAP	PA	
1045 - Chromium VI	EPA 7199	10163005	NELAP	PA	
1095 - Mercury	EPA 7470A	10165807	NELAP	PA	
4570 - 1,2-Dibromo-3-chloropropane (DBCP)	EPA 8011	10173009	NELAP	PA	
4585 - 1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8011	10173009	NELAP	PA	
4750 - Ethanol	EPA 8015	10173203	NELAP	PA	
4785 - Ethylene glycol	EPA 8015	10173203	NELAP	PA	
4895 - Isopropyl alcohol (2-Propanol, Isopropanol)	EPA 8015	10173203	NELAP	PA	
4930 - Methanol	EPA 8015	10173203	NELAP	PA	
4420 - tert-Butyl alcohol	EPA 8015	10173203	NELAP	PA	
9369 - Diesel range organics (DRO)	EPA 8015B	10173601	NELAP	PA	
9408 - Gasoline range organics (GRO)	EPA 8015B	10173601	NELAP	PA	
2050 - Total Petroleum Hydrocarbons (TPH)	EPA 8015B	10173601	NELAP	PA	
9369 - Diesel range organics (DRO)	EPA 8015C	10173805	NELAP	PA	
9408 - Gasoline range organics (GRO)	EPA 8015C	10173805	NELAP	PA	
4375 - Benzene	EPA 8021B	10174808	NELAP	PA	
4765 - Ethylbenzene	EPA 8021B	10174808	NELAP	PA	
4900 - Isopropylbenzene	EPA 8021B	10174808	NELAP	PA	
5000 - Methyl tert-butyl ether (MTBE)	EPA 8021B	10174808	NELAP	PA	
5005 - Naphthalene	EPA 8021B	10174808	NELAP	PA	
5140 - Toluene	EPA 8021B	10174808	NELAP	PA	
5260 - Xylene (total)	EPA 8021B	10174808	NELAP	PA	
5245 - m-Xylene	EPA 8021B	10174808	NELAP	PA	
5250 - o-Xylene	EPA 8021B	10174808	NELAP	PA	
5255 - p-Xylene	EPA 8021B	10174808	NELAP	PA	

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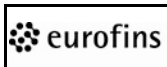
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Non Potable Water

Analyte	Method Name	Method Code	Type	AB
7355 - 4,4'-DDD	EPA 8081B	10178800	NELAP	PA
7360 - 4,4'-DDE	EPA 8081B	10178800	NELAP	PA
7365 - 4,4'-DDT	EPA 8081B	10178800	NELAP	PA
7025 - Aldrin	EPA 8081B	10178800	NELAP	PA
7250 - Chlordane (tech.)	EPA 8081B	10178800	NELAP	PA
7470 - Dieldrin	EPA 8081B	10178800	NELAP	PA
7510 - Endosulfan I	EPA 8081B	10178800	NELAP	PA
7515 - Endosulfan II	EPA 8081B	10178800	NELAP	PA
7520 - Endosulfan sulfate	EPA 8081B	10178800	NELAP	PA
7540 - Endrin	EPA 8081B	10178800	NELAP	PA
7530 - Endrin aldehyde	EPA 8081B	10178800	NELAP	PA
7535 - Endrin ketone	EPA 8081B	10178800	NELAP	PA
7685 - Heptachlor	EPA 8081B	10178800	NELAP	PA
7690 - Heptachlor epoxide	EPA 8081B	10178800	NELAP	PA
7740 - Kepone	EPA 8081B	10178800	NELAP	PA
7810 - Methoxychlor	EPA 8081B	10178800	NELAP	PA
8250 - Toxaphene (Chlorinated camphene)	EPA 8081B	10178800	NELAP	PA
7110 - alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8081B	10178800	NELAP	PA
7115 - beta-BHC (beta-Hexachlorocyclohexane)	EPA 8081B	10178800	NELAP	PA
7105 - delta-BHC	EPA 8081B	10178800	NELAP	PA
7120 - gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8081B	10178800	NELAP	PA
8880 - Aroclor-1016 (PCB-1016)	EPA 8082	10179007	NELAP	PA
8885 - Aroclor-1221 (PCB-1221)	EPA 8082	10179007	NELAP	PA
8890 - Aroclor-1232 (PCB-1232)	EPA 8082	10179007	NELAP	PA
8895 - Aroclor-1242 (PCB-1242)	EPA 8082	10179007	NELAP	PA
8900 - Aroclor-1248 (PCB-1248)	EPA 8082	10179007	NELAP	PA
8905 - Aroclor-1254 (PCB-1254)	EPA 8082	10179007	NELAP	PA
8910 - Aroclor-1260 (PCB-1260)	EPA 8082	10179007	NELAP	PA
8912 - Aroclor-1262 (PCB-1262)	EPA 8082	10179007	NELAP	PA
8913 - Aroclor-1268 (PCB-1268)	EPA 8082	10179007	NELAP	PA
7065 - Atrazine	EPA 8141	10181803	NELAP	PA
7075 - Azinphos-methyl (Guthion)	EPA 8141	10181803	NELAP	PA
7125 - Bolstar (Sulprofos)	EPA 8141	10181803	NELAP	PA
7300 - Chlorpyrifos	EPA 8141	10181803	NELAP	PA
7315 - Coumaphos	EPA 8141	10181803	NELAP	PA
7395 - Demeton-o	EPA 8141	10181803	NELAP	PA
7385 - Demeton-s	EPA 8141	10181803	NELAP	PA
7410 - Diazinon	EPA 8141	10181803	NELAP	PA
8610 - Dichlorvos (DDVP, Dichlorvos)	EPA 8141	10181803	NELAP	PA
8625 - Disulfoton	EPA 8141	10181803	NELAP	PA
7550 - EPN	EPA 8141	10181803	NELAP	PA
7565 - Ethion	EPA 8141	10181803	NELAP	PA
7570 - Ethoprop	EPA 8141	10181803	NELAP	PA
7580 - Fomphur	EPA 8141	10181803	NELAP	PA
7600 - Fensulfothion	EPA 8141	10181803	NELAP	PA
7770 - Malathion	EPA 8141	10181803	NELAP	PA
7785 - Merphos	EPA 8141	10181803	NELAP	PA
7825 - Methyl parathion (Parathion, methyl)	EPA 8141	10181803	NELAP	PA
7850 - Mevinphos	EPA 8141	10181803	NELAP	PA
7905 - Naled	EPA 8141	10181803	NELAP	PA
7955 - Parathion, ethyl	EPA 8141	10181803	NELAP	PA
7985 - Phorate	EPA 8141	10181803	NELAP	PA
8110 - Ronnel	EPA 8141	10181803	NELAP	PA

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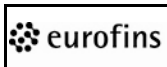
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Non Potable Water

Analyte	Method Name	Method Code	Type	AB
8125 - Simazine	EPA 8141	10181803	NELAP	PA
8140 - Stirophos	EPA 8141	10181803	NELAP	PA
8245 - Tokuthion (Prothiophos)	EPA 8141	10181803	NELAP	PA
8275 - Trichloronate	EPA 8141	10181803	NELAP	PA
7065 - Atrazine	EPA 8141A	10182000	NELAP	PA
7075 - Azinphos-methyl (Guthion)	EPA 8141A	10182000	NELAP	PA
7125 - Bolstar (Sulprofos)	EPA 8141A	10182000	NELAP	PA
7300 - Chlorpyrifos	EPA 8141A	10182000	NELAP	PA
7315 - Coumaphos	EPA 8141A	10182000	NELAP	PA
7395 - Demeton-o	EPA 8141A	10182000	NELAP	PA
7385 - Demeton-s	EPA 8141A	10182000	NELAP	PA
7410 - Diazinon	EPA 8141A	10182000	NELAP	PA
8610 - Dichlorovos (DDVP, Dichlorvos)	EPA 8141A	10182000	NELAP	PA
8625 - Disulfoton	EPA 8141A	10182000	NELAP	PA
7550 - EPN	EPA 8141A	10182000	NELAP	PA
7565 - Ethion	EPA 8141A	10182000	NELAP	PA
7570 - Ethoprop	EPA 8141A	10182000	NELAP	PA
7580 - Famphur	EPA 8141A	10182000	NELAP	PA
7600 - Fensulfothion	EPA 8141A	10182000	NELAP	PA
7770 - Malathion	EPA 8141A	10182000	NELAP	PA
7785 - Merphos	EPA 8141A	10182000	NELAP	PA
7825 - Methyl parathion (Parathion, methyl)	EPA 8141A	10182000	NELAP	PA
7850 - Mevinphos	EPA 8141A	10182000	NELAP	PA
7905 - Naled	EPA 8141A	10182000	NELAP	PA
7955 - Parathion, ethyl	EPA 8141A	10182000	NELAP	PA
7985 - Phorate	EPA 8141A	10182000	NELAP	PA
8110 - Ronnel	EPA 8141A	10182000	NELAP	PA
8125 - Simazine	EPA 8141A	10182000	NELAP	PA
8140 - Stirophos	EPA 8141A	10182000	NELAP	PA
8245 - Tokuthion (Prothiophos)	EPA 8141A	10182000	NELAP	PA
8275 - Trichloronate	EPA 8141A	10182000	NELAP	PA
8655 - 2,4,5-T	EPA 8151	10183003	NELAP	PA
8545 - 2,4-D	EPA 8151	10183003	NELAP	PA
8555 - Dalapon	EPA 8151	10183003	NELAP	PA
8595 - Dicamba	EPA 8151	10183003	NELAP	PA
8605 - Dichloroprop (Dichlorprop)	EPA 8151	10183003	NELAP	PA
7775 - MCPA	EPA 8151	10183003	NELAP	PA
7780 - MCPP	EPA 8151	10183003	NELAP	PA
8650 - Silvex (2,4,5-TP)	EPA 8151	10183003	NELAP	PA
5105 - 1,1,1,2-Tetrachloroethane	EPA 8260B	10184802	NELAP	PA
5160 - 1,1,1-Trichloroethane	EPA 8260B	10184802	NELAP	PA
5110 - 1,1,2,2-Tetrachloroethane	EPA 8260B	10184802	NELAP	PA
5195 - 1,1,2-Trichloro-1,2,2-trifluoroethane	EPA 8260B	10184802	NELAP	PA
5185 - 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	EPA 8260B	10184802	NELAP	PA
5165 - 1,1,2-Trichloroethane	EPA 8260B	10184802	NELAP	PA
4630 - 1,1-Dichloroethane	EPA 8260B	10184802	NELAP	PA
4640 - 1,1-Dichloroethylene	EPA 8260B	10184802	NELAP	PA
4670 - 1,1-Dichloropropene	EPA 8260B	10184802	NELAP	PA
5150 - 1,2,3-Trichlorobenzene	EPA 8260B	10184802	NELAP	PA
5180 - 1,2,3-Trichloropropane	EPA 8260B	10184802	NELAP	PA
5155 - 1,2,4-Trichlorobenzene	EPA 8260B	10184802	NELAP	PA
5210 - 1,2,4-Trimethylbenzene	EPA 8260B	10184802	NELAP	PA
4570 - 1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260B	10184802	NELAP	PA
4585 - 1,2-Dibromoethane (EDB, Ethylene	EPA 8260B	10184802	NELAP	PA

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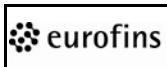
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 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Non Potable Water

Analyte	Method Name	Method Code	Type	AB
dibromide)				
4610 - 1,2-Dichlorobenzene	EPA 8260B	10184802	NELAP	PA
4635 - 1,2-Dichloroethane (Ethylene dichloride)	EPA 8260B	10184802	NELAP	PA
4655 - 1,2-Dichloropropane	EPA 8260B	10184802	NELAP	PA
5215 - 1,3,5-Trimethylbenzene	EPA 8260B	10184802	NELAP	PA
4615 - 1,3-Dichlorobenzene	EPA 8260B	10184802	NELAP	PA
4660 - 1,3-Dichloropropane	EPA 8260B	10184802	NELAP	PA
4620 - 1,4-Dichlorobenzene	EPA 8260B	10184802	NELAP	PA
4735 - 1,4-Dioxane (1,4- Diethyleneoxide)	EPA 8260B	10184802	NELAP	PA
4665 - 2,2-Dichloropropane	EPA 8260B	10184802	NELAP	PA
4410 - 2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260B	10184802	NELAP	PA
4500 - 2-Chloroethyl vinyl ether	EPA 8260B	10184802	NELAP	PA
4535 - 2-Chlorotoluene	EPA 8260B	10184802	NELAP	PA
4860 - 2-Hexanone	EPA 8260B	10184802	NELAP	PA
4540 - 4-Chlorotoluene	EPA 8260B	10184802	NELAP	PA
4910 - 4-Isopropyltoluene (p-Cymene)	EPA 8260B	10184802	NELAP	PA
4995 - 4-Methyl-2-pentanone (MIBK)	EPA 8260B	10184802	NELAP	PA
4315 - Acetone	EPA 8260B	10184802	NELAP	PA
4320 - Acetonitrile	EPA 8260B	10184802	NELAP	PA
4325 - Acrolein (Propenal)	EPA 8260B	10184802	NELAP	PA
4340 - Acrylonitrile	EPA 8260B	10184802	NELAP	PA
4350 - Allyl alcohol	EPA 8260B	10184802	NELAP	PA
4355 - Allyl chloride (3-Chloropropene)	EPA 8260B	10184802	NELAP	PA
4375 - Benzene	EPA 8260B	10184802	NELAP	PA
5635 - Benzyl chloride	EPA 8260B	10184802	NELAP	PA
4385 - Bromobenzene	EPA 8260B	10184802	NELAP	PA
4390 - Bromochloromethane	EPA 8260B	10184802	NELAP	PA
4395 - Bromodichloromethane	EPA 8260B	10184802	NELAP	PA
4400 - Bromoform	EPA 8260B	10184802	NELAP	PA
4450 - Carbon disulfide	EPA 8260B	10184802	NELAP	PA
4455 - Carbon tetrachloride	EPA 8260B	10184802	NELAP	PA
4475 - Chlorobenzene	EPA 8260B	10184802	NELAP	PA
4575 - Chlorodibromomethane	EPA 8260B	10184802	NELAP	PA
4485 - Chloroethane (Ethyl chloride)	EPA 8260B	10184802	NELAP	PA
4505 - Chloroform	EPA 8260B	10184802	NELAP	PA
4525 - Chloroprene (2-Chloro-1,3-butadiene)	EPA 8260B	10184802	NELAP	PA
4555 - Cyclohexane	EPA 8260B	10184802	NELAP	PA
9375 - Di-isopropylether (DIPE) (Isopropyl ether)	EPA 8260B	10184802	NELAP	PA
4580 - Dibromochloropropane	EPA 8260B	10184802	NELAP	PA
4590 - Dibromofluoromethane	EPA 8260B	10184802	NELAP	PA
4595 - Dibromomethane (Methylene bromide)	EPA 8260B	10184802	NELAP	PA
4625 - Dichlorodifluoromethane (Freon-12)	EPA 8260B	10184802	NELAP	PA
4745 - Epichlorohydrin (1-Chloro-2,3-epoxypropane)	EPA 8260B	10184802	NELAP	PA
4750 - Ethanol	EPA 8260B	10184802	NELAP	PA
4755 - Ethyl acetate	EPA 8260B	10184802	NELAP	PA
4810 - Ethyl methacrylate	EPA 8260B	10184802	NELAP	PA
4770 - Ethyl-t-butyl ether (ETBE) (2-Ethoxy-2-methylpropane)	EPA 8260B	10184802	NELAP	PA
4765 - Ethylbenzene	EPA 8260B	10184802	NELAP	PA
9408 - Gasoline range organics (GRO)	EPA 8260B	10184802	NELAP	PA

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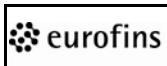
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	Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Non Potable Water

Analyte	Method Name	Method Code	Type	AB
4835 - Hexachlorobutadiene	EPA 8260B	10184802	NELAP	PA
4870 - Iodomethane (Methyl iodide)	EPA 8260B	10184802	NELAP	PA
4875 - Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8260B	10184802	NELAP	PA
4900 - Isopropylbenzene	EPA 8260B	10184802	NELAP	PA
4925 - Methacrylonitrile	EPA 8260B	10184802	NELAP	PA
4940 - Methyl acetate	EPA 8260B	10184802	NELAP	PA
4950 - Methyl bromide (Bromomethane)	EPA 8260B	10184802	NELAP	PA
4960 - Methyl chloride (Chloromethane)	EPA 8260B	10184802	NELAP	PA
5000 - Methyl tert-butyl ether (MTBE)	EPA 8260B	10184802	NELAP	PA
4975 - Methylene chloride (Dichloromethane)	EPA 8260B	10184802	NELAP	PA
5005 - Naphthalene	EPA 8260B	10184802	NELAP	PA
5035 - Pentachloroethane	EPA 8260B	10184802	NELAP	PA
5080 - Propionitrile (Ethyl cyanide)	EPA 8260B	10184802	NELAP	PA
5100 - Styrene	EPA 8260B	10184802	NELAP	PA
4370 - T-amylmethylether (TAME)	EPA 8260B	10184802	NELAP	PA
5115 - Tetrachloroethylene (Perchloroethylene)	EPA 8260B	10184802	NELAP	PA
5120 - Tetrahydrofuran (THF)	EPA 8260B	10184802	NELAP	PA
5140 - Toluene	EPA 8260B	10184802	NELAP	PA
5170 - Trichloroethene (Trichloroethylene)	EPA 8260B	10184802	NELAP	PA
5175 - Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	EPA 8260B	10184802	NELAP	PA
5225 - Vinyl acetate	EPA 8260B	10184802	NELAP	PA
5235 - Vinyl chloride	EPA 8260B	10184802	NELAP	PA
5260 - Xylene (total)	EPA 8260B	10184802	NELAP	PA
4705 - cis & trans-1,2-Dichloroethene	EPA 8260B	10184802	NELAP	PA
4645 - cis-1,2-Dichloroethylene	EPA 8260B	10184802	NELAP	PA
4680 - cis-1,3-Dichloropropene	EPA 8260B	10184802	NELAP	PA
5240 - m+p-xylene	EPA 8260B	10184802	NELAP	PA
4435 - n-Butylbenzene	EPA 8260B	10184802	NELAP	PA
5085 - n-Propylamine	EPA 8260B	10184802	NELAP	PA
5090 - n-Propylbenzene	EPA 8260B	10184802	NELAP	PA
5250 - o-Xylene	EPA 8260B	10184802	NELAP	PA
4440 - sec-Butylbenzene	EPA 8260B	10184802	NELAP	PA
4420 - tert-Butyl alcohol	EPA 8260B	10184802	NELAP	PA
4445 - tert-Butylbenzene	EPA 8260B	10184802	NELAP	PA
4700 - trans-1,2-Dichloroethylene	EPA 8260B	10184802	NELAP	PA
4685 - trans-1,3-Dichloropropylene	EPA 8260B	10184802	NELAP	PA
4605 - trans-1,4-Dichloro-2-butene	EPA 8260B	10184802	NELAP	PA
6715 - 1,2,4,5-Tetrachlorobenzene	EPA 8270C	10185805	NELAP	PA
5155 - 1,2,4-Trichlorobenzene	EPA 8270C	10185805	NELAP	PA
4610 - 1,2-Dichlorobenzene	EPA 8270C	10185805	NELAP	PA
6220 - 1,2-Diphenylhydrazine	EPA 8270C	10185805	NELAP	PA
6885 - 1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8270C	10185805	NELAP	PA
4615 - 1,3-Dichlorobenzene	EPA 8270C	10185805	NELAP	PA
6160 - 1,3-Dinitrobenzene (1,3-DNB)	EPA 8270C	10185805	NELAP	PA
4620 - 1,4-Dichlorobenzene	EPA 8270C	10185805	NELAP	PA
6165 - 1,4-Dinitrobenzene	EPA 8270C	10185805	NELAP	PA
4735 - 1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8270C	10185805	NELAP	PA
6420 - 1,4-Naphthoquinone	EPA 8270C	10185805	NELAP	PA
6630 - 1,4-Phenylenediamine	EPA 8270C	10185805	NELAP	PA
5790 - 1-Chloronaphthalene	EPA 8270C	10185805	NELAP	PA
6380 - 1-Methylnaphthalene	EPA 8270C	10185805	NELAP	PA
6425 - 1-Naphthylamine	EPA 8270C	10185805	NELAP	PA

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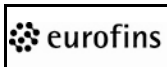
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Non Potable Water

Analyte	Method Name	Method Code	Type	AB
6735 - 2,3,4,6-Tetrachlorophenol	EPA 8270C	10185805	NELAP	PA
6835 - 2,4,5-Trichlorophenol	EPA 8270C	10185805	NELAP	PA
6840 - 2,4,6-Trichlorophenol	EPA 8270C	10185805	NELAP	PA
6000 - 2,4-Dichlorophenol	EPA 8270C	10185805	NELAP	PA
6130 - 2,4-Dimethylphenol	EPA 8270C	10185805	NELAP	PA
6175 - 2,4-Dinitrophenol	EPA 8270C	10185805	NELAP	PA
6185 - 2,4-Dinitrotoluene (2,4-DNT)	EPA 8270C	10185805	NELAP	PA
6005 - 2,6-Dichlorophenol	EPA 8270C	10185805	NELAP	PA
6190 - 2,6-Dinitrotoluene (2,6-DNT)	EPA 8270C	10185805	NELAP	PA
5515 - 2-Acetylaminofluorene	EPA 8270C	10185805	NELAP	PA
5795 - 2-Chloronaphthalene	EPA 8270C	10185805	NELAP	PA
5800 - 2-Chlorophenol	EPA 8270C	10185805	NELAP	PA
6360 - 2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	EPA 8270C	10185805	NELAP	PA
5145 - 2-Methylaniline (o-Toluidine)	EPA 8270C	10185805	NELAP	PA
6385 - 2-Methylnaphthalene	EPA 8270C	10185805	NELAP	PA
6400 - 2-Methylphenol (o-Cresol)	EPA 8270C	10185805	NELAP	PA
6430 - 2-Naphthylamine	EPA 8270C	10185805	NELAP	PA
6460 - 2-Nitroaniline	EPA 8270C	10185805	NELAP	PA
6490 - 2-Nitrophenol	EPA 8270C	10185805	NELAP	PA
5050 - 2-Picoline (2-Methylpyridine)	EPA 8270C	10185805	NELAP	PA
5945 - 3,3'-Dichlorobenzidine	EPA 8270C	10185805	NELAP	PA
6120 - 3,3'-Dimethylbenzidine	EPA 8270C	10185805	NELAP	PA
6355 - 3-Methylcholanthrene	EPA 8270C	10185805	NELAP	PA
6405 - 3-Methylphenol (m-Cresol)	EPA 8270C	10185805	NELAP	PA
6465 - 3-Nitroaniline	EPA 8270C	10185805	NELAP	PA
5540 - 4-Aminobiphenyl	EPA 8270C	10185805	NELAP	PA
5660 - 4-Bromophenyl phenyl ether	EPA 8270C	10185805	NELAP	PA
5700 - 4-Chloro-3-methylphenol	EPA 8270C	10185805	NELAP	PA
5745 - 4-Chloroaniline	EPA 8270C	10185805	NELAP	PA
5825 - 4-Chlorophenyl phenylether	EPA 8270C	10185805	NELAP	PA
6410 - 4-Methylphenol (p-Cresol)	EPA 8270C	10185805	NELAP	PA
6470 - 4-Nitroaniline	EPA 8270C	10185805	NELAP	PA
6500 - 4-Nitrophenol	EPA 8270C	10185805	NELAP	PA
6510 - 4-Nitroquinoline 1-oxide	EPA 8270C	10185805	NELAP	PA
6570 - 5-Nitro-o-toluidine	EPA 8270C	10185805	NELAP	PA
6115 - 7,12-Dimethylbenz(a) anthracene	EPA 8270C	10185805	NELAP	PA
5500 - Acenaphthene	EPA 8270C	10185805	NELAP	PA
5505 - Acenaphthylene	EPA 8270C	10185805	NELAP	PA
5510 - Acetophenone	EPA 8270C	10185805	NELAP	PA
5545 - Aniline	EPA 8270C	10185805	NELAP	PA
5555 - Anthracene	EPA 8270C	10185805	NELAP	PA
5560 - Aramite	EPA 8270C	10185805	NELAP	PA
5595 - Benzidine	EPA 8270C	10185805	NELAP	PA
5575 - Benzo(a)anthracene	EPA 8270C	10185805	NELAP	PA
5580 - Benzo(a)pyrene	EPA 8270C	10185805	NELAP	PA
5585 - Benzo(b)fluoranthene	EPA 8270C	10185805	NELAP	PA
5590 - Benzo(g,h,i)perylene	EPA 8270C	10185805	NELAP	PA
5600 - Benzo(k)fluoranthene	EPA 8270C	10185805	NELAP	PA
5610 - Benzoic acid	EPA 8270C	10185805	NELAP	PA
5630 - Benzyl alcohol	EPA 8270C	10185805	NELAP	PA
5670 - Butyl benzyl phthalate	EPA 8270C	10185805	NELAP	PA
7180 - Caprolactam	EPA 8270C	10185805	NELAP	PA
5680 - Carbazole	EPA 8270C	10185805	NELAP	PA
5855 - Chrysene	EPA 8270C	10185805	NELAP	PA
6065 - Di(2-ethylhexyl) phthalate (bis(2-	EPA 8270C	10185805	NELAP	PA

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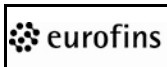
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Non Potable Water

Analyte	Method Name	Method Code	Type	AB
Ethylhexyl)phthalate, DEHP)				
5925 - Di-n-butyl phthalate	EPA 8270C	10185805	NELAP	PA
6200 - Di-n-octyl phthalate	EPA 8270C	10185805	NELAP	PA
7405 - Diallate	EPA 8270C	10185805	NELAP	PA
5895 - Dibenz(a,h) anthracene	EPA 8270C	10185805	NELAP	PA
5905 - Dibenzofuran	EPA 8270C	10185805	NELAP	PA
6135 - Dimethyl phthalate	EPA 8270C	10185805	NELAP	PA
8620 - Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8270C	10185805	NELAP	PA
6205 - Diphenylamine	EPA 8270C	10185805	NELAP	PA
8625 - Disulfoton	EPA 8270C	10185805	NELAP	PA
6260 - Ethyl methanesulfonate	EPA 8270C	10185805	NELAP	PA
7580 - Famphur	EPA 8270C	10185805	NELAP	PA
6265 - Fluoranthene	EPA 8270C	10185805	NELAP	PA
6270 - Fluorene	EPA 8270C	10185805	NELAP	PA
6275 - Hexachlorobenzene	EPA 8270C	10185805	NELAP	PA
4835 - Hexachlorobutadiene	EPA 8270C	10185805	NELAP	PA
6285 - Hexachlorocyclopentadiene	EPA 8270C	10185805	NELAP	PA
4840 - Hexachloroethane	EPA 8270C	10185805	NELAP	PA
6295 - Hexachloropropene	EPA 8270C	10185805	NELAP	PA
6315 - Indeno(1,2,3-cd) pyrene	EPA 8270C	10185805	NELAP	PA
7725 - Isodrin	EPA 8270C	10185805	NELAP	PA
6320 - Isophorone	EPA 8270C	10185805	NELAP	PA
6325 - Isosafrole	EPA 8270C	10185805	NELAP	PA
7740 - Kepone	EPA 8270C	10185805	NELAP	PA
6345 - Methapyrilene	EPA 8270C	10185805	NELAP	PA
6375 - Methyl methanesulfonate	EPA 8270C	10185805	NELAP	PA
7825 - Methyl parathion (Parathion, methyl)	EPA 8270C	10185805	NELAP	PA
5005 - Naphthalene	EPA 8270C	10185805	NELAP	PA
5015 - Nitrobenzene	EPA 8270C	10185805	NELAP	PA
7955 - Parathion, ethyl	EPA 8270C	10185805	NELAP	PA
6600 - Pentachloronitrobenzene	EPA 8270C	10185805	NELAP	PA
6605 - Pentachlorophenol	EPA 8270C	10185805	NELAP	PA
6610 - Phenacetin	EPA 8270C	10185805	NELAP	PA
6615 - Phenanthrene	EPA 8270C	10185805	NELAP	PA
6625 - Phenol	EPA 8270C	10185805	NELAP	PA
7985 - Phorate	EPA 8270C	10185805	NELAP	PA
6650 - Pronamide (Kerb)	EPA 8270C	10185805	NELAP	PA
6665 - Pyrene	EPA 8270C	10185805	NELAP	PA
5095 - Pyridine	EPA 8270C	10185805	NELAP	PA
6670 - Quinoline	EPA 8270C	10185805	NELAP	PA
6685 - Saffrole	EPA 8270C	10185805	NELAP	PA
8155 - Sulfotep	EPA 8270C	10185805	NELAP	PA
8235 - Thionazin (Zinophos)	EPA 8270C	10185805	NELAP	PA
6750 - Thiophenol (Benzenethiol)	EPA 8270C	10185805	NELAP	PA
6125 - a-a-Dimethylphenethylamine	EPA 8270C	10185805	NELAP	PA
5760 - bis(2-Chloroethoxy)methane	EPA 8270C	10185805	NELAP	PA
5765 - bis(2-Chloroethyl) ether	EPA 8270C	10185805	NELAP	PA
5780 - bis(2-Chloroisopropyl) ether	EPA 8270C	10185805	NELAP	PA
5025 - n-Nitroso-di-n-butylamine	EPA 8270C	10185805	NELAP	PA
6545 - n-Nitrosodi-n-propylamine	EPA 8270C	10185805	NELAP	PA
6525 - n-Nitrosodiethylamine	EPA 8270C	10185805	NELAP	PA
6530 - n-Nitrosodimethylamine	EPA 8270C	10185805	NELAP	PA
6535 - n-Nitrosodiphenylamine	EPA 8270C	10185805	NELAP	PA
6550 - n-Nitrosomethylethylamine	EPA 8270C	10185805	NELAP	PA
6555 - n-Nitrosomorpholine	EPA 8270C	10185805	NELAP	PA

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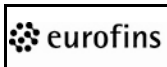
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Non Potable Water

Analyte	Method Name	Method Code	Type	AB
6560 - n-Nitrosopiperidine	EPA 8270C	10185805	NELAP	PA
6565 - n-Nitrosopyrrolidine	EPA 8270C	10185805	NELAP	PA
8290 - o,o,o-Triethyl phosphorothioate	EPA 8270C	10185805	NELAP	PA
8310 - tris-(2,3-Dibromopropyl) phosphate (tris-BP)	EPA 8270C	10185805	NELAP	PA
6715 - 1,2,4,5-Tetrachlorobenzene	EPA 8270D	10186002	NELAP	PA
5155 - 1,2,4-Trichlorobenzene	EPA 8270D	10186002	NELAP	PA
4610 - 1,2-Dichlorobenzene	EPA 8270D	10186002	NELAP	PA
6220 - 1,2-Diphenylhydrazine	EPA 8270D	10186002	NELAP	PA
6885 - 1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8270D	10186002	NELAP	PA
4615 - 1,3-Dichlorobenzene	EPA 8270D	10186002	NELAP	PA
6160 - 1,3-Dinitrobenzene (1,3-DNB)	EPA 8270D	10186002	NELAP	PA
4620 - 1,4-Dichlorobenzene	EPA 8270D	10186002	NELAP	PA
6165 - 1,4-Dinitrobenzene	EPA 8270D	10186002	NELAP	PA
4735 - 1,4-Dioxane (1,4- Diethyleneoxide)	EPA 8270D	10186002	NELAP	PA
6420 - 1,4-Naphthoquinone	EPA 8270D	10186002	NELAP	PA
6630 - 1,4-Phenylenediamine	EPA 8270D	10186002	NELAP	PA
5790 - 1-Chloronaphthalene	EPA 8270D	10186002	NELAP	PA
6380 - 1-Methylnaphthalene	EPA 8270D	10186002	NELAP	PA
6425 - 1-Naphthylamine	EPA 8270D	10186002	NELAP	PA
6735 - 2,3,4,6-Tetrachlorophenol	EPA 8270D	10186002	NELAP	PA
6835 - 2,4,5-Trichlorophenol	EPA 8270D	10186002	NELAP	PA
6840 - 2,4,6-Trichlorophenol	EPA 8270D	10186002	NELAP	PA
6000 - 2,4-Dichlorophenol	EPA 8270D	10186002	NELAP	PA
6130 - 2,4-Dimethylphenol	EPA 8270D	10186002	NELAP	PA
6175 - 2,4-Dinitrophenol	EPA 8270D	10186002	NELAP	PA
6185 - 2,4-Dinitrotoluene (2,4-DNT)	EPA 8270D	10186002	NELAP	PA
6005 - 2,6-Dichlorophenol	EPA 8270D	10186002	NELAP	PA
6190 - 2,6-Dinitrotoluene (2,6-DNT)	EPA 8270D	10186002	NELAP	PA
5515 - 2-Acetylaminofluorene	EPA 8270D	10186002	NELAP	PA
5795 - 2-Chloronaphthalene	EPA 8270D	10186002	NELAP	PA
5800 - 2-Chlorophenol	EPA 8270D	10186002	NELAP	PA
6360 - 2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	EPA 8270D	10186002	NELAP	PA
5145 - 2-Methylaniline (o-Toluidine)	EPA 8270D	10186002	NELAP	PA
6385 - 2-Methylnaphthalene	EPA 8270D	10186002	NELAP	PA
6400 - 2-Methylphenol (o-Cresol)	EPA 8270D	10186002	NELAP	PA
6430 - 2-Naphthylamine	EPA 8270D	10186002	NELAP	PA
6460 - 2-Nitroaniline	EPA 8270D	10186002	NELAP	PA
6490 - 2-Nitrophenol	EPA 8270D	10186002	NELAP	PA
5050 - 2-Picoline (2-Methylpyridine)	EPA 8270D	10186002	NELAP	PA
5945 - 3,3'-Dichlorobenzidine	EPA 8270D	10186002	NELAP	PA
6120 - 3,3'-Dimethylbenzidine	EPA 8270D	10186002	NELAP	PA
6355 - 3-Methylcholanthrene	EPA 8270D	10186002	NELAP	PA
6405 - 3-Methylphenol (m-Cresol)	EPA 8270D	10186002	NELAP	PA
6465 - 3-Nitroaniline	EPA 8270D	10186002	NELAP	PA
5540 - 4-Aminobiphenyl	EPA 8270D	10186002	NELAP	PA
5660 - 4-Bromophenyl phenyl ether	EPA 8270D	10186002	NELAP	PA
5700 - 4-Chloro-3-methylphenol	EPA 8270D	10186002	NELAP	PA
5745 - 4-Chloroaniline	EPA 8270D	10186002	NELAP	PA
5825 - 4-Chlorophenyl phenylether	EPA 8270D	10186002	NELAP	PA
6410 - 4-Methylphenol (p-Cresol)	EPA 8270D	10186002	NELAP	PA
6470 - 4-Nitroaniline	EPA 8270D	10186002	NELAP	PA
6500 - 4-Nitrophenol	EPA 8270D	10186002	NELAP	PA
6510 - 4-Nitroquinoline 1-oxide	EPA 8270D	10186002	NELAP	PA
6570 - 5-Nitro-o-toluidine	EPA 8270D	10186002	NELAP	PA

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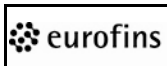
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AI Number: 30729
Expiration Date: June 30, 2015

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	Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Non Potable Water

Analyte	Method Name	Method Code	Type	AB
6115 - 7,12-Dimethylbenz(a) anthracene	EPA 8270D	10186002	NELAP	PA
5500 - Acenaphthene	EPA 8270D	10186002	NELAP	PA
5505 - Acenaphthylene	EPA 8270D	10186002	NELAP	PA
5510 - Acetophenone	EPA 8270D	10186002	NELAP	PA
5545 - Aniline	EPA 8270D	10186002	NELAP	PA
5555 - Anthracene	EPA 8270D	10186002	NELAP	PA
5560 - Aramite	EPA 8270D	10186002	NELAP	PA
5595 - Benzidine	EPA 8270D	10186002	NELAP	PA
5575 - Benzo(a)anthracene	EPA 8270D	10186002	NELAP	PA
5580 - Benzo(a)pyrene	EPA 8270D	10186002	NELAP	PA
5585 - Benzo(b)fluoranthene	EPA 8270D	10186002	NELAP	PA
5590 - Benzo(g,h,i)perylene	EPA 8270D	10186002	NELAP	PA
5600 - Benzo(k)fluoranthene	EPA 8270D	10186002	NELAP	PA
5610 - Benzoic acid	EPA 8270D	10186002	NELAP	PA
5630 - Benzyl alcohol	EPA 8270D	10186002	NELAP	PA
5635 - Benzyl chloride	EPA 8270D	10186002	NELAP	PA
5670 - Butyl benzyl phthalate	EPA 8270D	10186002	NELAP	PA
7180 - Caprolactam	EPA 8270D	10186002	NELAP	PA
5680 - Carbazole	EPA 8270D	10186002	NELAP	PA
5855 - Chrysene	EPA 8270D	10186002	NELAP	PA
6065 - Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)	EPA 8270D	10186002	NELAP	PA
5925 - Di-n-butyl phthalate	EPA 8270D	10186002	NELAP	PA
6200 - Di-n-octyl phthalate	EPA 8270D	10186002	NELAP	PA
7405 - Diallate	EPA 8270D	10186002	NELAP	PA
5895 - Dibenz(a,h) anthracene	EPA 8270D	10186002	NELAP	PA
5905 - Dibenzofuran	EPA 8270D	10186002	NELAP	PA
6135 - Dimethyl phthalate	EPA 8270D	10186002	NELAP	PA
8620 - Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8270D	10186002	NELAP	PA
6205 - Diphenylamine	EPA 8270D	10186002	NELAP	PA
8625 - Disulfoton	EPA 8270D	10186002	NELAP	PA
6260 - Ethyl methanesulfonate	EPA 8270D	10186002	NELAP	PA
7580 - Famphur	EPA 8270D	10186002	NELAP	PA
6265 - Fluoranthene	EPA 8270D	10186002	NELAP	PA
6270 - Fluorene	EPA 8270D	10186002	NELAP	PA
6275 - Hexachlorobenzene	EPA 8270D	10186002	NELAP	PA
4835 - Hexachlorobutadiene	EPA 8270D	10186002	NELAP	PA
6285 - Hexachlorocyclopentadiene	EPA 8270D	10186002	NELAP	PA
4840 - Hexachloroethane	EPA 8270D	10186002	NELAP	PA
6295 - Hexachloropropene	EPA 8270D	10186002	NELAP	PA
6315 - Indeno(1,2,3-cd) pyrene	EPA 8270D	10186002	NELAP	PA
7725 - Isodrin	EPA 8270D	10186002	NELAP	PA
6320 - Isophorone	EPA 8270D	10186002	NELAP	PA
6325 - Isosafrole	EPA 8270D	10186002	NELAP	PA
7740 - Kepone	EPA 8270D	10186002	NELAP	PA
6345 - Methapyrilene	EPA 8270D	10186002	NELAP	PA
6375 - Methyl methanesulfonate	EPA 8270D	10186002	NELAP	PA
7825 - Methyl parathion (Parathion, methyl)	EPA 8270D	10186002	NELAP	PA
5005 - Naphthalene	EPA 8270D	10186002	NELAP	PA
5015 - Nitrobenzene	EPA 8270D	10186002	NELAP	PA
7955 - Parathion, ethyl	EPA 8270D	10186002	NELAP	PA
6600 - Pentachloronitrobenzene	EPA 8270D	10186002	NELAP	PA
6605 - Pentachlorophenol	EPA 8270D	10186002	NELAP	PA
6610 - Phenacetin	EPA 8270D	10186002	NELAP	PA
6615 - Phenanthrene	EPA 8270D	10186002	NELAP	PA

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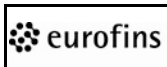
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Non Potable Water

Analyte	Method Name	Method Code	Type	AB
6625 - Phenol	EPA 8270D	10186002	NELAP	PA
7985 - Phorate	EPA 8270D	10186002	NELAP	PA
6650 - Pronamide (Kerb)	EPA 8270D	10186002	NELAP	PA
5095 - Pyridine	EPA 8270D	10186002	NELAP	PA
6670 - Quinoline	EPA 8270D	10186002	NELAP	PA
6685 - Saffrole	EPA 8270D	10186002	NELAP	PA
8155 - Sulfotepp	EPA 8270D	10186002	NELAP	PA
8235 - Thionazin (Zinophos)	EPA 8270D	10186002	NELAP	PA
6750 - Thiophenol (Benzenethiol)	EPA 8270D	10186002	NELAP	PA
6125 - a-a-Dimethylphenethylamine	EPA 8270D	10186002	NELAP	PA
5760 - bis(2-Chloroethoxy)methane	EPA 8270D	10186002	NELAP	PA
5765 - bis(2-Chloroethyl) ether	EPA 8270D	10186002	NELAP	PA
5780 - bis(2-Chloroisopropyl) ether	EPA 8270D	10186002	NELAP	PA
5025 - n-Nitroso-di-n-butylamine	EPA 8270D	10186002	NELAP	PA
6545 - n-Nitrosodi-n-propylamine	EPA 8270D	10186002	NELAP	PA
6525 - n-Nitrosodiethylamine	EPA 8270D	10186002	NELAP	PA
6530 - n-Nitrosodimethylamine	EPA 8270D	10186002	NELAP	PA
6535 - n-Nitrosodiphenylamine	EPA 8270D	10186002	NELAP	PA
6550 - n-Nitrosomethylethylamine	EPA 8270D	10186002	NELAP	PA
6555 - n-Nitrosomorpholine	EPA 8270D	10186002	NELAP	PA
6560 - n-Nitrosopiperidine	EPA 8270D	10186002	NELAP	PA
6565 - n-Nitrosopyrrolidine	EPA 8270D	10186002	NELAP	PA
8290 - o,o,o-Triethyl phosphorothioate	EPA 8270D	10186002	NELAP	PA
8310 - tris-(2,3-Dibromopropyl) phosphate (tris-BP)	EPA 8270D	10186002	NELAP	PA
9519 - 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	EPA 8290A	10187403	NELAP	PA
9516 - 1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	EPA 8290A	10187403	NELAP	PA
9426 - 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	EPA 8290A	10187403	NELAP	PA
9420 - 1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	EPA 8290A	10187403	NELAP	PA
9423 - 1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	EPA 8290A	10187403	NELAP	PA
9453 - 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)	EPA 8290A	10187403	NELAP	PA
9471 - 1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)	EPA 8290A	10187403	NELAP	PA
9456 - 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin(1,2,3,6,7,8-Hxcdd)	EPA 8290A	10187403	NELAP	PA
9474 - 1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)	EPA 8290A	10187403	NELAP	PA
9459 - 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)	EPA 8290A	10187403	NELAP	PA
9477 - 1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)	EPA 8290A	10187403	NELAP	PA
9540 - 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)	EPA 8290A	10187403	NELAP	PA
9543 - 1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)	EPA 8290A	10187403	NELAP	PA
9480 - 2,3,4,6,7,8-Hexachlorodibenzofuran	EPA 8290A	10187403	NELAP	PA
9549 - 2,3,4,7,8-Pentachlorodibenzofuran	EPA 8290A	10187403	NELAP	PA
9612 - 2,3,7,8-Tetrachlorodibenzofuran	EPA 8290A	10187403	NELAP	PA

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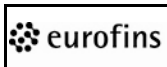
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Non Potable Water					
Analyte	Method Name	Method Code	Type	AB	
9438 - Total Hpcdd	EPA 8290A	10187403	NELAP	PA	
9444 - Total Hpcdf	EPA 8290A	10187403	NELAP	PA	
9468 - Total Hxcdd	EPA 8290A	10187403	NELAP	PA	
9483 - Total Hxcdf	EPA 8290A	10187403	NELAP	PA	
9555 - Total Pecdd	EPA 8290A	10187403	NELAP	PA	
9552 - Total Pecdf	EPA 8290A	10187403	NELAP	PA	
9609 - Total TCDD	EPA 8290A	10187403	NELAP	PA	
9615 - Total TCDF	EPA 8290A	10187403	NELAP	PA	
5500 - Acenaphthene	EPA 8310	10187607	NELAP	PA	
5505 - Acenaphthylene	EPA 8310	10187607	NELAP	PA	
5555 - Anthracene	EPA 8310	10187607	NELAP	PA	
5575 - Benzo(a)anthracene	EPA 8310	10187607	NELAP	PA	
5580 - Benzo(a)pyrene	EPA 8310	10187607	NELAP	PA	
5585 - Benzo(b)fluoranthene	EPA 8310	10187607	NELAP	PA	
5590 - Benzo(g,h,i)perylene	EPA 8310	10187607	NELAP	PA	
5600 - Benzo(k)fluoranthene	EPA 8310	10187607	NELAP	PA	
5855 - Chrysene	EPA 8310	10187607	NELAP	PA	
5895 - Dibenz(a,h) anthracene	EPA 8310	10187607	NELAP	PA	
6265 - Fluoranthene	EPA 8310	10187607	NELAP	PA	
6270 - Fluorene	EPA 8310	10187607	NELAP	PA	
6315 - Indeno(1,2,3-cd) pyrene	EPA 8310	10187607	NELAP	PA	
5005 - Naphthalene	EPA 8310	10187607	NELAP	PA	
6615 - Phenanthrene	EPA 8310	10187607	NELAP	PA	
6665 - Pyrene	EPA 8310	10187607	NELAP	PA	
6885 - 1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8330	10189807	NELAP	PA	
6160 - 1,3-Dinitrobenzene (1,3-DNB)	EPA 8330	10189807	NELAP	PA	
9651 - 2,4,6-Trinitrotoluene (2,4,6-TNT)	EPA 8330	10189807	NELAP	PA	
6185 - 2,4-Dinitrotoluene (2,4-DNT)	EPA 8330	10189807	NELAP	PA	
6190 - 2,6-Dinitrotoluene (2,6-DNT)	EPA 8330	10189807	NELAP	PA	
9303 - 2-Amino-4,6-dinitrotoluene (2-am-dnt)	EPA 8330	10189807	NELAP	PA	
9507 - 2-Nitrotoluene	EPA 8330	10189807	NELAP	PA	
9510 - 3-Nitrotoluene	EPA 8330	10189807	NELAP	PA	
9306 - 4-Amino-2,6-dinitrotoluene (4-am-dnt)	EPA 8330	10189807	NELAP	PA	
9513 - 4-Nitrotoluene	EPA 8330	10189807	NELAP	PA	
6415 - Methyl-2,4,6-trinitrophenylamine (tetryl)	EPA 8330	10189807	NELAP	PA	
5015 - Nitrobenzene	EPA 8330	10189807	NELAP	PA	
6485 - Nitroglycerin	EPA 8330	10189807	NELAP	PA	
9522 - Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	EPA 8330	10189807	NELAP	PA	
9558 - Pentaerythritoltetranitrate	EPA 8330	10189807	NELAP	PA	
9432 - RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	EPA 8330	10189807	NELAP	PA	
6885 - 1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8330A	10190008	NELAP	PA	
6160 - 1,3-Dinitrobenzene (1,3-DNB)	EPA 8330A	10190008	NELAP	PA	
9651 - 2,4,6-Trinitrotoluene (2,4,6-TNT)	EPA 8330A	10190008	NELAP	PA	
6185 - 2,4-Dinitrotoluene (2,4-DNT)	EPA 8330A	10190008	NELAP	PA	
6190 - 2,6-Dinitrotoluene (2,6-DNT)	EPA 8330A	10190008	NELAP	PA	
9303 - 2-Amino-4,6-dinitrotoluene (2-am-dnt)	EPA 8330A	10190008	NELAP	PA	
9507 - 2-Nitrotoluene	EPA 8330A	10190008	NELAP	PA	
9510 - 3-Nitrotoluene	EPA 8330A	10190008	NELAP	PA	
9306 - 4-Amino-2,6-dinitrotoluene (4-am-dnt)	EPA 8330A	10190008	NELAP	PA	

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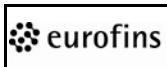
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Non Potable Water					
Analyte	Method Name	Method Code	Type	AB	
9513 - 4-Nitrotoluene	EPA 8330A	10190008	NELAP	PA	
6415 - Methyl-2,4,6-trinitrophenylnitramine (tetryl)	EPA 8330A	10190008	NELAP	PA	
5015 - Nitrobenzene	EPA 8330A	10190008	NELAP	PA	
6485 - Nitroglycerin	EPA 8330A	10190008	NELAP	PA	
9522 - Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	EPA 8330A	10190008	NELAP	PA	
9558 - Pentaerythritoltetranitrate	EPA 8330A	10190008	NELAP	PA	
9432 - RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	EPA 8330A	10190008	NELAP	PA	
6485 - Nitroglycerin	EPA 8332	10190406	NELAP	PA	
1645 - Total Cyanide	EPA 9012	10193201	NELAP	PA	
1645 - Total Cyanide	EPA 9012A	10193405	NELAP	PA	
1900 - pH	EPA 9040B	10197203	NELAP	PA	
1625 - Corrosivity (pH)	EPA 9045	10197805	NELAP	PA	
1900 - pH	EPA 9045	10197805	NELAP	PA	
1610 - Conductivity	EPA 9050	10198604	NELAP	PA	
1610 - Conductivity	EPA 9050A	10198808	NELAP	PA	
1540 - Bromide	EPA 9056	10199005	NELAP	PA	
1575 - Chloride	EPA 9056	10199403	NELAP	PA	
1730 - Fluoride	EPA 9056	10199403	NELAP	PA	
1805 - Nitrate	EPA 9056	10199403	NELAP	PA	
1835 - Nitrite	EPA 9056	10199403	NELAP	PA	
2000 - Sulfate	EPA 9056	10199403	NELAP	PA	
1575 - Chloride	EPA 9056A	10199607	NELAP	PA	
1730 - Fluoride	EPA 9056A	10199607	NELAP	PA	
1805 - Nitrate	EPA 9056A	10199607	NELAP	PA	
1835 - Nitrite	EPA 9056A	10199607	NELAP	PA	
1840 - Nitrite as N	EPA 9056A	10199607	NELAP	PA	
2000 - Sulfate	EPA 9056A	10199607	NELAP	PA	
2040 - Total Organic Carbon	EPA 9060	10200201	NELAP	PA	
1905 - Total Phenolics	EPA 9066	10200609	NELAP	PA	
4747 - Ethane	EPA RSK-175 (GC/FID)	10212905	NELAP	PA	
4926 - Methane	EPA RSK-175 (GC/FID)	10212905	NELAP	PA	
100263 - Propane	EPA RSK-175 (GC/FID)	10212905	NELAP	PA	
5029 - n-Propane	EPA RSK-175 (GC/FID)	10212905	NELAP	PA	
1095 - Mercury	EPA 1631E	10237204	NELAP	PA	
6380 - 1-Methylnaphthalene	EPA 8270C SIM	10242407	NELAP	PA	
5500 - Acenaphthene	EPA 8270C SIM	10242407	NELAP	PA	
5505 - Acenaphthylene	EPA 8270C SIM	10242407	NELAP	PA	
5555 - Anthracene	EPA 8270C SIM	10242407	NELAP	PA	
5575 - Benzo(a)anthracene	EPA 8270C SIM	10242407	NELAP	PA	
5580 - Benzo(a)pyrene	EPA 8270C SIM	10242407	NELAP	PA	
5585 - Benzo(b)fluoranthene	EPA 8270C SIM	10242407	NELAP	PA	
5590 - Benzo(g,h,i)perylene	EPA 8270C SIM	10242407	NELAP	PA	
5600 - Benzo(k)fluoranthene	EPA 8270C SIM	10242407	NELAP	PA	
5855 - Chrysene	EPA 8270C SIM	10242407	NELAP	PA	
5895 - Dibenz(a,h)anthracene	EPA 8270C SIM	10242407	NELAP	PA	
6265 - Fluoranthene	EPA 8270C SIM	10242407	NELAP	PA	
6270 - Fluorene	EPA 8270C SIM	10242407	NELAP	PA	
6315 - Indeno(1,2,3-cd)pyrene	EPA 8270C SIM	10242407	NELAP	PA	
5005 - Naphthalene	EPA 8270C SIM	10242407	NELAP	PA	
6615 - Phenanthrene	EPA 8270C SIM	10242407	NELAP	PA	
6665 - Pyrene	EPA 8270C SIM	10242407	NELAP	PA	
6380 - 1-Methylnaphthalene	EPA 8270D SIM	10242509	NELAP	PA	
5500 - Acenaphthene	EPA 8270D SIM	10242509	NELAP	PA	

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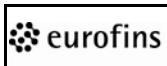
Certificate Number: 02055

AI Number: 30729
Expiration Date: June 30, 2015

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 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Non Potable Water

Analyte	Method Name	Method Code	Type	AB
5505 - Acenaphthylene	EPA 8270D SIM	10242509	NELAP	PA
5555 - Anthracene	EPA 8270D SIM	10242509	NELAP	PA
5575 - Benzo(a)anthracene	EPA 8270D SIM	10242509	NELAP	PA
5580 - Benzo(a)pyrene	EPA 8270D SIM	10242509	NELAP	PA
5585 - Benzo(b)fluoranthene	EPA 8270D SIM	10242509	NELAP	PA
5590 - Benzo(g,h,i)perylene	EPA 8270D SIM	10242509	NELAP	PA
5600 - Benzo(k)fluoranthene	EPA 8270D SIM	10242509	NELAP	PA
5855 - Chrysene	EPA 8270D SIM	10242509	NELAP	PA
5895 - Dibenz(a,h) anthracene	EPA 8270D SIM	10242509	NELAP	PA
6265 - Fluoranthene	EPA 8270D SIM	10242509	NELAP	PA
6270 - Fluorene	EPA 8270D SIM	10242509	NELAP	PA
6315 - Indeno(1,2,3-cd) pyrene	EPA 8270D SIM	10242509	NELAP	PA
5005 - Naphthalene	EPA 8270D SIM	10242509	NELAP	PA
6615 - Phenanthrene	EPA 8270D SIM	10242509	NELAP	PA
6665 - Pyrene	EPA 8270D SIM	10242509	NELAP	PA
1645 - Total Cyanide	EPA 9012B	10243206	NELAP	PA
1900 - pH	EPA 9040C	10244403	NELAP	PA
1575 - Chloride	EPA 300.0	10275408	NELAP	PA
1840 - Nitrite as N	EPA 300.0	10275408	NELAP	PA
2000 - Sulfate	EPA 300.0	10275408	NELAP	PA
1500 - Acidity, as CaCO ₃	SM 2310 B, 20th ED	20044206	NELAP	PA
100410 - Alkalinity, bicarbonate	SM 2320 B, 18th ED	20044808	NELAP	LA
100411 - Alkalinity, carbonate	SM 2320 B, 18th ED	20044808	NELAP	LA
1505 - Alkalinity as CaCO ₃	SM 2320 B, 20th ED	20045209	NELAP	PA
1755 - Total hardness as CaCO ₃	SM 2340 B, 19th ED	20046008	NELAP	PA
1755 - Total hardness as CaCO ₃	SM 2340 B, 20th ED	20046202	NELAP	PA
1955 - Residue-filterable (TDS)	SM 2340 C, 20th ED	20047205	NELAP	PA
1610 - Conductivity	SM 2510 B, 20th ED	20048208	NELAP	PA
1610 - Conductivity	SM 2510 B, 21st ED	20048402	NELAP	PA
1950 - Residue-total	SM 2540 B, 20th ED	20049007	NELAP	PA
1955 - Residue-filterable (TDS)	SM 2540 C, 20th ED	20050004	NELAP	PA
1960 - Residue-nonfilterable (TSS)	SM 2540 D, 20th ED	20050800	NELAP	PA
1965 - Residue-settleable	SM 2540 F, 20th ED	20051803	NELAP	PA
2030 - Temperature, deg. C	SM 2550 B, 20th ED	20052806	NELAP	PA
1575 - Chloride	SM 4500-Cl ⁻ C, 20th ED	20084804	NELAP	PA
1940 - Total residual chlorine	SM 4500-Cl ⁻ F, 20th ED	20087201	NELAP	PA
1645 - Total Cyanide	SM 4500-CN ⁻ C, 20th ED	20091605	NELAP	PA
1635 - Cyanide	SM 4500-CN ⁻ E, 20th ED	20092404	NELAP	PA
1510 - Amenable cyanide	SM 4500-CN ⁻ G, 20th ED	20093203	NELAP	PA
1730 - Fluoride	SM 4500-F ⁻ B, 20th ED	20101002	NELAP	PA
1900 - pH	SM 4500-H ⁺ B, 20th ED	20104807	NELAP	PA
1515 - Ammonia as N	SM 4500-NH ₃ B, 20th ED	20105606	NELAP	PA
1515 - Ammonia as N	SM 4500-NH ₃ C, 20th ED	20106405	NELAP	PA
1515 - Ammonia as N	SM 4500-NH ₃ D, 20th ED	20109006	NELAP	PA
1880 - Oxygen, dissolved	SM 4500-O G, 20th ED	20121204	NELAP	PA
1910 - Total Phosphorus	SM 4500-P B 5, 20th ED	20123200	NELAP	PA
1910 - Total Phosphorus	SM 4500-P E, 20th ED	20123802	NELAP	PA
1910 - Total Phosphorus	SM 4500-P F, 20th ED	20124601	NELAP	PA
2005 - Sulfide	SM 4500-S ₂ ⁻ D, 20th ED	20125400	NELAP	PA
2005 - Sulfide	SM 4500-S ₂ ⁻ F, 20th ED	20126209	NELAP	PA
1990 - Silica as SiO ₂	SM 4500-SiO ₂ C, 20th ED	20128205	NELAP	PA
1530 - Biochemical oxygen demand	SM 5210 B, 20th ED	20134809	NELAP	PA
1555 - Carbonaceous BOD, CBOD	SM 5210 B, 20th ED	20134809	NELAP	PA
2040 - Total Organic Carbon	SM 5310 B, 20th ED	20137400	NELAP	PA
2040 - Total Organic Carbon	SM 5310 C, 20th ED	20138403	NELAP	PA
2025 - Surfactants - MBAS	SM 5540 C, 20th ED	20144609	NELAP	PA

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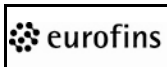
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Non Potable Water

Analyte	Method Name	Method Code	Type	AB
1605 - Color	SM 2120 B, 20th ED	20224004	NELAP	PA
6385 - 2-Methylnaphthalene	MADEP EPH, Rev.1.1	90017202	NELAP	PA
5500 - Acenaphthene	MADEP EPH, Rev.1.1	90017202	NELAP	PA
5505 - Acenaphthylene	MADEP EPH, Rev.1.1	90017202	NELAP	PA
5555 - Anthracene	MADEP EPH, Rev.1.1	90017202	NELAP	PA
5575 - Benzo(a)anthracene	MADEP EPH, Rev.1.1	90017202	NELAP	PA
5580 - Benzo(a)pyrene	MADEP EPH, Rev.1.1	90017202	NELAP	PA
5585 - Benzo(b)fluoranthene	MADEP EPH, Rev.1.1	90017202	NELAP	PA
5590 - Benzo(g,h,i)perylene	MADEP EPH, Rev.1.1	90017202	NELAP	PA
5600 - Benzo(k)fluoranthene	MADEP EPH, Rev.1.1	90017202	NELAP	PA
5855 - Chrysene	MADEP EPH, Rev.1.1	90017202	NELAP	PA
5895 - Dibenz(a,h) anthracene	MADEP EPH, Rev.1.1	90017202	NELAP	PA
6218 - EPH Aliphatic C19-C36	MADEP EPH, Rev.1.1	90017202	NELAP	PA
6222 - EPH Aliphatic C9-C18	MADEP EPH, Rev.1.1	90017202	NELAP	PA
6232 - EPH Aromatic C11-C22	MADEP EPH, Rev.1.1	90017202	NELAP	PA
6234 - EPH Aromatic C11-C22 Unadjusted	MADEP EPH, Rev.1.1	90017202	NELAP	PA
6265 - Fluoranthene	MADEP EPH, Rev.1.1	90017202	NELAP	PA
6270 - Fluorene	MADEP EPH, Rev.1.1	90017202	NELAP	PA
6315 - Indeno(1,2,3-cd) pyrene	MADEP EPH, Rev.1.1	90017202	NELAP	PA
5005 - Naphthalene	MADEP EPH, Rev.1.1	90017202	NELAP	PA
6615 - Phenanthrene	MADEP EPH, Rev.1.1	90017202	NELAP	PA
6665 - Pyrene	MADEP EPH, Rev.1.1	90017202	NELAP	PA
4375 - Benzene	MADEP VPH, Rev.1.1	90017406	NELAP	PA
4765 - Ethylbenzene	MADEP VPH, Rev.1.1	90017406	NELAP	PA
5000 - Methyl tert-butyl ether (MTBE)	MADEP VPH, Rev.1.1	90017406	NELAP	PA
5005 - Naphthalene	MADEP VPH, Rev.1.1	90017406	NELAP	PA
5140 - Toluene	MADEP VPH, Rev.1.1	90017406	NELAP	PA
5304 - VPH Aliphatic C5-C8	MADEP VPH, Rev.1.1	90017406	NELAP	PA
5305 - VPH Aliphatic C5-C8 Unadjusted	MADEP VPH, Rev.1.1	90017406	NELAP	PA
5306 - VPH Aliphatic C9-C12	MADEP VPH, Rev.1.1	90017406	NELAP	PA
5307 - VPH Aliphatic C9-C12 Unadjusted	MADEP VPH, Rev.1.1	90017406	NELAP	PA
5311 - VPH Aromatic C9-C10	MADEP VPH, Rev.1.1	90017406	NELAP	PA
5240 - m+p-xylene	MADEP VPH, Rev.1.1	90017406	NELAP	PA
5250 - o-Xylene	MADEP VPH, Rev.1.1	90017406	NELAP	PA
2050 - Total Petroleum Hydrocarbons (TPH)	TNRCC 1005, Rev.3	90019208	NELAP	PA

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
4330 - Acrylamide	EPA 8270C (extended)	2330	NELAP	PA
5570 - Benzaldehyde	EPA 8270C (extended)	2330	NELAP	PA
4330 - Acrylamide	EPA 8270D (extended)	2560	NELAP	PA
5570 - Benzaldehyde	EPA 8270D (extended)	2560	NELAP	PA
1780 - Ignitability	EPA 1010	10116606	NELAP	PA
1466 - Toxicity Characteristic Leaching Procedure (TCLP)	EPA 1311	10118806	NELAP	PA
1460 - Synthetic Precipitation Leaching Procedure	EPA 1312	10119003	NELAP	PA
100007 - Acid Digestion of Sediments, Sludges, and soils	EPA 3050B	10135601	NELAP	PA
1402 - Alkaline Digestion for Hexavalent Chromium	EPA 3060A	10136604	NELAP	PA
1444 - Separatory Funnel Liquid-liquid extraction	EPA 3510C	10138202	NELAP	PA

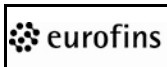
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Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
1452 - Soxhlet Extraction	EPA 3540C	10140202	NELAP	PA
1428 - Microwave Extraction	EPA 3546	10141205	NELAP	PA
1468 - Ultrasonic Extraction	EPA 3550C	10142004	NELAP	PA
1456 - Sulfur Clean-Up	EPA 3660B	10148400	NELAP	PA
2020 - Sulfuric acid/permanganate clean-up	EPA 3665	10148604	NELAP	PA
2020 - Sulfuric acid/permanganate clean-up	EPA 3665A	10148808	NELAP	PA
100017 - Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples	EPA 5030	10153001	NELAP	PA
1406 - Purge and trap for aqueous phase samples	EPA 5030	10153001	NELAP	PA
100017 - Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples	EPA 5035	10154004	NELAP	PA
1000 - Aluminum	EPA 6010B	10155609	NELAP	PA
1005 - Antimony	EPA 6010B	10155609	NELAP	PA
1010 - Arsenic	EPA 6010B	10155609	NELAP	PA
1015 - Barium	EPA 6010B	10155609	NELAP	PA
1020 - Beryllium	EPA 6010B	10155609	NELAP	PA
1025 - Boron	EPA 6010B	10155609	NELAP	PA
1030 - Cadmium	EPA 6010B	10155609	NELAP	PA
1035 - Calcium	EPA 6010B	10155609	NELAP	PA
1040 - Chromium	EPA 6010B	10155609	NELAP	PA
1050 - Cobalt	EPA 6010B	10155609	NELAP	PA
1055 - Copper	EPA 6010B	10155609	NELAP	PA
1070 - Iron	EPA 6010B	10155609	NELAP	PA
1075 - Lead	EPA 6010B	10155609	NELAP	PA
1080 - Lithium	EPA 6010B	10155609	NELAP	PA
1085 - Magnesium	EPA 6010B	10155609	NELAP	PA
1090 - Manganese	EPA 6010B	10155609	NELAP	PA
1100 - Molybdenum	EPA 6010B	10155609	NELAP	PA
1105 - Nickel	EPA 6010B	10155609	NELAP	PA
1125 - Potassium	EPA 6010B	10155609	NELAP	PA
1140 - Selenium	EPA 6010B	10155609	NELAP	PA
1150 - Silver	EPA 6010B	10155609	NELAP	PA
1155 - Sodium	EPA 6010B	10155609	NELAP	PA
1160 - Strontium	EPA 6010B	10155609	NELAP	PA
1165 - Thallium	EPA 6010B	10155609	NELAP	PA
1175 - Tin	EPA 6010B	10155609	NELAP	PA
1180 - Titanium	EPA 6010B	10155609	NELAP	PA
1185 - Vanadium	EPA 6010B	10155609	NELAP	PA
1190 - Zinc	EPA 6010B	10155609	NELAP	PA
1000 - Aluminum	EPA 6010C	10155803	NELAP	PA
1005 - Antimony	EPA 6010C	10155803	NELAP	PA
1010 - Arsenic	EPA 6010C	10155803	NELAP	PA
1015 - Barium	EPA 6010C	10155803	NELAP	PA
1020 - Beryllium	EPA 6010C	10155803	NELAP	PA
1025 - Boron	EPA 6010C	10155803	NELAP	PA
1030 - Cadmium	EPA 6010C	10155803	NELAP	PA
1035 - Calcium	EPA 6010C	10155803	NELAP	PA
1040 - Chromium	EPA 6010C	10155803	NELAP	PA
1050 - Cobalt	EPA 6010C	10155803	NELAP	PA
1055 - Copper	EPA 6010C	10155803	NELAP	PA
1070 - Iron	EPA 6010C	10155803	NELAP	PA
1075 - Lead	EPA 6010C	10155803	NELAP	PA
1080 - Lithium	EPA 6010C	10155803	NELAP	PA

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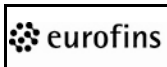
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 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
1085 - Magnesium	EPA 6010C	10155803	NELAP	PA
1090 - Manganese	EPA 6010C	10155803	NELAP	PA
1100 - Molybdenum	EPA 6010C	10155803	NELAP	PA
1105 - Nickel	EPA 6010C	10155803	NELAP	PA
1125 - Potassium	EPA 6010C	10155803	NELAP	PA
1140 - Selenium	EPA 6010C	10155803	NELAP	PA
1150 - Silver	EPA 6010C	10155803	NELAP	PA
1155 - Sodium	EPA 6010C	10155803	NELAP	PA
1160 - Strontium	EPA 6010C	10155803	NELAP	PA
2017 - Sulfur	EPA 6010C	10155803	NELAP	PA
1165 - Thallium	EPA 6010C	10155803	NELAP	PA
1175 - Tin	EPA 6010C	10155803	NELAP	PA
1180 - Titanium	EPA 6010C	10155803	NELAP	PA
1185 - Vanadium	EPA 6010C	10155803	NELAP	PA
1190 - Zinc	EPA 6010C	10155803	NELAP	PA
1000 - Aluminum	EPA 6020	10156000	NELAP	PA
1005 - Antimony	EPA 6020	10156000	NELAP	PA
1010 - Arsenic	EPA 6020	10156000	NELAP	PA
1015 - Barium	EPA 6020	10156000	NELAP	PA
1020 - Beryllium	EPA 6020	10156000	NELAP	PA
1030 - Cadmium	EPA 6020	10156000	NELAP	PA
1035 - Calcium	EPA 6020	10156000	NELAP	PA
1040 - Chromium	EPA 6020	10156000	NELAP	PA
1050 - Cobalt	EPA 6020	10156000	NELAP	PA
1055 - Copper	EPA 6020	10156000	NELAP	PA
1070 - Iron	EPA 6020	10156000	NELAP	PA
1075 - Lead	EPA 6020	10156000	NELAP	PA
1085 - Magnesium	EPA 6020	10156000	NELAP	PA
1090 - Manganese	EPA 6020	10156000	NELAP	PA
1100 - Molybdenum	EPA 6020	10156000	NELAP	PA
1105 - Nickel	EPA 6020	10156000	NELAP	PA
1125 - Potassium	EPA 6020	10156000	NELAP	PA
1140 - Selenium	EPA 6020	10156000	NELAP	PA
1150 - Silver	EPA 6020	10156000	NELAP	PA
1155 - Sodium	EPA 6020	10156000	NELAP	PA
1160 - Strontium	EPA 6020	10156000	NELAP	PA
1165 - Thallium	EPA 6020	10156000	NELAP	PA
1175 - Tin	EPA 6020	10156000	NELAP	PA
1185 - Vanadium	EPA 6020	10156000	NELAP	PA
1190 - Zinc	EPA 6020	10156000	NELAP	PA
1155 - Sodium	EPA 6020	10156204	NELAP	PA
1000 - Aluminum	EPA 6020A	10156408	NELAP	PA
1005 - Antimony	EPA 6020A	10156408	NELAP	PA
1010 - Arsenic	EPA 6020A	10156408	NELAP	PA
1015 - Barium	EPA 6020A	10156408	NELAP	PA
1020 - Beryllium	EPA 6020A	10156408	NELAP	PA
1030 - Cadmium	EPA 6020A	10156408	NELAP	PA
1035 - Calcium	EPA 6020A	10156408	NELAP	PA
1040 - Chromium	EPA 6020A	10156408	NELAP	PA
1050 - Cobalt	EPA 6020A	10156408	NELAP	PA
1055 - Copper	EPA 6020A	10156408	NELAP	PA
1070 - Iron	EPA 6020A	10156408	NELAP	PA
1075 - Lead	EPA 6020A	10156408	NELAP	PA
1085 - Magnesium	EPA 6020A	10156408	NELAP	PA
1090 - Manganese	EPA 6020A	10156408	NELAP	PA
1100 - Molybdenum	EPA 6020A	10156408	NELAP	PA

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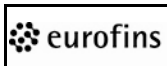
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Solid Chemical Materials					
Analyte	Method Name	Method Code	Type	AB	
1105 - Nickel	EPA 6020A	10156408	NELAP	PA	
1125 - Potassium	EPA 6020A	10156408	NELAP	PA	
1140 - Selenium	EPA 6020A	10156408	NELAP	PA	
1150 - Silver	EPA 6020A	10156408	NELAP	PA	
1155 - Sodium	EPA 6020A	10156408	NELAP	PA	
1160 - Strontium	EPA 6020A	10156408	NELAP	PA	
1165 - Thallium	EPA 6020A	10156408	NELAP	PA	
1175 - Tin	EPA 6020A	10156408	NELAP	PA	
1180 - Titanium	EPA 6020A	10156408	NELAP	PA	
1185 - Vanadium	EPA 6020A	10156408	NELAP	PA	
1190 - Zinc	EPA 6020A	10156408	NELAP	PA	
1045 - Chromium VI	EPA 7196A	10162400	NELAP	PA	
1045 - Chromium VI	EPA 7199	10163005	NELAP	PA	
1095 - Mercury	EPA 7471A	10166208	NELAP	PA	
1095 - Mercury	EPA 7471B	10166402	NELAP	PA	
9369 - Diesel range organics (DRO)	EPA 8015B	10173601	NELAP	PA	
4750 - Ethanol	EPA 8015B	10173601	NELAP	PA	
4785 - Ethylene glycol	EPA 8015B	10173601	NELAP	PA	
9408 - Gasoline range organics (GRO)	EPA 8015B	10173601	NELAP	PA	
4930 - Methanol	EPA 8015B	10173601	NELAP	PA	
9369 - Diesel range organics (DRO)	EPA 8015C	10173805	NELAP	PA	
4750 - Ethanol	EPA 8015C	10173805	NELAP	PA	
4785 - Ethylene glycol	EPA 8015C	10173805	NELAP	PA	
9408 - Gasoline range organics (GRO)	EPA 8015C	10173805	NELAP	PA	
4930 - Methanol	EPA 8015C	10173805	NELAP	PA	
4375 - Benzene	EPA 8021B	10174808	NELAP	PA	
4765 - Ethylbenzene	EPA 8021B	10174808	NELAP	PA	
4900 - Isopropylbenzene	EPA 8021B	10174808	NELAP	PA	
5000 - Methyl tert-butyl ether (MTBE)	EPA 8021B	10174808	NELAP	PA	
5005 - Naphthalene	EPA 8021B	10174808	NELAP	PA	
5140 - Toluene	EPA 8021B	10174808	NELAP	PA	
5260 - Xylene (total)	EPA 8021B	10174808	NELAP	PA	
5245 - m-Xylene	EPA 8021B	10174808	NELAP	PA	
5250 - o-Xylene	EPA 8021B	10174808	NELAP	PA	
5255 - p-Xylene	EPA 8021B	10174808	NELAP	PA	
7355 - 4,4'-DDD	EPA 8081A	10178606	NELAP	PA	
7360 - 4,4'-DDE	EPA 8081A	10178606	NELAP	PA	
7365 - 4,4'-DDT	EPA 8081A	10178606	NELAP	PA	
7025 - Aldrin	EPA 8081A	10178606	NELAP	PA	
7250 - Chlordane (tech.)	EPA 8081A	10178606	NELAP	PA	
7470 - Dieldrin	EPA 8081A	10178606	NELAP	PA	
7510 - Endosulfan I	EPA 8081A	10178606	NELAP	PA	
7515 - Endosulfan II	EPA 8081A	10178606	NELAP	PA	
7520 - Endosulfan sulfate	EPA 8081A	10178606	NELAP	PA	
7540 - Endrin	EPA 8081A	10178606	NELAP	PA	
7530 - Endrin aldehyde	EPA 8081A	10178606	NELAP	PA	
7535 - Endrin ketone	EPA 8081A	10178606	NELAP	PA	
7685 - Heptachlor	EPA 8081A	10178606	NELAP	PA	
7690 - Heptachlor epoxide	EPA 8081A	10178606	NELAP	PA	
7740 - Kepone	EPA 8081A	10178606	NELAP	PA	
7810 - Methoxychlor	EPA 8081A	10178606	NELAP	PA	
7870 - Mirex	EPA 8081A	10178606	NELAP	PA	
8250 - Toxaphene (Chlorinated camphene)	EPA 8081A	10178606	NELAP	PA	
7110 - alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8081A	10178606	NELAP	PA	
7240 - alpha-Chlordane	EPA 8081A	10178606	NELAP	PA	

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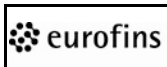
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AI Number: 30729
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 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
7115 - beta-BHC (beta-Hexachlorocyclohexane)	EPA 8081A	10178606	NELAP	PA
7105 - delta-BHC	EPA 8081A	10178606	NELAP	PA
7120 - gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)	EPA 8081A	10178606	NELAP	PA
7245 - gamma-Chlordane	EPA 8081A	10178606	NELAP	PA
7355 - 4,4'-DDD	EPA 8081B	10178800	NELAP	PA
7360 - 4,4'-DDE	EPA 8081B	10178800	NELAP	PA
7365 - 4,4'-DDT	EPA 8081B	10178800	NELAP	PA
7025 - Aldrin	EPA 8081B	10178800	NELAP	PA
7250 - Chlordane (tech.)	EPA 8081B	10178800	NELAP	PA
7470 - Dieldrin	EPA 8081B	10178800	NELAP	PA
7510 - Endosulfan I	EPA 8081B	10178800	NELAP	PA
7515 - Endosulfan II	EPA 8081B	10178800	NELAP	PA
7520 - Endosulfan sulfate	EPA 8081B	10178800	NELAP	PA
7540 - Endrin	EPA 8081B	10178800	NELAP	PA
7530 - Endrin aldehyde	EPA 8081B	10178800	NELAP	PA
7535 - Endrin ketone	EPA 8081B	10178800	NELAP	PA
7685 - Heptachlor	EPA 8081B	10178800	NELAP	PA
7690 - Heptachlor epoxide	EPA 8081B	10178800	NELAP	PA
7740 - Kepone	EPA 8081B	10178800	NELAP	PA
7810 - Methoxychlor	EPA 8081B	10178800	NELAP	PA
7870 - Mirex	EPA 8081B	10178800	NELAP	PA
8250 - Toxaphene (Chlorinated camphene)	EPA 8081B	10178800	NELAP	PA
7110 - alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8081B	10178800	NELAP	PA
7240 - alpha-Chlordane	EPA 8081B	10178800	NELAP	PA
7115 - beta-BHC (beta-Hexachlorocyclohexane)	EPA 8081B	10178800	NELAP	PA
7105 - delta-BHC	EPA 8081B	10178800	NELAP	PA
7120 - gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)	EPA 8081B	10178800	NELAP	PA
7245 - gamma-Chlordane	EPA 8081B	10178800	NELAP	PA
8880 - Aroclor-1016 (PCB-1016)	EPA 8082	10179007	NELAP	PA
8885 - Aroclor-1221 (PCB-1221)	EPA 8082	10179007	NELAP	PA
8890 - Aroclor-1232 (PCB-1232)	EPA 8082	10179007	NELAP	PA
8895 - Aroclor-1242 (PCB-1242)	EPA 8082	10179007	NELAP	PA
8900 - Aroclor-1248 (PCB-1248)	EPA 8082	10179007	NELAP	PA
8905 - Aroclor-1254 (PCB-1254)	EPA 8082	10179007	NELAP	PA
8910 - Aroclor-1260 (PCB-1260)	EPA 8082	10179007	NELAP	PA
8912 - Aroclor-1262 (PCB-1262)	EPA 8082	10179007	NELAP	PA
8913 - Aroclor-1268 (PCB-1268)	EPA 8082	10179007	NELAP	PA
8880 - Aroclor-1016 (PCB-1016)	EPA 8082A	10179201	NELAP	PA
8885 - Aroclor-1221 (PCB-1221)	EPA 8082A	10179201	NELAP	PA
8890 - Aroclor-1232 (PCB-1232)	EPA 8082A	10179201	NELAP	PA
8895 - Aroclor-1242 (PCB-1242)	EPA 8082A	10179201	NELAP	PA
8900 - Aroclor-1248 (PCB-1248)	EPA 8082A	10179201	NELAP	PA
8905 - Aroclor-1254 (PCB-1254)	EPA 8082A	10179201	NELAP	PA
8910 - Aroclor-1260 (PCB-1260)	EPA 8082A	10179201	NELAP	PA
8912 - Aroclor-1262 (PCB-1262)	EPA 8082A	10179201	NELAP	PA
8913 - Aroclor-1268 (PCB-1268)	EPA 8082A	10179201	NELAP	PA
7600 - Fensulfothion	EPA 8141	10181803	NELAP	PA
7785 - Merphos	EPA 8141	10181803	NELAP	PA
8140 - Stirophos	EPA 8141	10181803	NELAP	PA
7005 - Alachlor	EPA 8141A	10182000	NELAP	PA
7065 - Atrazine	EPA 8141A	10182000	NELAP	PA

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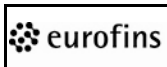
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Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
7075 - Azinphos-methyl (Guthion)	EPA 8141A	10182000	NELAP	PA
7125 - Bolstar (Sulprofos)	EPA 8141A	10182000	NELAP	PA
7300 - Chlorpyrifos	EPA 8141A	10182000	NELAP	PA
7395 - Demeton-o	EPA 8141A	10182000	NELAP	PA
7385 - Demeton-s	EPA 8141A	10182000	NELAP	PA
7410 - Diazinon	EPA 8141A	10182000	NELAP	PA
8610 - Dichlorovos (DDVP, Dichlorvos)	EPA 8141A	10182000	NELAP	PA
8625 - Disulfoton	EPA 8141A	10182000	NELAP	PA
7550 - EPN	EPA 8141A	10182000	NELAP	PA
7565 - Ethion	EPA 8141A	10182000	NELAP	PA
7570 - Ethoprop	EPA 8141A	10182000	NELAP	PA
7580 - Famphur	EPA 8141A	10182000	NELAP	PA
7600 - Fensulfothion	EPA 8141A	10182000	NELAP	PA
7605 - Fenthion	EPA 8141A	10182000	NELAP	PA
7770 - Malathion	EPA 8141A	10182000	NELAP	PA
7785 - Merphos	EPA 8141A	10182000	NELAP	PA
7825 - Methyl parathion (Parathion, methyl)	EPA 8141A	10182000	NELAP	PA
7850 - Mevinphos	EPA 8141A	10182000	NELAP	PA
7905 - Naled	EPA 8141A	10182000	NELAP	PA
7955 - Parathion, ethyl	EPA 8141A	10182000	NELAP	PA
7985 - Phorate	EPA 8141A	10182000	NELAP	PA
8110 - Ronnel	EPA 8141A	10182000	NELAP	PA
8125 - Simazine	EPA 8141A	10182000	NELAP	PA
7005 - Alachlor	EPA 8141B	10182204	NELAP	PA
7065 - Atrazine	EPA 8141B	10182204	NELAP	PA
7075 - Azinphos-methyl (Guthion)	EPA 8141B	10182204	NELAP	PA
7125 - Bolstar (Sulprofos)	EPA 8141B	10182204	NELAP	PA
7300 - Chlorpyrifos	EPA 8141B	10182204	NELAP	PA
7395 - Demeton-o	EPA 8141B	10182204	NELAP	PA
7385 - Demeton-s	EPA 8141B	10182204	NELAP	PA
7410 - Diazinon	EPA 8141B	10182204	NELAP	PA
8610 - Dichlorovos (DDVP, Dichlorvos)	EPA 8141B	10182204	NELAP	PA
8625 - Disulfoton	EPA 8141B	10182204	NELAP	PA
7550 - EPN	EPA 8141B	10182204	NELAP	PA
7565 - Ethion	EPA 8141B	10182204	NELAP	PA
7570 - Ethoprop	EPA 8141B	10182204	NELAP	PA
7580 - Famphur	EPA 8141B	10182204	NELAP	PA
7600 - Fensulfothion	EPA 8141B	10182204	NELAP	PA
7605 - Fenthion	EPA 8141B	10182204	NELAP	PA
7770 - Malathion	EPA 8141B	10182204	NELAP	PA
7785 - Merphos	EPA 8141B	10182204	NELAP	PA
7825 - Methyl parathion (Parathion, methyl)	EPA 8141B	10182204	NELAP	PA
7850 - Mevinphos	EPA 8141B	10182204	NELAP	PA
7905 - Naled	EPA 8141B	10182204	NELAP	PA
7955 - Parathion, ethyl	EPA 8141B	10182204	NELAP	PA
7985 - Phorate	EPA 8141B	10182204	NELAP	PA
8110 - Ronnel	EPA 8141B	10182204	NELAP	PA
8125 - Simazine	EPA 8141B	10182204	NELAP	PA
8655 - 2,4,5-T	EPA 8151	10183003	NELAP	PA
8545 - 2,4-D	EPA 8151	10183003	NELAP	PA
8560 - 2,4-DB	EPA 8151	10183003	NELAP	PA
8555 - Dalapon	EPA 8151	10183003	NELAP	PA
8595 - Dicamba	EPA 8151	10183003	NELAP	PA
8605 - Dichloroprop (Dichlorprop)	EPA 8151	10183003	NELAP	PA
8620 - Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8151	10183003	NELAP	PA

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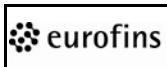
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Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
7775 - MCPA	EPA 8151	10183003	NELAP	PA
7780 - MCPP	EPA 8151	10183003	NELAP	PA
6605 - Pentachlorophenol	EPA 8151	10183003	NELAP	PA
8645 - Picloram	EPA 8151	10183003	NELAP	PA
8650 - Silvex (2,4,5-TP)	EPA 8151	10183003	NELAP	PA
8655 - 2,4,5-T	EPA 8151A	10183207	NELAP	PA
8545 - 2,4-D	EPA 8151A	10183207	NELAP	PA
8560 - 2,4-DB	EPA 8151A	10183207	NELAP	PA
8555 - Dalapon	EPA 8151A	10183207	NELAP	PA
8595 - Dicamba	EPA 8151A	10183207	NELAP	PA
8605 - Dichloroprop (Dichlorprop)	EPA 8151A	10183207	NELAP	PA
8620 - Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8151A	10183207	NELAP	PA
7775 - MCPA	EPA 8151A	10183207	NELAP	PA
7780 - MCPP	EPA 8151A	10183207	NELAP	PA
6605 - Pentachlorophenol	EPA 8151A	10183207	NELAP	PA
8645 - Picloram	EPA 8151A	10183207	NELAP	PA
8650 - Silvex (2,4,5-TP)	EPA 8151A	10183207	NELAP	PA
5105 - 1,1,1,2-Tetrachloroethane	EPA 8260	10184404	NELAP	PA
5160 - 1,1,1-Trichloroethane	EPA 8260	10184404	NELAP	PA
5110 - 1,1,2,2-Tetrachloroethane	EPA 8260	10184404	NELAP	PA
5185 - 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	EPA 8260	10184404	NELAP	PA
5165 - 1,1,2-Trichloroethane	EPA 8260	10184404	NELAP	PA
4630 - 1,1-Dichloroethane	EPA 8260	10184404	NELAP	PA
4640 - 1,1-Dichloroethylene	EPA 8260	10184404	NELAP	PA
4670 - 1,1-Dichloropropene	EPA 8260	10184404	NELAP	PA
5150 - 1,2,3-Trichlorobenzene	EPA 8260	10184404	NELAP	PA
5180 - 1,2,3-Trichloropropane	EPA 8260	10184404	NELAP	PA
5155 - 1,2,4-Trichlorobenzene	EPA 8260	10184404	NELAP	PA
5210 - 1,2,4-Trimethylbenzene	EPA 8260	10184404	NELAP	PA
4570 - 1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260	10184404	NELAP	PA
4585 - 1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8260	10184404	NELAP	PA
4610 - 1,2-Dichlorobenzene	EPA 8260	10184404	NELAP	PA
4635 - 1,2-Dichloroethane (Ethylene dichloride)	EPA 8260	10184404	NELAP	PA
4655 - 1,2-Dichloropropane	EPA 8260	10184404	NELAP	PA
5215 - 1,3,5-Trimethylbenzene	EPA 8260	10184404	NELAP	PA
4615 - 1,3-Dichlorobenzene	EPA 8260	10184404	NELAP	PA
4660 - 1,3-Dichloropropane	EPA 8260	10184404	NELAP	PA
4620 - 1,4-Dichlorobenzene	EPA 8260	10184404	NELAP	PA
4735 - 1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8260	10184404	NELAP	PA
4665 - 2,2-Dichloropropane	EPA 8260	10184404	NELAP	PA
4410 - 2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260	10184404	NELAP	PA
4500 - 2-Chloroethyl vinyl ether	EPA 8260	10184404	NELAP	PA
4535 - 2-Chlorotoluene	EPA 8260	10184404	NELAP	PA
4860 - 2-Hexanone	EPA 8260	10184404	NELAP	PA
4540 - 4-Chlorotoluene	EPA 8260	10184404	NELAP	PA
4910 - 4-Isopropyltoluene (p-Cymene)	EPA 8260	10184404	NELAP	PA
4995 - 4-Methyl-2-pentanone (MIBK)	EPA 8260	10184404	NELAP	PA
4315 - Acetone	EPA 8260	10184404	NELAP	PA
4320 - Acetonitrile	EPA 8260	10184404	NELAP	PA
4325 - Acrolein (Propenal)	EPA 8260	10184404	NELAP	PA

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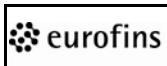
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Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
4340 - Acrylonitrile	EPA 8260	10184404	NELAP	PA
4355 - Allyl chloride (3-Chloropropene)	EPA 8260	10184404	NELAP	PA
4375 - Benzene	EPA 8260	10184404	NELAP	PA
5635 - Benzyl chloride	EPA 8260	10184404	NELAP	PA
4385 - Bromobenzene	EPA 8260	10184404	NELAP	PA
4390 - Bromochloromethane	EPA 8260	10184404	NELAP	PA
4395 - Bromodichloromethane	EPA 8260	10184404	NELAP	PA
4400 - Bromoform	EPA 8260	10184404	NELAP	PA
4450 - Carbon disulfide	EPA 8260	10184404	NELAP	PA
4455 - Carbon tetrachloride	EPA 8260	10184404	NELAP	PA
4475 - Chlorobenzene	EPA 8260	10184404	NELAP	PA
4575 - Chlorodibromomethane	EPA 8260	10184404	NELAP	PA
4485 - Chloroethane (Ethyl chloride)	EPA 8260	10184404	NELAP	PA
4505 - Chloroform	EPA 8260	10184404	NELAP	PA
4525 - Chloroprene (2-Chloro-1,3-butadiene)	EPA 8260	10184404	NELAP	PA
4555 - Cyclohexane	EPA 8260	10184404	NELAP	PA
9375 - Di-isopropylether (DIPE) (Isopropyl ether)	EPA 8260	10184404	NELAP	PA
4580 - Dibromochloropropane	EPA 8260	10184404	NELAP	PA
4595 - Dibromomethane (Methylene bromide)	EPA 8260	10184404	NELAP	PA
4625 - Dichlorodifluoromethane (Freon-12)	EPA 8260	10184404	NELAP	PA
4750 - Ethanol	EPA 8260	10184404	NELAP	PA
4755 - Ethyl acetate	EPA 8260	10184404	NELAP	PA
4810 - Ethyl methacrylate	EPA 8260	10184404	NELAP	PA
4770 - Ethyl-t-butyl ether (ETBE) (2-Ethoxy-2-methylpropane)	EPA 8260	10184404	NELAP	PA
4765 - Ethylbenzene	EPA 8260	10184404	NELAP	PA
9408 - Gasoline range organics (GRO)	EPA 8260	10184404	NELAP	PA
4835 - Hexachlorobutadiene	EPA 8260	10184404	NELAP	PA
4875 - Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8260	10184404	NELAP	PA
4895 - Isopropyl alcohol (2-Propanol, Isopropanol)	EPA 8260	10184404	NELAP	PA
4900 - Isopropylbenzene	EPA 8260	10184404	NELAP	PA
4925 - Methacrylonitrile	EPA 8260	10184404	NELAP	PA
4950 - Methyl bromide (Bromomethane)	EPA 8260	10184404	NELAP	PA
4960 - Methyl chloride (Chloromethane)	EPA 8260	10184404	NELAP	PA
5000 - Methyl tert-butyl ether (MTBE)	EPA 8260	10184404	NELAP	PA
4965 - Methylcyclohexane	EPA 8260	10184404	NELAP	PA
4975 - Methylene chloride (Dichloromethane)	EPA 8260	10184404	NELAP	PA
5005 - Naphthalene	EPA 8260	10184404	NELAP	PA
5035 - Pentachloroethane	EPA 8260	10184404	NELAP	PA
5080 - Propionitrile (Ethyl cyanide)	EPA 8260	10184404	NELAP	PA
5100 - Styrene	EPA 8260	10184404	NELAP	PA
4370 - T-amylmethylether (TAME)	EPA 8260	10184404	NELAP	PA
5115 - Tetrachloroethylene (Perchloroethylene)	EPA 8260	10184404	NELAP	PA
5140 - Toluene	EPA 8260	10184404	NELAP	PA
5170 - Trichloroethene (Trichloroethylene)	EPA 8260	10184404	NELAP	PA
5175 - Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	EPA 8260	10184404	NELAP	PA
5225 - Vinyl acetate	EPA 8260	10184404	NELAP	PA
5235 - Vinyl chloride	EPA 8260	10184404	NELAP	PA

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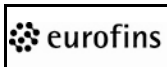
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	Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
5260 - Xylene (total)	EPA 8260	10184404	NELAP	PA
4680 - cis-1,3-Dichloropropene	EPA 8260	10184404	NELAP	PA
5240 - m+p-xylene	EPA 8260	10184404	NELAP	PA
4425 - n-Butyl alcohol (1-Butanol, n-Butanol)	EPA 8260	10184404	NELAP	PA
4435 - n-Butylbenzene	EPA 8260	10184404	NELAP	PA
5090 - n-Propylbenzene	EPA 8260	10184404	NELAP	PA
5250 - o-Xylene	EPA 8260	10184404	NELAP	PA
4440 - sec-Butylbenzene	EPA 8260	10184404	NELAP	PA
4420 - tert-Butyl alcohol	EPA 8260	10184404	NELAP	PA
4445 - tert-Butylbenzene	EPA 8260	10184404	NELAP	PA
4700 - trans-1,2-Dichloroethylene	EPA 8260	10184404	NELAP	PA
4685 - trans-1,3-Dichloropropylene	EPA 8260	10184404	NELAP	PA
4605 - trans-1,4-Dichloro-2-butene	EPA 8260	10184404	NELAP	PA
5105 - 1,1,1,2-Tetrachloroethane	EPA 8260B	10184802	NELAP	PA
5160 - 1,1,1-Trichloroethane	EPA 8260B	10184802	NELAP	PA
5110 - 1,1,2,2-Tetrachloroethane	EPA 8260B	10184802	NELAP	PA
5195 - 1,1,2-Trichloro-1,2,2-trifluoroethane	EPA 8260B	10184802	NELAP	PA
5185 - 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	EPA 8260B	10184802	NELAP	PA
5165 - 1,1,2-Trichloroethane	EPA 8260B	10184802	NELAP	PA
4630 - 1,1-Dichloroethane	EPA 8260B	10184802	NELAP	PA
4640 - 1,1-Dichloroethylene	EPA 8260B	10184802	NELAP	PA
4670 - 1,1-Dichloropropene	EPA 8260B	10184802	NELAP	PA
5150 - 1,2,3-Trichlorobenzene	EPA 8260B	10184802	NELAP	PA
5180 - 1,2,3-Trichloropropene	EPA 8260B	10184802	NELAP	PA
5155 - 1,2,4-Trichlorobenzene	EPA 8260B	10184802	NELAP	PA
5210 - 1,2,4-Trimethylbenzene	EPA 8260B	10184802	NELAP	PA
4570 - 1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260B	10184802	NELAP	PA
4585 - 1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8260B	10184802	NELAP	PA
4610 - 1,2-Dichlorobenzene	EPA 8260B	10184802	NELAP	PA
4635 - 1,2-Dichloroethane (Ethylene dichloride)	EPA 8260B	10184802	NELAP	PA
4655 - 1,2-Dichloropropane	EPA 8260B	10184802	NELAP	PA
5215 - 1,3,5-Trimethylbenzene	EPA 8260B	10184802	NELAP	PA
4615 - 1,3-Dichlorobenzene	EPA 8260B	10184802	NELAP	PA
4660 - 1,3-Dichloropropane	EPA 8260B	10184802	NELAP	PA
4620 - 1,4-Dichlorobenzene	EPA 8260B	10184802	NELAP	PA
4735 - 1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8260B	10184802	NELAP	PA
4665 - 2,2-Dichloropropane	EPA 8260B	10184802	NELAP	PA
4410 - 2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260B	10184802	NELAP	PA
4500 - 2-Chloroethyl vinyl ether	EPA 8260B	10184802	NELAP	PA
4535 - 2-Chlorotoluene	EPA 8260B	10184802	NELAP	PA
4860 - 2-Hexanone	EPA 8260B	10184802	NELAP	PA
4368 - 2-methyl-2-butanol (tert-Amyl alcohol)	EPA 8260B	10184802	NELAP	PA
4540 - 4-Chlorotoluene	EPA 8260B	10184802	NELAP	PA
4910 - 4-Isopropyltoluene (p-Cymene)	EPA 8260B	10184802	NELAP	PA
4995 - 4-Methyl-2-pentanone (MIBK)	EPA 8260B	10184802	NELAP	PA
4315 - Acetone	EPA 8260B	10184802	NELAP	PA
4320 - Acetonitrile	EPA 8260B	10184802	NELAP	PA
4325 - Acrolein (Propenal)	EPA 8260B	10184802	NELAP	PA
4340 - Acrylonitrile	EPA 8260B	10184802	NELAP	PA

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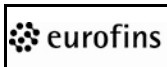
Certificate Number: 02055

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	Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
4355 - Allyl chloride (3-Chloropropene)	EPA 8260B	10184802	NELAP	PA
4375 - Benzene	EPA 8260B	10184802	NELAP	PA
5635 - Benzyl chloride	EPA 8260B	10184802	NELAP	PA
4380 - Bromoacetone	EPA 8260B	10184802	NELAP	PA
4385 - Bromobenzene	EPA 8260B	10184802	NELAP	PA
4390 - Bromochloromethane	EPA 8260B	10184802	NELAP	PA
4395 - Bromodichloromethane	EPA 8260B	10184802	NELAP	PA
4400 - Bromoform	EPA 8260B	10184802	NELAP	PA
4450 - Carbon disulfide	EPA 8260B	10184802	NELAP	PA
4455 - Carbon tetrachloride	EPA 8260B	10184802	NELAP	PA
4475 - Chlorobenzene	EPA 8260B	10184802	NELAP	PA
4575 - Chlorodibromomethane	EPA 8260B	10184802	NELAP	PA
4485 - Chloroethane (Ethyl chloride)	EPA 8260B	10184802	NELAP	PA
4505 - Chloroform	EPA 8260B	10184802	NELAP	PA
4525 - Chloroprene (2-Chloro-1,3-butadiene)	EPA 8260B	10184802	NELAP	PA
4555 - Cyclohexane	EPA 8260B	10184802	NELAP	PA
4560 - Cyclohexanone	EPA 8260B	10184802	NELAP	PA
9375 - Di-isopropylether (DIPE) (Isopropyl ether)	EPA 8260B	10184802	NELAP	PA
4580 - Dibromochloropropane	EPA 8260B	10184802	NELAP	PA
4595 - Dibromomethane (Methylene bromide)	EPA 8260B	10184802	NELAP	PA
4625 - Dichlorodifluoromethane (Freon-12)	EPA 8260B	10184802	NELAP	PA
4745 - Epichlorohydrin (1-Chloro-2,3-epoxypropane)	EPA 8260B	10184802	NELAP	PA
4750 - Ethanol	EPA 8260B	10184802	NELAP	PA
4755 - Ethyl acetate	EPA 8260B	10184802	NELAP	PA
4810 - Ethyl methacrylate	EPA 8260B	10184802	NELAP	PA
4770 - Ethyl-t-butyl ether (ETBE) (2-Ethoxy-2-methylpropane)	EPA 8260B	10184802	NELAP	PA
4765 - Ethylbenzene	EPA 8260B	10184802	NELAP	PA
9408 - Gasoline range organics (GRO)	EPA 8260B	10184802	NELAP	PA
4835 - Hexachlorobutadiene	EPA 8260B	10184802	NELAP	PA
4870 - Iodomethane (Methyl iodide)	EPA 8260B	10184802	NELAP	PA
4875 - Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8260B	10184802	NELAP	PA
4895 - Isopropyl alcohol (2-Propanol, Isopropanol)	EPA 8260B	10184802	NELAP	PA
4900 - Isopropylbenzene	EPA 8260B	10184802	NELAP	PA
4925 - Methacrylonitrile	EPA 8260B	10184802	NELAP	PA
4940 - Methyl acetate	EPA 8260B	10184802	NELAP	PA
4950 - Methyl bromide (Bromomethane)	EPA 8260B	10184802	NELAP	PA
4960 - Methyl chloride (Chloromethane)	EPA 8260B	10184802	NELAP	PA
5000 - Methyl tert-butyl ether (MTBE)	EPA 8260B	10184802	NELAP	PA
4965 - Methylcyclohexane	EPA 8260B	10184802	NELAP	PA
4975 - Methylene chloride (Dichloromethane)	EPA 8260B	10184802	NELAP	PA
5005 - Naphthalene	EPA 8260B	10184802	NELAP	PA
5035 - Pentachloroethane	EPA 8260B	10184802	NELAP	PA
5080 - Propionitrile (Ethyl cyanide)	EPA 8260B	10184802	NELAP	PA
5100 - Styrene	EPA 8260B	10184802	NELAP	PA
4370 - T-amylmethylether (TAME)	EPA 8260B	10184802	NELAP	PA
5115 - Tetrachloroethylene (Perchloroethylene)	EPA 8260B	10184802	NELAP	PA
5140 - Toluene	EPA 8260B	10184802	NELAP	PA

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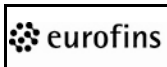
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AI Number: 30729
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Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
5170 - Trichloroethene (Trichloroethylene)	EPA 8260B	10184802	NELAP	PA
5175 - Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	EPA 8260B	10184802	NELAP	PA
5225 - Vinyl acetate	EPA 8260B	10184802	NELAP	PA
5235 - Vinyl chloride	EPA 8260B	10184802	NELAP	PA
5260 - Xylene (total)	EPA 8260B	10184802	NELAP	PA
4705 - cis & trans-1,2-Dichloroethene	EPA 8260B	10184802	NELAP	PA
4645 - cis-1,2-Dichloroethylene	EPA 8260B	10184802	NELAP	PA
4680 - cis-1,3-Dichloropropene	EPA 8260B	10184802	NELAP	PA
5240 - m+p-xylene	EPA 8260B	10184802	NELAP	PA
4425 - n-Butyl alcohol (1-Butanol, n-Butanol)	EPA 8260B	10184802	NELAP	PA
4435 - n-Butylbenzene	EPA 8260B	10184802	NELAP	PA
5090 - n-Propylbenzene	EPA 8260B	10184802	NELAP	PA
5250 - o-Xylene	EPA 8260B	10184802	NELAP	PA
4440 - sec-Butylbenzene	EPA 8260B	10184802	NELAP	PA
4420 - tert-Butyl alcohol	EPA 8260B	10184802	NELAP	PA
4445 - tert-Butylbenzene	EPA 8260B	10184802	NELAP	PA
4700 - trans-1,2-Dichloroethylene	EPA 8260B	10184802	NELAP	PA
4685 - trans-1,3-Dichloropropylene	EPA 8260B	10184802	NELAP	PA
4605 - trans-1,4-Dichloro-2-butene	EPA 8260B	10184802	NELAP	PA
5510 - Acetophenone	EPA 8270	10185203	NELAP	PA
5560 - Aramite	EPA 8270	10185203	NELAP	PA
5900 - Dibenz(a, j) acridine	EPA 8270	10185203	NELAP	PA
5765 - bis(2-Chloroethyl) ether	EPA 8270	10185203	NELAP	PA
6550 - n-Nitrosomethylethylamine	EPA 8270	10185203	NELAP	PA
6703 - 1,1'-Biphenyl (BZ-0)	EPA 8270C	10185805	NELAP	PA
6705 - 1,2,3,4-Tetrachlorobenzene	EPA 8270C	10185805	NELAP	PA
6710 - 1,2,3,5-Tetrachlorobenzene	EPA 8270C	10185805	NELAP	PA
6715 - 1,2,4,5-Tetrachlorobenzene	EPA 8270C	10185805	NELAP	PA
5155 - 1,2,4-Trichlorobenzene	EPA 8270C	10185805	NELAP	PA
4610 - 1,2-Dichlorobenzene	EPA 8270C	10185805	NELAP	PA
6155 - 1,2-Dinitrobenzene	EPA 8270C	10185805	NELAP	PA
6220 - 1,2-Diphenylhydrazine	EPA 8270C	10185805	NELAP	PA
6800 - 1,3,5-Trichlorobenzene	EPA 8270C	10185805	NELAP	PA
6885 - 1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8270C	10185805	NELAP	PA
4615 - 1,3-Dichlorobenzene	EPA 8270C	10185805	NELAP	PA
6160 - 1,3-Dinitrobenzene (1,3-DNB)	EPA 8270C	10185805	NELAP	PA
4620 - 1,4-Dichlorobenzene	EPA 8270C	10185805	NELAP	PA
6165 - 1,4-Dinitrobenzene	EPA 8270C	10185805	NELAP	PA
4735 - 1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8270C	10185805	NELAP	PA
6420 - 1,4-Naphthoquinone	EPA 8270C	10185805	NELAP	PA
6630 - 1,4-Phenylenediamine	EPA 8270C	10185805	NELAP	PA
5790 - 1-Chloronaphthalene	EPA 8270C	10185805	NELAP	PA
6380 - 1-Methylnaphthalene	EPA 8270C	10185805	NELAP	PA
6425 - 1-Naphthylamine	EPA 8270C	10185805	NELAP	PA
6735 - 2,3,4,6-Tetrachlorophenol	EPA 8270C	10185805	NELAP	PA
6835 - 2,4,5-Trichlorophenol	EPA 8270C	10185805	NELAP	PA
6840 - 2,4,6-Trichlorophenol	EPA 8270C	10185805	NELAP	PA
6000 - 2,4-Dichlorophenol	EPA 8270C	10185805	NELAP	PA
6130 - 2,4-Dimethylphenol	EPA 8270C	10185805	NELAP	PA
6175 - 2,4-Dinitrophenol	EPA 8270C	10185805	NELAP	PA
6185 - 2,4-Dinitrotoluene (2,4-DNT)	EPA 8270C	10185805	NELAP	PA
6005 - 2,6-Dichlorophenol	EPA 8270C	10185805	NELAP	PA
6190 - 2,6-Dinitrotoluene (2,6-DNT)	EPA 8270C	10185805	NELAP	PA
5515 - 2-Acetylaminofluorene	EPA 8270C	10185805	NELAP	PA

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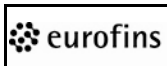
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Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
5795 - 2-Chloronaphthalene	EPA 8270C	10185805	NELAP	PA
5800 - 2-Chlorophenol	EPA 8270C	10185805	NELAP	PA
6360 - 2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	EPA 8270C	10185805	NELAP	PA
5145 - 2-Methylaniline (o-Toluidine)	EPA 8270C	10185805	NELAP	PA
6385 - 2-Methylnaphthalene	EPA 8270C	10185805	NELAP	PA
6400 - 2-Methylphenol (o-Cresol)	EPA 8270C	10185805	NELAP	PA
6430 - 2-Naphthylamine	EPA 8270C	10185805	NELAP	PA
6460 - 2-Nitroaniline	EPA 8270C	10185805	NELAP	PA
6490 - 2-Nitrophenol	EPA 8270C	10185805	NELAP	PA
5050 - 2-Picoline (2-Methylpyridine)	EPA 8270C	10185805	NELAP	PA
5945 - 3,3'-Dichlorobenzidine	EPA 8270C	10185805	NELAP	PA
6100 - 3,3'-Dimethoxybenzidine	EPA 8270C	10185805	NELAP	PA
6120 - 3,3'-Dimethylbenzidine	EPA 8270C	10185805	NELAP	PA
6355 - 3-Methylcholanthrene	EPA 8270C	10185805	NELAP	PA
6405 - 3-Methylphenol (m-Cresol)	EPA 8270C	10185805	NELAP	PA
6465 - 3-Nitroaniline	EPA 8270C	10185805	NELAP	PA
6365 - 4,4'-Methylenebis(2-chloroaniline)	EPA 8270C	10185805	NELAP	PA
5540 - 4-Aminobiphenyl	EPA 8270C	10185805	NELAP	PA
5660 - 4-Bromophenyl phenyl ether	EPA 8270C	10185805	NELAP	PA
5700 - 4-Chloro-3-methylphenol	EPA 8270C	10185805	NELAP	PA
5745 - 4-Chloroaniline	EPA 8270C	10185805	NELAP	PA
5825 - 4-Chlorophenyl phenylether	EPA 8270C	10185805	NELAP	PA
6410 - 4-Methylphenol (p-Cresol)	EPA 8270C	10185805	NELAP	PA
6470 - 4-Nitroaniline	EPA 8270C	10185805	NELAP	PA
6500 - 4-Nitrophenol	EPA 8270C	10185805	NELAP	PA
6510 - 4-Nitroquinoline 1-oxide	EPA 8270C	10185805	NELAP	PA
6570 - 5-Nitro-o-toluidine	EPA 8270C	10185805	NELAP	PA
6115 - 7,12-Dimethylbenz(a) anthracene	EPA 8270C	10185805	NELAP	PA
5500 - Acenaphthene	EPA 8270C	10185805	NELAP	PA
5505 - Acenaphthylene	EPA 8270C	10185805	NELAP	PA
5510 - Acetophenone	EPA 8270C	10185805	NELAP	PA
5545 - Aniline	EPA 8270C	10185805	NELAP	PA
5555 - Anthracene	EPA 8270C	10185805	NELAP	PA
5560 - Aramite	EPA 8270C	10185805	NELAP	PA
7065 - Atrazine	EPA 8270C	10185805	NELAP	PA
5570 - Benzaldehyde	EPA 8270C	10185805	NELAP	PA
5567 - Benzenethiol	EPA 8270C	10185805	NELAP	PA
5595 - Benzidine	EPA 8270C	10185805	NELAP	PA
5575 - Benzo(a)anthracene	EPA 8270C	10185805	NELAP	PA
5580 - Benzo(a)pyrene	EPA 8270C	10185805	NELAP	PA
5585 - Benzo(b)fluoranthene	EPA 8270C	10185805	NELAP	PA
5590 - Benzo(g,h,i)perylene	EPA 8270C	10185805	NELAP	PA
5600 - Benzo(k)fluoranthene	EPA 8270C	10185805	NELAP	PA
5610 - Benzoic acid	EPA 8270C	10185805	NELAP	PA
5630 - Benzyl alcohol	EPA 8270C	10185805	NELAP	PA
5670 - Butyl benzyl phthalate	EPA 8270C	10185805	NELAP	PA
7180 - Caprolactam	EPA 8270C	10185805	NELAP	PA
5680 - Carbazole	EPA 8270C	10185805	NELAP	PA
7260 - Chlorobenzilate	EPA 8270C	10185805	NELAP	PA
5855 - Chrysene	EPA 8270C	10185805	NELAP	PA
6065 - Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)	EPA 8270C	10185805	NELAP	PA
5925 - Di-n-butyl phthalate	EPA 8270C	10185805	NELAP	PA
6200 - Di-n-octyl phthalate	EPA 8270C	10185805	NELAP	PA
7405 - Diallyl	EPA 8270C	10185805	NELAP	PA

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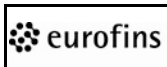
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 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Solid Chemical Materials					
Analyte	Method Name	Method Code	Type	AB	
9354 - Dibenz(a, h) acridine	EPA 8270C	10185805	NELAP	PA	
5900 - Dibenz(a, j) acridine	EPA 8270C	10185805	NELAP	PA	
5895 - Dibenz(a,h) anthracene	EPA 8270C	10185805	NELAP	PA	
5905 - Dibenzofuran	EPA 8270C	10185805	NELAP	PA	
6070 - Diethyl phthalate	EPA 8270C	10185805	NELAP	PA	
7475 - Dimethoate	EPA 8270C	10185805	NELAP	PA	
6135 - Dimethyl phthalate	EPA 8270C	10185805	NELAP	PA	
8620 - Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8270C	10185805	NELAP	PA	
6205 - Diphenylamine	EPA 8270C	10185805	NELAP	PA	
8625 - Disulfoton	EPA 8270C	10185805	NELAP	PA	
6260 - Ethyl methanesulfonate	EPA 8270C	10185805	NELAP	PA	
7580 - Fampdur	EPA 8270C	10185805	NELAP	PA	
6265 - Fluoranthene	EPA 8270C	10185805	NELAP	PA	
6270 - Fluorene	EPA 8270C	10185805	NELAP	PA	
6275 - Hexachlorobenzene	EPA 8270C	10185805	NELAP	PA	
4835 - Hexachlorobutadiene	EPA 8270C	10185805	NELAP	PA	
6285 - Hexachlorocyclopentadiene	EPA 8270C	10185805	NELAP	PA	
4840 - Hexachloroethane	EPA 8270C	10185805	NELAP	PA	
6295 - Hexachloropropene	EPA 8270C	10185805	NELAP	PA	
6312 - Indene	EPA 8270C	10185805	NELAP	PA	
6315 - Indeno(1,2,3-cd) pyrene	EPA 8270C	10185805	NELAP	PA	
7725 - Isodrin	EPA 8270C	10185805	NELAP	PA	
6320 - Isophorone	EPA 8270C	10185805	NELAP	PA	
6325 - Isosaffrole	EPA 8270C	10185805	NELAP	PA	
7740 - Kepone	EPA 8270C	10185805	NELAP	PA	
6345 - Methapyrilene	EPA 8270C	10185805	NELAP	PA	
6375 - Methyl methanesulfonate	EPA 8270C	10185805	NELAP	PA	
7825 - Methyl parathion (Parathion, methyl)	EPA 8270C	10185805	NELAP	PA	
5005 - Naphthalene	EPA 8270C	10185805	NELAP	PA	
5015 - Nitrobenzene	EPA 8270C	10185805	NELAP	PA	
7955 - Parathion, ethyl	EPA 8270C	10185805	NELAP	PA	
6590 - Pentachlorobenzene	EPA 8270C	10185805	NELAP	PA	
6600 - Pentachloronitrobenzene	EPA 8270C	10185805	NELAP	PA	
6605 - Pentachlorophenol	EPA 8270C	10185805	NELAP	PA	
6610 - Phenacetin	EPA 8270C	10185805	NELAP	PA	
6615 - Phenanthrene	EPA 8270C	10185805	NELAP	PA	
6625 - Phenol	EPA 8270C	10185805	NELAP	PA	
7985 - Phorate	EPA 8270C	10185805	NELAP	PA	
6640 - Phthalic anhydride	EPA 8270C	10185805	NELAP	PA	
6650 - Pronamide (Kerb)	EPA 8270C	10185805	NELAP	PA	
6665 - Pyrene	EPA 8270C	10185805	NELAP	PA	
5095 - Pyridine	EPA 8270C	10185805	NELAP	PA	
6670 - Quinoline	EPA 8270C	10185805	NELAP	PA	
6685 - Saftrole	EPA 8270C	10185805	NELAP	PA	
8235 - Thionazin (Zinophos)	EPA 8270C	10185805	NELAP	PA	
6125 - a-a-Dimethylphenethylamine	EPA 8270C	10185805	NELAP	PA	
5760 - bis(2-Chloroethoxy)methane	EPA 8270C	10185805	NELAP	PA	
5765 - bis(2-Chloroethyl) ether	EPA 8270C	10185805	NELAP	PA	
5780 - bis(2-Chloroisopropyl) ether	EPA 8270C	10185805	NELAP	PA	
6245 - bis(2-Ethoxyethyl) phthalate	EPA 8270C	10185805	NELAP	PA	
6062 - bis(2-Ethylhexyl)adipate	EPA 8270C	10185805	NELAP	PA	
5025 - n-Nitroso-di-n-butylamine	EPA 8270C	10185805	NELAP	PA	
6545 - n-Nitrosodi-n-propylamine	EPA 8270C	10185805	NELAP	PA	
6525 - n-Nitrosodiethylamine	EPA 8270C	10185805	NELAP	PA	
6530 - n-Nitrosodimethylamine	EPA 8270C	10185805	NELAP	PA	

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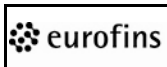
Certificate Number: 02055

AI Number: 30729
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 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
6535 - n-Nitrosodiphenylamine	EPA 8270C	10185805	NELAP	PA
6550 - n-Nitrosomethylethylamine	EPA 8270C	10185805	NELAP	PA
6555 - n-Nitrosomorpholine	EPA 8270C	10185805	NELAP	PA
6560 - n-Nitrosopiperidine	EPA 8270C	10185805	NELAP	PA
6565 - n-Nitrosopyrrolidine	EPA 8270C	10185805	NELAP	PA
8290 - o,o,o-Triethyl phosphorothioate	EPA 8270C	10185805	NELAP	PA
8310 - tris-(2,3-Dibromopropyl) phosphate (tris-BP)	EPA 8270C	10185805	NELAP	PA
6703 - 1,1'-Biphenyl (BZ-0)	EPA 8270D	10186002	NELAP	PA
6705 - 1,2,3,4-Tetrachlorobenzene	EPA 8270D	10186002	NELAP	PA
6710 - 1,2,3,5-Tetrachlorobenzene	EPA 8270D	10186002	NELAP	PA
6715 - 1,2,4,5-Tetrachlorobenzene	EPA 8270D	10186002	NELAP	PA
5155 - 1,2,4-Trichlorobenzene	EPA 8270D	10186002	NELAP	PA
4610 - 1,2-Dichlorobenzene	EPA 8270D	10186002	NELAP	PA
6155 - 1,2-Dinitrobenzene	EPA 8270D	10186002	NELAP	PA
6220 - 1,2-Diphenylhydrazine	EPA 8270D	10186002	NELAP	PA
6800 - 1,3,5-Trichlorobenzene	EPA 8270D	10186002	NELAP	PA
6885 - 1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8270D	10186002	NELAP	PA
4615 - 1,3-Dichlorobenzene	EPA 8270D	10186002	NELAP	PA
6160 - 1,3-Dinitrobenzene (1,3-DNB)	EPA 8270D	10186002	NELAP	PA
4620 - 1,4-Dichlorobenzene	EPA 8270D	10186002	NELAP	PA
6165 - 1,4-Dinitrobenzene	EPA 8270D	10186002	NELAP	PA
4735 - 1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8270D	10186002	NELAP	PA
6420 - 1,4-Naphthoquinone	EPA 8270D	10186002	NELAP	PA
6630 - 1,4-Phenylenediamine	EPA 8270D	10186002	NELAP	PA
5790 - 1-Chloronaphthalene	EPA 8270D	10186002	NELAP	PA
6380 - 1-Methylnaphthalene	EPA 8270D	10186002	NELAP	PA
6425 - 1-Naphthylamine	EPA 8270D	10186002	NELAP	PA
6735 - 2,3,4,6-Tetrachlorophenol	EPA 8270D	10186002	NELAP	PA
6835 - 2,4,5-Trichlorophenol	EPA 8270D	10186002	NELAP	PA
6840 - 2,4,6-Trichlorophenol	EPA 8270D	10186002	NELAP	PA
6000 - 2,4-Dichlorophenol	EPA 8270D	10186002	NELAP	PA
6130 - 2,4-Dimethylphenol	EPA 8270D	10186002	NELAP	PA
6175 - 2,4-Dinitrophenol	EPA 8270D	10186002	NELAP	PA
6185 - 2,4-Dinitrotoluene (2,4-DNT)	EPA 8270D	10186002	NELAP	PA
6005 - 2,6-Dichlorophenol	EPA 8270D	10186002	NELAP	PA
6190 - 2,6-Dinitrotoluene (2,6-DNT)	EPA 8270D	10186002	NELAP	PA
5515 - 2-Acetylaminofluorene	EPA 8270D	10186002	NELAP	PA
5795 - 2-Chloronaphthalene	EPA 8270D	10186002	NELAP	PA
5800 - 2-Chlorophenol	EPA 8270D	10186002	NELAP	PA
6360 - 2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	EPA 8270D	10186002	NELAP	PA
5145 - 2-Methylaniline (o-Toluidine)	EPA 8270D	10186002	NELAP	PA
6385 - 2-Methylnaphthalene	EPA 8270D	10186002	NELAP	PA
6400 - 2-Methylphenol (o-Cresol)	EPA 8270D	10186002	NELAP	PA
6430 - 2-Naphthylamine	EPA 8270D	10186002	NELAP	PA
6460 - 2-Nitroaniline	EPA 8270D	10186002	NELAP	PA
6490 - 2-Nitrophenol	EPA 8270D	10186002	NELAP	PA
5050 - 2-Picoline (2-Methylpyridine)	EPA 8270D	10186002	NELAP	PA
5945 - 3,3'-Dichlorobenzidine	EPA 8270D	10186002	NELAP	PA
6100 - 3,3'-Dimethoxybenzidine	EPA 8270D	10186002	NELAP	PA
6120 - 3,3'-Dimethylbenzidine	EPA 8270D	10186002	NELAP	PA
6355 - 3-Methylcholanthrene	EPA 8270D	10186002	NELAP	PA
6405 - 3-Methylphenol (m-Cresol)	EPA 8270D	10186002	NELAP	PA
6465 - 3-Nitroaniline	EPA 8270D	10186002	NELAP	PA
6365 - 4,4'-Methylenebis(2-chloroaniline)	EPA 8270D	10186002	NELAP	PA

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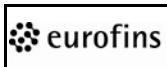
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Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
5540 - 4-Aminobiphenyl	EPA 8270D	10186002	NELAP	PA
5660 - 4-Bromophenyl phenyl ether	EPA 8270D	10186002	NELAP	PA
5700 - 4-Chloro-3-methylphenol	EPA 8270D	10186002	NELAP	PA
5745 - 4-Chloroaniline	EPA 8270D	10186002	NELAP	PA
5825 - 4-Chlorophenyl phenylether	EPA 8270D	10186002	NELAP	PA
6410 - 4-Methylphenol (p-Cresol)	EPA 8270D	10186002	NELAP	PA
6470 - 4-Nitroaniline	EPA 8270D	10186002	NELAP	PA
6500 - 4-Nitrophenol	EPA 8270D	10186002	NELAP	PA
6510 - 4-Nitroquinoline 1-oxide	EPA 8270D	10186002	NELAP	PA
6570 - 5-Nitro-o-toluidine	EPA 8270D	10186002	NELAP	PA
6115 - 7,12-Dimethylbenz(a) anthracene	EPA 8270D	10186002	NELAP	PA
5500 - Acenaphthene	EPA 8270D	10186002	NELAP	PA
5505 - Acenaphthylene	EPA 8270D	10186002	NELAP	PA
5510 - Acetophenone	EPA 8270D	10186002	NELAP	PA
5545 - Aniline	EPA 8270D	10186002	NELAP	PA
5555 - Anthracene	EPA 8270D	10186002	NELAP	PA
5560 - Aramite	EPA 8270D	10186002	NELAP	PA
7065 - Atrazine	EPA 8270D	10186002	NELAP	PA
5567 - Benzenethiol	EPA 8270D	10186002	NELAP	PA
5595 - Benzidine	EPA 8270D	10186002	NELAP	PA
5575 - Benzo(a)anthracene	EPA 8270D	10186002	NELAP	PA
5580 - Benzo(a)pyrene	EPA 8270D	10186002	NELAP	PA
5585 - Benzo(b)fluoranthene	EPA 8270D	10186002	NELAP	PA
5590 - Benzo(g,h,i)perylene	EPA 8270D	10186002	NELAP	PA
5600 - Benzo(k)fluoranthene	EPA 8270D	10186002	NELAP	PA
5610 - Benzoic acid	EPA 8270D	10186002	NELAP	PA
5630 - Benzyl alcohol	EPA 8270D	10186002	NELAP	PA
5670 - Butyl benzyl phthalate	EPA 8270D	10186002	NELAP	PA
7180 - Caprolactam	EPA 8270D	10186002	NELAP	PA
5680 - Carbazole	EPA 8270D	10186002	NELAP	PA
7260 - Chlorobenzilate	EPA 8270D	10186002	NELAP	PA
5855 - Chrysene	EPA 8270D	10186002	NELAP	PA
6065 - Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)	EPA 8270D	10186002	NELAP	PA
5925 - Di-n-butyl phthalate	EPA 8270D	10186002	NELAP	PA
6200 - Di-n-octyl phthalate	EPA 8270D	10186002	NELAP	PA
7405 - Diallate	EPA 8270D	10186002	NELAP	PA
9354 - Dibenz(a, h) acridine	EPA 8270D	10186002	NELAP	PA
5900 - Dibenz(a, j) acridine	EPA 8270D	10186002	NELAP	PA
5895 - Dibenz(a,h) anthracene	EPA 8270D	10186002	NELAP	PA
5905 - Dibenzofuran	EPA 8270D	10186002	NELAP	PA
6070 - Diethyl phthalate	EPA 8270D	10186002	NELAP	PA
7475 - Dimethoate	EPA 8270D	10186002	NELAP	PA
6135 - Dimethyl phthalate	EPA 8270D	10186002	NELAP	PA
8620 - Dimoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8270D	10186002	NELAP	PA
6205 - Diphenylamine	EPA 8270D	10186002	NELAP	PA
8625 - Disulfoton	EPA 8270D	10186002	NELAP	PA
6260 - Ethyl methanesulfonate	EPA 8270D	10186002	NELAP	PA
7580 - Famphur	EPA 8270D	10186002	NELAP	PA
6265 - Fluoranthene	EPA 8270D	10186002	NELAP	PA
6270 - Fluorene	EPA 8270D	10186002	NELAP	PA
6275 - Hexachlorobenzene	EPA 8270D	10186002	NELAP	PA
4835 - Hexachlorobutadiene	EPA 8270D	10186002	NELAP	PA
6285 - Hexachlorocyclopentadiene	EPA 8270D	10186002	NELAP	PA
4840 - Hexachloroethane	EPA 8270D	10186002	NELAP	PA

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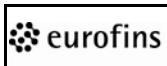
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Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
6295 - Hexachloropropene	EPA 8270D	10186002	NELAP	PA
6312 - Indene	EPA 8270D	10186002	NELAP	PA
6315 - Indeno(1,2,3-cd) pyrene	EPA 8270D	10186002	NELAP	PA
6320 - Isophorone	EPA 8270D	10186002	NELAP	PA
6325 - Isosafrole	EPA 8270D	10186002	NELAP	PA
6345 - Methapyrilene	EPA 8270D	10186002	NELAP	PA
6375 - Methyl methanesulfonate	EPA 8270D	10186002	NELAP	PA
7825 - Methyl parathion (Parathion, methyl)	EPA 8270D	10186002	NELAP	PA
5005 - Naphthalene	EPA 8270D	10186002	NELAP	PA
5015 - Nitrobenzene	EPA 8270D	10186002	NELAP	PA
7955 - Parathion, ethyl	EPA 8270D	10186002	NELAP	PA
6590 - Pentachlorobenzene	EPA 8270D	10186002	NELAP	PA
6600 - Pentachloronitrobenzene	EPA 8270D	10186002	NELAP	PA
6605 - Pentachlorophenol	EPA 8270D	10186002	NELAP	PA
6610 - Phenacetin	EPA 8270D	10186002	NELAP	PA
6615 - Phenanthrene	EPA 8270D	10186002	NELAP	PA
6625 - Phenol	EPA 8270D	10186002	NELAP	PA
7985 - Phorate	EPA 8270D	10186002	NELAP	PA
6640 - Phthalic anhydride	EPA 8270D	10186002	NELAP	PA
6650 - Pronamide (Kerb)	EPA 8270D	10186002	NELAP	PA
6665 - Pyrene	EPA 8270D	10186002	NELAP	PA
5095 - Pyridine	EPA 8270D	10186002	NELAP	PA
6670 - Quinoline	EPA 8270D	10186002	NELAP	PA
6685 - Safrole	EPA 8270D	10186002	NELAP	PA
8235 - Thionazin (Zinophos)	EPA 8270D	10186002	NELAP	PA
6125 - a-a-Dimethylphenethylamine	EPA 8270D	10186002	NELAP	PA
5760 - bis(2-Chloroethoxy)methane	EPA 8270D	10186002	NELAP	PA
5765 - bis(2-Chloroethyl) ether	EPA 8270D	10186002	NELAP	PA
5780 - bis(2-Chloroisopropyl) ether	EPA 8270D	10186002	NELAP	PA
6062 - bis(2-Ethylhexyl)adipate	EPA 8270D	10186002	NELAP	PA
5025 - n-Nitroso-di-n-butylamine	EPA 8270D	10186002	NELAP	PA
6545 - n-Nitrosodi-n-propylamine	EPA 8270D	10186002	NELAP	PA
6525 - n-Nitrosodiethylamine	EPA 8270D	10186002	NELAP	PA
6530 - n-Nitrosodimethylamine	EPA 8270D	10186002	NELAP	PA
6535 - n-Nitrosodiphenylamine	EPA 8270D	10186002	NELAP	PA
6550 - n-Nitrosomethylethylamine	EPA 8270D	10186002	NELAP	PA
6555 - n-Nitrosomorpholine	EPA 8270D	10186002	NELAP	PA
6560 - n-Nitrosopiperidine	EPA 8270D	10186002	NELAP	PA
6565 - n-Nitrosopyrrolidine	EPA 8270D	10186002	NELAP	PA
8290 - o,o,o-Triethyl phosphorothioate	EPA 8270D	10186002	NELAP	PA
8310 - tris-(2,3-Dibromopropyl) phosphate (tris-BP)	EPA 8270D	10186002	NELAP	PA
9519 - 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	EPA 8290	10187209	NELAP	PA
9516 - 1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	EPA 8290	10187209	NELAP	PA
9426 - 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	EPA 8290	10187209	NELAP	PA
9420 - 1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	EPA 8290	10187209	NELAP	PA
9423 - 1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	EPA 8290	10187209	NELAP	PA
9453 - 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)	EPA 8290	10187209	NELAP	PA

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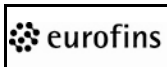
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Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
9471 - 1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)	EPA 8290	10187209	NELAP	PA
9456 - 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-Hxcdd)	EPA 8290	10187209	NELAP	PA
9474 - 1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)	EPA 8290	10187209	NELAP	PA
9459 - 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)	EPA 8290	10187209	NELAP	PA
9477 - 1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)	EPA 8290	10187209	NELAP	PA
9540 - 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)	EPA 8290	10187209	NELAP	PA
9543 - 1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)	EPA 8290	10187209	NELAP	PA
9480 - 2,3,4,6,7,8-Hexachlorodibenzofuran	EPA 8290	10187209	NELAP	PA
9549 - 2,3,4,7,8-Pentachlorodibenzofuran	EPA 8290	10187209	NELAP	PA
9618 - 2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD)	EPA 8290	10187209	NELAP	PA
9612 - 2,3,7,8-Tetrachlorodibenzofuran	EPA 8290	10187209	NELAP	PA
9438 - Total Hpcdd	EPA 8290	10187209	NELAP	PA
9444 - Total Hpcdf	EPA 8290	10187209	NELAP	PA
9468 - Total Hxcdd	EPA 8290	10187209	NELAP	PA
9483 - Total Hxcdf	EPA 8290	10187209	NELAP	PA
9555 - Total Pecdd	EPA 8290	10187209	NELAP	PA
9552 - Total Pecdf	EPA 8290	10187209	NELAP	PA
9609 - Total TCDD	EPA 8290	10187209	NELAP	PA
9615 - Total TCDF	EPA 8290	10187209	NELAP	PA
9519 - 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	EPA 8290A	10187403	NELAP	PA
9516 - 1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	EPA 8290A	10187403	NELAP	PA
9426 - 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	EPA 8290A	10187403	NELAP	PA
9420 - 1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	EPA 8290A	10187403	NELAP	PA
9423 - 1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	EPA 8290A	10187403	NELAP	PA
9453 - 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd)	EPA 8290A	10187403	NELAP	PA
9471 - 1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf)	EPA 8290A	10187403	NELAP	PA
9456 - 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-Hxcdd)	EPA 8290A	10187403	NELAP	PA
9474 - 1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf)	EPA 8290A	10187403	NELAP	PA
9459 - 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd)	EPA 8290A	10187403	NELAP	PA
9477 - 1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf)	EPA 8290A	10187403	NELAP	PA
9540 - 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd)	EPA 8290A	10187403	NELAP	PA
9543 - 1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf)	EPA 8290A	10187403	NELAP	PA
9480 - 2,3,4,6,7,8-Hexachlorodibenzofuran	EPA 8290A	10187403	NELAP	PA

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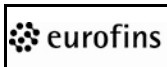
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Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
9549 - 2,3,4,7,8-Pentachlorodibenzofuran	EPA 8290A	10187403	NELAP	PA
9618 - 2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)	EPA 8290A	10187403	NELAP	PA
9612 - 2,3,7,8-Tetrachlorodibenzofuran	EPA 8290A	10187403	NELAP	PA
9438 - Total Hpcdd	EPA 8290A	10187403	NELAP	PA
9444 - Total Hpcdf	EPA 8290A	10187403	NELAP	PA
9468 - Total Hxcdd	EPA 8290A	10187403	NELAP	PA
9483 - Total Hxcdf	EPA 8290A	10187403	NELAP	PA
9555 - Total Pecdd	EPA 8290A	10187403	NELAP	PA
9552 - Total Pecdf	EPA 8290A	10187403	NELAP	PA
9609 - Total TCDD	EPA 8290A	10187403	NELAP	PA
9615 - Total TCDF	EPA 8290A	10187403	NELAP	PA
5500 - Acenaphthene	EPA 8310	10187607	NELAP	PA
5505 - Acenaphthylene	EPA 8310	10187607	NELAP	PA
5555 - Anthracene	EPA 8310	10187607	NELAP	PA
5575 - Benzo(a)anthracene	EPA 8310	10187607	NELAP	PA
5580 - Benzo(a)pyrene	EPA 8310	10187607	NELAP	PA
5585 - Benzo(b)fluoranthene	EPA 8310	10187607	NELAP	PA
5590 - Benzo(g,h,i)perylene	EPA 8310	10187607	NELAP	PA
5600 - Benzo(k)fluoranthene	EPA 8310	10187607	NELAP	PA
5855 - Chrysene	EPA 8310	10187607	NELAP	PA
5895 - Dibenz(a,h) anthracene	EPA 8310	10187607	NELAP	PA
6265 - Fluoranthene	EPA 8310	10187607	NELAP	PA
6270 - Fluorene	EPA 8310	10187607	NELAP	PA
6315 - Indeno(1,2,3-cd) pyrene	EPA 8310	10187607	NELAP	PA
5005 - Naphthalene	EPA 8310	10187607	NELAP	PA
6615 - Phenanthrene	EPA 8310	10187607	NELAP	PA
6665 - Pyrene	EPA 8310	10187607	NELAP	PA
6110 - 2,5-Dimethylbenzaldehyde	EPA 8315	10187801	NELAP	PA
4300 - Acetaldehyde	EPA 8315	10187801	NELAP	PA
4325 - Acrolein (Propenal)	EPA 8315	10187801	NELAP	PA
5570 - Benzaldehyde	EPA 8315	10187801	NELAP	PA
4430 - Butylaldehyde (Butanal)	EPA 8315	10187801	NELAP	PA
4545 - Crotonaldehyde	EPA 8315	10187801	NELAP	PA
4815 - Formaldehyde	EPA 8315	10187801	NELAP	PA
3825 - Hexanaldehyde (Hexanal)	EPA 8315	10187801	NELAP	PA
6330 - Isovaleraldehyde	EPA 8315	10187801	NELAP	PA
3965 - Propionaldehyde (Propanal)	EPA 8315	10187801	NELAP	PA
6755 - Toluualdehyde (1,2-Toluualdehyde)	EPA 8315	10187801	NELAP	PA
5125 - m-Toluualdehyde (1,3-Toluualdehyde)	EPA 8315	10187801	NELAP	PA
6760 - p-Toluualdehyde (1,4-Toluualdehyde)	EPA 8315	10187801	NELAP	PA
7710 - 3-Hydroxycarbofuran	EPA 8318	10188406	NELAP	PA
7010 - Aldicarb (Temik)	EPA 8318	10188406	NELAP	PA
7015 - Aldicarb sulfone	EPA 8318	10188406	NELAP	PA
7195 - Carbaryl (Sevin)	EPA 8318	10188406	NELAP	PA
7205 - Carbofuran (Furaden)	EPA 8318	10188406	NELAP	PA
7800 - Methiocarb (Mesurol)	EPA 8318	10188406	NELAP	PA
7805 - Methomyl (Lannate)	EPA 8318	10188406	NELAP	PA
8080 - Propoxur (Baygon)	EPA 8318	10188406	NELAP	PA
7710 - 3-Hydroxycarbofuran	EPA 8318A	10188600	NELAP	PA
7010 - Aldicarb (Temik)	EPA 8318A	10188600	NELAP	PA
7015 - Aldicarb sulfone	EPA 8318A	10188600	NELAP	PA
7195 - Carbaryl (Sevin)	EPA 8318A	10188600	NELAP	PA
7205 - Carbofuran (Furaden)	EPA 8318A	10188600	NELAP	PA
7800 - Methiocarb (Mesurol)	EPA 8318A	10188600	NELAP	PA
7805 - Methomyl (Lannate)	EPA 8318A	10188600	NELAP	PA

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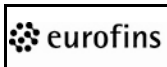
Certificate Number: 02055

AI Number: 30729
Expiration Date: June 30, 2015

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 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
8080 - Propoxur (Baygon)	EPA 8318A	10188600	NELAP	PA
6885 - 1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8330	10189807	NELAP	PA
6160 - 1,3-Dinitrobenzene (1,3-DNB)	EPA 8330	10189807	NELAP	PA
9651 - 2,4,6-Trinitrotoluene (2,4,6-TNT)	EPA 8330	10189807	NELAP	PA
6185 - 2,4-Dinitrotoluene (2,4-DNT)	EPA 8330	10189807	NELAP	PA
6190 - 2,6-Dinitrotoluene (2,6-DNT)	EPA 8330	10189807	NELAP	PA
9303 - 2-Amino-4,6-dinitrotoluene (2-am-dnt)	EPA 8330	10189807	NELAP	PA
9507 - 2-Nitrotoluene	EPA 8330	10189807	NELAP	PA
9510 - 3-Nitrotoluene	EPA 8330	10189807	NELAP	PA
9306 - 4-Amino-2,6-dinitrotoluene (4-am-dnt)	EPA 8330	10189807	NELAP	PA
9513 - 4-Nitrotoluene	EPA 8330	10189807	NELAP	PA
6415 - Methyl-2,4,6-trinitrophenylnitramine (tetryl)	EPA 8330	10189807	NELAP	PA
5015 - Nitrobenzene	EPA 8330	10189807	NELAP	PA
9522 - Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	EPA 8330	10189807	NELAP	PA
9558 - Pentaerythritoltetranitrate	EPA 8330	10189807	NELAP	PA
9432 - RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	EPA 8330	10189807	NELAP	PA
6885 - 1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8330A	10190008	NELAP	PA
6160 - 1,3-Dinitrobenzene (1,3-DNB)	EPA 8330A	10190008	NELAP	PA
9651 - 2,4,6-Trinitrotoluene (2,4,6-TNT)	EPA 8330A	10190008	NELAP	PA
6185 - 2,4-Dinitrotoluene (2,4-DNT)	EPA 8330A	10190008	NELAP	PA
6190 - 2,6-Dinitrotoluene (2,6-DNT)	EPA 8330A	10190008	NELAP	PA
9303 - 2-Amino-4,6-dinitrotoluene (2-am-dnt)	EPA 8330A	10190008	NELAP	PA
9507 - 2-Nitrotoluene	EPA 8330A	10190008	NELAP	PA
9510 - 3-Nitrotoluene	EPA 8330A	10190008	NELAP	PA
9306 - 4-Amino-2,6-dinitrotoluene (4-am-dnt)	EPA 8330A	10190008	NELAP	PA
9513 - 4-Nitrotoluene	EPA 8330A	10190008	NELAP	PA
6415 - Methyl-2,4,6-trinitrophenylnitramine (tetryl)	EPA 8330A	10190008	NELAP	PA
5015 - Nitrobenzene	EPA 8330A	10190008	NELAP	PA
9522 - Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	EPA 8330A	10190008	NELAP	PA
9558 - Pentaerythritoltetranitrate	EPA 8330A	10190008	NELAP	PA
9432 - RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	EPA 8330A	10190008	NELAP	PA
1645 - Total Cyanide	EPA 9012A	10193405	NELAP	PA
1615 - Corrosivity	EPA 9045C	10198400	NELAP	PA
1900 - pH	EPA 9045C	10198400	NELAP	PA
1610 - Conductivity	EPA 9050	10198604	NELAP	PA
1610 - Conductivity	EPA 9050A	10198808	NELAP	PA
1905 - Total Phenolics	EPA 9066	10200609	NELAP	PA
1860 - Oil & Grease	EPA 9071B	10201602	NELAP	PA
1560 - Cation exchange capacity	EPA 9081	10203404	NELAP	PA
1780 - Ignitability	EPA 1010A	10234807	NELAP	PA
6380 - 1-Methylnaphthalene	EPA 8270C SIM	10242407	NELAP	PA
5500 - Acenaphthene	EPA 8270C SIM	10242407	NELAP	PA
5505 - Acenaphthylene	EPA 8270C SIM	10242407	NELAP	PA
5555 - Anthracene	EPA 8270C SIM	10242407	NELAP	PA
5575 - Benzo(a)anthracene	EPA 8270C SIM	10242407	NELAP	PA
5580 - Benzo(a)pyrene	EPA 8270C SIM	10242407	NELAP	PA

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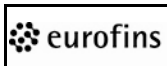
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Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
5585 - Benzo(b)fluoranthene	EPA 8270C SIM	10242407	NELAP	PA
5590 - Benzo(g,h,i)perylene	EPA 8270C SIM	10242407	NELAP	PA
5600 - Benzo(k)fluoranthene	EPA 8270C SIM	10242407	NELAP	PA
5855 - Chrysene	EPA 8270C SIM	10242407	NELAP	PA
5895 - Dibenz(a,h) anthracene	EPA 8270C SIM	10242407	NELAP	PA
6265 - Fluoranthene	EPA 8270C SIM	10242407	NELAP	PA
6270 - Fluorene	EPA 8270C SIM	10242407	NELAP	PA
6315 - Indeno(1,2,3-cd) pyrene	EPA 8270C SIM	10242407	NELAP	PA
5005 - Naphthalene	EPA 8270C SIM	10242407	NELAP	PA
6615 - Phenanthrene	EPA 8270C SIM	10242407	NELAP	PA
6665 - Pyrene	EPA 8270C SIM	10242407	NELAP	PA
6380 - 1-Methylnaphthalene	EPA 8270D SIM	10242509	NELAP	PA
5500 - Acenaphthene	EPA 8270D SIM	10242509	NELAP	PA
5505 - Acenaphthylene	EPA 8270D SIM	10242509	NELAP	PA
5555 - Anthracene	EPA 8270D SIM	10242509	NELAP	PA
5575 - Benzo(a)anthracene	EPA 8270D SIM	10242509	NELAP	PA
5580 - Benzo(a)pyrene	EPA 8270D SIM	10242509	NELAP	PA
5585 - Benzo(b)fluoranthene	EPA 8270D SIM	10242509	NELAP	PA
5590 - Benzo(g,h,i)perylene	EPA 8270D SIM	10242509	NELAP	PA
5600 - Benzo(k)fluoranthene	EPA 8270D SIM	10242509	NELAP	PA
5855 - Chrysene	EPA 8270D SIM	10242509	NELAP	PA
5895 - Dibenz(a,h) anthracene	EPA 8270D SIM	10242509	NELAP	PA
6265 - Fluoranthene	EPA 8270D SIM	10242509	NELAP	PA
6270 - Fluorene	EPA 8270D SIM	10242509	NELAP	PA
6315 - Indeno(1,2,3-cd) pyrene	EPA 8270D SIM	10242509	NELAP	PA
5005 - Naphthalene	EPA 8270D SIM	10242509	NELAP	PA
6615 - Phenanthrene	EPA 8270D SIM	10242509	NELAP	PA
6665 - Pyrene	EPA 8270D SIM	10242509	NELAP	PA
1900 - pH	EPA 9040C	10244403	NELAP	PA
4870 - Iodomethane (Methyl iodide)	EPA 8260C	10307003	NELAP	PA
9369 - Diesel range organics (DRO)	TNRCC 1005, Rev.3	90019208	NELAP	PA

Biological Tissue

Analyte	Method Name	Method Code	Type	AB
1000 - Aluminum	EPA 6010	10155201	NELAP	LA
1005 - Antimony	EPA 6010	10155201	NELAP	LA
1010 - Arsenic	EPA 6010	10155201	NELAP	LA
1015 - Barium	EPA 6010	10155201	NELAP	LA
1020 - Beryllium	EPA 6010	10155201	NELAP	LA
1025 - Boron	EPA 6010	10155201	NELAP	LA
1030 - Cadmium	EPA 6010	10155201	NELAP	LA
1035 - Calcium	EPA 6010	10155201	NELAP	LA
1040 - Chromium	EPA 6010	10155201	NELAP	LA
1050 - Cobalt	EPA 6010	10155201	NELAP	LA
1055 - Copper	EPA 6010	10155201	NELAP	LA
1070 - Iron	EPA 6010	10155201	NELAP	LA
1075 - Lead	EPA 6010	10155201	NELAP	LA
1085 - Magnesium	EPA 6010	10155201	NELAP	LA
1090 - Manganese	EPA 6010	10155201	NELAP	LA
1100 - Molybdenum	EPA 6010	10155201	NELAP	LA
1105 - Nickel	EPA 6010	10155201	NELAP	LA
1125 - Potassium	EPA 6010	10155201	NELAP	LA
1140 - Selenium	EPA 6010	10155201	NELAP	LA
1150 - Silver	EPA 6010	10155201	NELAP	LA

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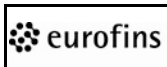
Certificate Number: 02055

AI Number: 30729
Expiration Date: June 30, 2015

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 Lancaster Laboratories Environmental	Document Title: NELAP Scope of Testing	Eurofins Document Reference: 1-P-QM-GDL-9015386
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Biological Tissue					
Analyte	Method Name	Method Code	Type	AB	
1155 - Sodium	EPA 6010	10155201	NELAP	LA	
1160 - Strontium	EPA 6010	10155201	NELAP	LA	
1165 - Thallium	EPA 6010	10155201	NELAP	LA	
1175 - Tin	EPA 6010	10155201	NELAP	LA	
1180 - Titanium	EPA 6010	10155201	NELAP	LA	
1185 - Vanadium	EPA 6010	10155201	NELAP	LA	
1190 - Zinc	EPA 6010	10155201	NELAP	LA	
1005 - Antimony	EPA 6020	10156000	NELAP	LA	
1010 - Arsenic	EPA 6020	10156000	NELAP	LA	
1020 - Beryllium	EPA 6020	10156000	NELAP	LA	
1030 - Cadmium	EPA 6020	10156000	NELAP	LA	
1040 - Chromium	EPA 6020	10156000	NELAP	LA	
1055 - Copper	EPA 6020	10156000	NELAP	LA	
1075 - Lead	EPA 6020	10156000	NELAP	LA	
1105 - Nickel	EPA 6020	10156000	NELAP	LA	
1140 - Selenium	EPA 6020	10156000	NELAP	LA	
1165 - Thallium	EPA 6020	10156000	NELAP	LA	
1095 - Mercury	EPA 7471	10166004	NELAP	LA	
7355 - 4,4'-DDD	EPA 8081	10178402	NELAP	LA	
7360 - 4,4'-DDE	EPA 8081	10178402	NELAP	LA	
7365 - 4,4'-DDT	EPA 8081	10178402	NELAP	LA	
7025 - Aldrin	EPA 8081	10178402	NELAP	LA	
7250 - Chlordane (tech.)	EPA 8081	10178402	NELAP	LA	
7470 - Dieldrin	EPA 8081	10178402	NELAP	LA	
7685 - Heptachlor	EPA 8081	10178402	NELAP	LA	
7690 - Heptachlor epoxide	EPA 8081	10178402	NELAP	LA	
8250 - Toxaphene (Chlorinated camphene)	EPA 8081	10178402	NELAP	LA	
7110 - alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8081	10178402	NELAP	LA	
7115 - beta-BHC (beta-Hexachlorocyclohexane)	EPA 8081	10178402	NELAP	LA	
7105 - delta-BHC	EPA 8081	10178402	NELAP	LA	
7120 - gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8081	10178402	NELAP	LA	
8880 - Aroclor-1016 (PCB-1016)	EPA 8082	10179007	NELAP	LA	
8885 - Aroclor-1221 (PCB-1221)	EPA 8082	10179007	NELAP	LA	
8890 - Aroclor-1232 (PCB-1232)	EPA 8082	10179007	NELAP	LA	
8895 - Aroclor-1242 (PCB-1242)	EPA 8082	10179007	NELAP	LA	
8900 - Aroclor-1248 (PCB-1248)	EPA 8082	10179007	NELAP	LA	
8905 - Aroclor-1254 (PCB-1254)	EPA 8082	10179007	NELAP	LA	
8910 - Aroclor-1260 (PCB-1260)	EPA 8082	10179007	NELAP	LA	
6715 - 1,2,4,5-Tetrachlorobenzene	EPA 8270	10185203	NELAP	LA	
6400 - 2-Methylphenol (o-Cresol)	EPA 8270	10185203	NELAP	LA	
6405 - 3-Methylphenol (m-Cresol)	EPA 8270	10185203	NELAP	LA	
6410 - 4-Methylphenol (p-Cresol)	EPA 8270	10185203	NELAP	LA	
5855 - Chrysene	EPA 8270	10185203	NELAP	LA	
6275 - Hexachlorobenzene	EPA 8270	10185203	NELAP	LA	
4835 - Hexachlorobutadiene	EPA 8270	10185203	NELAP	LA	
6285 - Hexachlorocyclopentadiene	EPA 8270	10185203	NELAP	LA	
4840 - Hexachloroethane	EPA 8270	10185203	NELAP	LA	
6290 - Hexachlorophene	EPA 8270	10185203	NELAP	LA	
6590 - Pentachlorobenzene	EPA 8270	10185203	NELAP	LA	
6605 - Pentachlorophenol	EPA 8270	10185203	NELAP	LA	
5095 - Pyridine	EPA 8270	10185203	NELAP	LA	
5025 - n-Nitroso-di-n-butylamine	EPA 8270	10185203	NELAP	LA	
6525 - n-Nitrosodiethylamine	EPA 8270	10185203	NELAP	LA	

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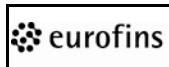
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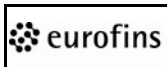
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Eurofins Document Reference	1-P-QM-GDL-9015387	Revision	3
Effective Date	Aug 8, 2014	Status	Effective
Historical/Local Document Number	DOD - Environmental Quality Policy Manual Appendix J		
Local Document Level	Level 1		
Local Document Type	POL - Policy		
Local Document Category	ES - Environmental Sciences		

Prepared by	Kathryn Brungard
Reviewed and Approved by	Duane Luckenbill;Review;Tuesday, July 29, 2014 11:05:28 AM EDT Robert Strocko;Review;Wednesday, July 30, 2014 1:06:19 PM EDT Dorothy Love;Approval;Wednesday, July 30, 2014 2:18:24 PM EDT

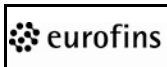
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Details on method quality control (QC) processes are provided in the individual Analytical Procedures. QC limits are maintained in the LIMS. This appendix provides an overview for representative methodology.

NOTE: This appendix is not applicable to OH VAP work. See the OH VAP approved SOPs for QC information.

SW - 846 Quality Control GC/MS Volatiles Method 8260		
Type	Frequency	Corrective Action
Surrogates: Toluene-d ₈ Bromofluorobenzene 1,2-Dichloroethane-d ₄ Dibromofluoromethane	Each sample, MS, MSD, LCS, and blank	Reanalyze sample if outside limits; if reanalysis confirms original, document on report and/or case narrative
Matrix Spikes: Spike all compounds of interest	Each group (≤ 20) of samples per matrix/level	Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Samples: Spike all compounds of interest	Each group (≤ 20) of samples per matrix/level	Reanalyze LCS and associated samples for compounds outside acceptance limits that are also outside MS/MSD acceptance limits. Compounds that fail high in the LCS and are ND in the samples, can be reported.
Matrix Spike Duplicates (RPD): Spike all compounds of interest	Each group (≤ 20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	Once for each 12-hour time period or ≤ 20 samples	Reanalyze blank and associated samples if blank outside limits
Internal Standards (ISTD): Fluorobenzene Chlorobenzene-d ₅ 1,4-Dichlorobenzene-d ₄	Each sample, MS, MSD, LCS, and blank	Reanalyze samples; if reanalysis confirms original, document on report or case narrative

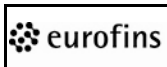
Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

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SW - 846 Quality Control GC/MS Semivolatiles Method 8270		
Type	Frequency	Corrective Action
Surrogate: Nitrobenzene-d ₅ 2-Fluorobiphenyl Terphenyl-d ₁₄ Phenol-d ₆ 2-Fluorophenol 2,4,6-Tribromophenol	Each sample, MS, MSD, LCS, and blank	Repeat extraction and analysis; if reanalysis confirms original, document on report and/or case narrative
Matrix Spikes: Spike all compounds of interest	Each group (≤ 20) of samples per matrix/level	Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Sample: Spike all compounds of interest	Each group (≤ 20) of samples per matrix/level	Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples, can be reported.
Matrix Spike Duplicates (RPD): Same as for matrix spikes	Each group (≤ 20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	Once per extraction group (≤ 20) of samples, each matrix, level	Re-extract and reanalyze blank and associated samples
Internal Standards (ISTD): 1,4-Dichlorobenzene-d ₄ Naphthalene-d ₈ Acenaphthene-d ₁₀ Phenanthrene-d ₁₀ Chrysene-d ₁₂ Perylene-d ₁₂	Each sample, MS, MSD, LCS, and blank	Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

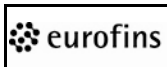
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SW - 846 Quality Control GC/MS Semivolatiles Method 8270 SIM		
Type	Frequency	Corrective Action
Surrogate: 1-Methylnaphthalene-d10 Fluoranthene-d10 Benzo(a)pyrene-d12	Each sample, MS, MSD, LCS, and blank	Repeat extraction and analysis; if reanalysis confirms original, document on report and/or case narrative
Matrix Spikes: Spike all compounds of interest	Each group (≤ 20) of samples per matrix/level	Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Sample: Spike all compounds of interest	Each group (≤ 20) of samples per matrix/level	Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples, can be reported.
Matrix Spike Duplicates (RPD): Same as for matrix spikes	Each group (≤ 20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	Once per extraction group (≤ 20) of samples, each matrix, level	Re-extract and reanalyze blank and associated samples
Internal Standards (ISTD): 1,4-Dichlorobenzene-d ₄ Naphthalene-d ₈ Acenaphthene-d ₁₀ Phenanthrene-d ₁₀ Chrysene-d ₁₂ Perylene-d ₁₂	Each sample, MS, MSD, LCS, and blank	Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative

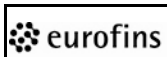
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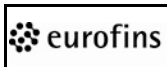
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SW - 846 Quality Control Dioxins/Furans Method 8290		
Type	Frequency	Corrective Action
Labeled Compounds: 13C Labeled Isotope of each of 17 Toxic PCDD/PCDF	Each sample, OPR, and blank	Repeat extraction and analysis; if reanalysis confirms original, document on report and/or case narrative
Ongoing Precision and Recovery Standard (OPR): Spike all compounds of interest	Each group (≤ 20) of samples per matrix/level	Reanalyze OPR and associated samples for compounds outside acceptance limits that are also outside MS/MSD acceptance limits. Compounds that fail high in the OPR and are ND in the samples, can be reported.
Blanks:	Once for each 12-hour time period or ≤ 20 samples	Reanalyze blank and associated samples if blank outside limits
Internal Standards (ISTD): 13C12-1234-TCDD 13C12-123468-HxCDD	Each sample, OPR, and blank	RT \pm 15 secs of retention time in initial calibration.

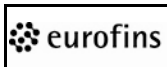
Quality Control Dioxins/Furans Method 1613B		
Type	Frequency	Corrective Action
Labeled Compounds: 13C Labeled Isotope of each of 17 Toxic PCDD/PCDF	Each sample, OPR, and blank	Repeat extraction and analysis; if reanalysis confirms original, document on report and/or case narrative
Ongoing Precision and Recovery Standard (OPR): Spike all compounds of interest	Each group (≤ 20) of samples per matrix/level	Reanalyze OPR and associated samples for compounds outside acceptance limits that are also outside MS/MSD acceptance limits. Compounds that fail high in the OPR and are ND in the samples, can be reported.
Blanks:	Once for each 12-hour time period or ≤ 20 samples	Reanalyze blank and associated samples if blank outside limits
Internal Standards (ISTD): 13C12-1234-TCDD 13C12-123468-HxCDD	Each sample, OPR, and blank	RT \pm 15 secs of retention time in initial calibration.

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Quality Control Congeners Method 1668		
Type	Frequency	Corrective Action
Labeled Compounds: 13C Labeled Isotope of each of 18 Toxic PCBs	Each sample, OPR, and blank	Repeat extraction and analysis; if reanalysis confirms original, document on report and/or case narrative
Ongoing Precision and Recovery Standard (OPR): Spike all compounds of interest	Each group (≤ 20) of samples per matrix/level	Reanalyze OPR and associated samples for compounds outside acceptance limits that are also outside MS/MSD acceptance limits. Compounds that fail high in the OPR and are ND in the samples, can be reported.
Blanks:	Once for each 12-hour time period or ≤ 20 samples	Reanalyze blank and associated samples if blank outside limits
Internal Standards (ISTD): 13C12-PCB70 13C12-PCB111 13C12-PCB141 13C12-PCB170	Each sample, OPR, and blank	RT \pm 15 secs of retention time in initial calibration.

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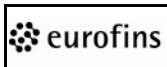
<p align="center">SW-846 Quality Control Pesticides/PCBs Methods 8081; 8082; 8141; 8151</p>		
Type	Frequency	Corrective Action
<p>Surrogate: <u>Organochlorine Pesticides & PCBs</u> Decachlorobiphenyl (DCB) Tetrachloro-<i>m</i>-xylene (TCMX)</p> <p><u>Herbicides:</u> Dichloroacetic acid (DCAA)</p> <p><u>Organophosphorous Pesticides:</u> 2-nitro-<i>m</i>-xylene (2NMX)</p>	<p>Added to each sample, MS/MSD, blank, LCS/LCSD during the extraction phase</p>	<p>Repeat extraction and analysis. If reanalysis confirms original result, report results and comment in case narrative</p>
<p>Matrix Spikes: <u>Organochlorine Pesticides:</u> Spike all compounds of interest, except PCBs, chlordane, and toxaphene</p> <p><u>Herbicides & Organophosphorous Pesticides:</u> all compounds of interest</p> <p><u>PCBs:</u> Aroclor 1016 & Aroclor 1260</p>	<p>Each extraction group (≤ 20) of samples per matrix/level</p>	<p>Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.</p>
<p>Laboratory Control Sample: <u>Organochlorine Pesticides:</u> Spike all compounds of interest, except PCBs, chlordane, and toxaphene</p> <p><u>Herbicides & Organophosphorous Pesticides:</u> all compounds of interest</p> <p><u>PCBs:</u> Aroclor 1016 & Aroclor 1260</p>	<p>Each group (≤ 20) when MS/MSD falls outside established limits</p>	<p>Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples can be reported.</p>

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<p align="center">SW-846 Quality Control Pesticides/PCBs Methods 8081; 8082; 8141; 8151 (continued)</p>		
Type	Frequency	Corrective Action
<p>Matrix Spike Duplicates (RPD): <u>Organochlorine Pesticides:</u> Spike all compounds of interest, except PCBs, chlordane, and toxaphene</p> <p><u>Herbicides & Organophosphorous Pesticides:</u> all compounds of interest</p> <p><u>PCBs:</u> Aroclor 1016 & Aroclor 1260</p>	<p>Each extraction group (≤ 20) of samples per matrix/level</p>	<p>Evaluated in conjunction with acceptable LCS.</p> <p>Acceptable LCS would be indicative of matrix effects on the MS/MSD.</p>
<p>Blanks:</p>	<p>Once per extraction group (≤ 20) of samples, each matrix, level</p>	<p>Inject a hexane or solvent blank first to be sure the analytical system is clean then reinject the blank itself. If the reinjected blank is acceptable, any samples extracted with this blank should be reinjected if they, too, contain the analyte which was contaminating the blank. If the reinjected blank is unacceptable, any affected samples must be reextracted.</p>
<p>Internal Standards (ISTD): <u>Herbicides:</u> 4,4'-dibromo octafluorobiphenyl (DBOB)</p>	<p>Each sample, MS, MSD, LCS, and blank</p>	<p>Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative</p>

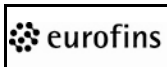
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SW-846 Quality Control Volatiles by GC 8021		
Type	Frequency	Corrective Action
Surrogates: <u>Aromatics:</u> 1-Bromo-4-chlorobenzene (PID)	Each sample, MS, MSD, LCS and blank	Reanalyze if the surrogate recovery is outside the limits unless matrix-related problems are evident.
Matrix Spikes: Spike all compounds of interest	Each group of samples (≤ 20) of similar matrix/level each method	Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Sample: Spike all compounds of interest	Each group (≤ 20); LCSD is analyzed if sufficient volume is not available for MS/MSD	Reanalyze LCS and associated samples for compounds outside of acceptance limits. Compounds that fail high in the LCS and are ND in the samples can be reported.
Internal Standard (ISTD): <u>Aromatics:</u> 1-chloro-3-fluorobenzene	Each sample, LCS, MS, MSD, blank, and standard	Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative. In cases where the sample matrix is elevating the ISTD recovery, a dilution and reanalysis may be performed.
Matrix Spike Duplicate (RPD): Same compounds as matrix spikes	Each group (≤ 20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	At least once per batch (≤ 20 samples) and once per 24 hours	Reanalyze blank and associated samples if blank is outside limits

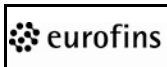
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SW-846 Quality Control Petroleum Analysis		
Type	Frequency	Corrective Action
Surrogate: α,α,α -Trifluorotoluene (PID)	Each sample, MS, MSD, LCS, and blank	Reanalyze if the surrogate recovery is outside the limits unless matrix-related problems are evident.
Matrix Spike: Spike all compounds of interest	Each group (≤ 20) of samples per matrix/level	Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Sample: Spike all compounds of interest	Each group (≤ 20) of samples per matrix/level. LCSD analyzed if sufficient volume is not available for MS/MSD	Reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high and are ND in the samples can be reported.
Matrix Spike Duplicates (RPD):	Each group (≤ 20) of samples per matrix/level	Evaluated by an analyst in relationship to other QC results
Blanks:	At least once per batch (≤ 20 samples) and once per 24 hours	Reanalyze blank and associated samples if blank is outside limits
Internal Standards (ISTD): 1-Chloro-3-fluorobenzene (PID)	Each sample, MS, MSD, LCS, and blank analyzed on the PID	Reanalyze samples; if reanalysis confirms original result, document on report or case narrative. In cases where the sample matrix is elevating the ISTD recovery, a dilution and reanalysis may be performed.

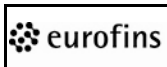
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SW-846 Quality Control TPH-DRO 8015B		
Type	Frequency	Corrective Action
Surrogate: o-Terphenyl	Added to each sample, MS/MSD, blank, LCS/LCSD during the extraction phase	Repeat extraction and analysis. If reanalysis confirms original result. report results and comment in case narrative.
Matrix Spike: # 2 Fuel	Each group (≤ 20) of samples per matrix/level	Reinject if surrogates appear low. If still out of spec, evaluate for matrix effect. If matrix effect, accept based on LCS data. If no matrix effect, repeat batch.
Laboratory Control Sample: # 2 Fuel	Each group (≤ 20) of samples per matrix/level	Reinject if surrogates appear low. If still out of spec, reextract batch. LCS that fails high and DRO is ND in the samples can be reported.
Laboratory Control Duplicates (RPD): # 2 Fuel	Each group (≤ 20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	Once per extraction group (≤ 20) of samples, each matrix, level	Inject a solvent blank first to be sure the analytical system is clean then reinject the blank itself. If the reinjected blank is acceptable, any samples extracted with this blank should be reinjected, if they, too, contain the analyte which was contaminating the blank. If the reinjecting blank is unacceptable, any affected samples must be re-extracted.

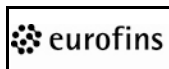
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SW-846 Quality Control TPH-GRO 8015B		
Type	Frequency	Corrective Action
Surrogate: Trifluorotoluene (FID)	Each sample, MS/MSD, LCS, and blank	Reanalyze if the surrogate recovery is outside the limits unless matrix-related problems are evident
Matrix Spike: Gasoline standard	Each group of samples of similar matrix/level (≤ 20) each method	Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Sample Gasoline standard	Each group (≤ 20) of samples. LCSD analyzed if sufficient volume is not available for MS/MSD.	Reanalyze LCS and associated samples. LCS that fails high and GRO is ND in the samples can be reported.
Matrix Spike Duplicate (RPD): Same compounds as matrix spikes	Each group (≤ 20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	At least one per 20 samples and at least once per 24 hours.	Reanalyze blank and associated samples if blank is outside limits

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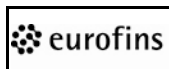
SW-846 Quality Control* Inorganics (Metals)		
Type	Frequency	Corrective Action
Internal Standard (ICP & ICP/MS only):	Each sample, standard and QC (Unspiked, Dup., MS, MSD, LCS, dilution, post digestion spike and blank)	If the internal standard response falls outside the specified range, then the samples would be reanalyzed.
Matrix Spikes:	Each group of samples of similar matrix/level (≤ 20) each method	Analyze post-digestion spike sample
Matrix Spike Duplicate (RPD):	Each group of samples of similar matrix/level (20) each method	Analyze post-digestion spike sample if not already run for MS, flag the data
Duplicates (RPD):	Each group of samples of similar matrix/level (≤ 20) each method	Flag the data

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SW-846 Quality Control* Inorganics (Metals)		
Type	Frequency	Corrective Action
Blanks: Initial Calibration (ICB) Continuing Calibration (CCB)	Each element immediately after calibration verification at 10% frequency or every 2 hours (beginning and end of run min.)	Correct problem, recalibrate, and rerun
Preparation Blank	Each SDG or batch (≤ 20 samples)	Redigest and reanalyze blank and associated samples if sample result is greater than the LOQ and $< 20 \times$ blank result
Serial Dilutions (ICP, ICP/MS only):	Each group of (≤ 20) of similar matrix/level	Flag the data
Interference Check Sample (ICP, ICP/MS only):	Each element after Initial Calibration Verification at beginning and end of the run or min. of $2 \times$ per 8 hour	Correct for interference, recalibrate the instrument
Laboratory Control Sample:	Each SDG or batch (≤ 20 samples), each method	Redigest and reanalyze LCS and associated samples. Elements in the LCS that fail high and are ND in the samples can be reported.
Post Digestion Spike:	When matrix spikes are outside 75 % - 125% range, or the statistical window (whichever is tighter).	Flag the data

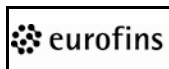
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QC Table for SW-846 Miscellaneous Water Tests			
Test	QC Type	Frequency	Corrective Action
Sulfide	Blank	Each group of samples of similar matrix (≤ 20)	Prepare the entire batch again and re-analyze.
	Laboratory Control Sample	Each group of samples of similar matrix (≤ 20)	Prepare the entire batch again and re-analyze. LCSs that fail high (and associated samples are ND) can be reported.
	Duplicate	Each group of samples of similar matrix (≤ 20)	Ensure that LCS meets acceptance criteria.
	Matrix Spike/ Matrix Spike Duplicate	Each group of samples of similar matrix (≤ 20)	Ensure that LCS meets acceptance criteria.
	Blank	Each group of samples of similar matrix (≤ 20)	Prepare the entire batch again and re-analyze.
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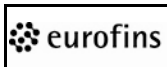
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Bromide (IC) Chloride (IC) Cyanide (total) Fluoride (IC) Nitrate/Nitrite (IC) Sulfate (IC)	Laboratory Control Sample	Each group of samples of similar matrix (≤ 20)	Prepare the entire batch again and re-analyze. LCSs that fail high (and associated samples are ND) can be reported.
	Duplicate	Each group of samples of similar matrix (≤ 10)	Ensure that LCS meets acceptance criteria.
	Matrix Spike	Each group of samples of similar matrix (≤ 10)	Ensure that LCS meets acceptance criteria.
Phenols TOC Quad	Blank	Each group of samples of similar matrix (≤ 20)	Prepare the entire batch again and re-analyze.
	Laboratory Control Sample	Each group of samples of similar matrix (≤ 20)	Prepare the entire batch again and re-analyze. LCSs that fail high (and associated samples are ND) can be reported.
	Matrix Spike/ Matrix Spike Duplicate	Each group of samples of similar matrix (≤ 10)	Ensure that LCS meets acceptance criteria.
pH Moisture	Laboratory Control Sample	Each group of samples of similar matrix (≤ 20)	Re-analyze samples.
	Duplicate	Each group of samples of similar matrix (≤ 10)	Ensure that LCS meets acceptance criteria.
Microbiology	Organism control	Each lot of media (minimum of one per month)	Investigate cause
	Negative control	Each lot of media (minimum of one per month)	Investigate cause

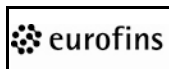
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Drinking Water Quality Control Inorganics (Metals)		
Type	Frequency	Corrective Action
Internal Standard (ICP & ICP/MS only):	Each sample, standard and QC (Unspiked, Dup., MS, LFB, Post Digestion Spike, dilution and blank)	If the internal standard response falls outside the specified range, then the samples would be reanalyzed.
Matrix Spikes:	Each group of samples of similar matrix/level (≤ 10) each method	Analyze post-digestion spike sample
Duplicates (RPD):	Each group of samples of similar matrix/level (≤ 10) each method	Flag the data
Blanks: Initial Calibration (ICB) Continuing Calibration (CCB)	Each wavelength immediately after calibration verification at 10% frequency	Correct problem, recalibrate, and rerun
Preparation Blank	Each batch (≤ 10 samples)	Redigest and reanalyze blank and associated samples if sample result < 10 times blank result or $> LOQ$
Laboratory Fortified Blank (LFB):	Each batch (≤ 10 samples)	Redigest and reanalyze LFB and associated samples. Elements that fail high in the LFB and are ND in the samples can be reported.
Post Digestion Spike:	When matrix spikes are outside range	Flag the data

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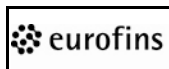
Drinking Water EPA Method 525.2 Quality Control		
Type	Frequency	Corrective Action
Lab Reagent Blank (LRB):	One per extraction batch of (≤ 20) samples	Re-extract and reanalyze blank and associated samples
Lab Fortified Blank (LFB): Spike all compounds of interest	One per extraction batch of (≤ 20) samples	Re-extract and reanalyze LFB and associated samples for compounds outside acceptance limits. Compounds that fail high in the LFB and are ND in the samples can be reported.
Matrix Spike/Matrix Spike Duplicate (MS/MSD): Spike all compounds of interest	One per extraction batch of (≤ 20) samples	Recoveries for LFB must be within criteria. If there is insufficient sample for MSD, then a duplicate (extraction and analysis) of another sample in the batch must be performed.
Surrogates: 1,3-Dimethyl-2-nitrobenzene Perylene-d ₁₂ Triphenylphosphate	Each sample, LFB, MS, MSD, and blank	Re-extract and reanalyze the sample
Internal Standards (ISTD): Acenaphthene-d ₁₀ Phenanthrene-d ₁₀ Chrysene-d ₁₂	Each sample, LFB, MS, MSD, and blank	Reanalyze samples

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QC Table for Miscellaneous Water Tests			
Test	QC Type	Frequency	Corrective Action
Alkalinity Ammonia (ISE) Ammonia (Distill) Dissolved Solids Fluoride (ISE) Hardness Sulfate (TURB) Sulfide Total Solids Turbidity	Blank	Each group of samples of similar matrix (≤ 20)	Prepare the entire batch again and re-analyze.
	Laboratory Fortified Blank	Each group of samples of similar matrix (≤ 20)	Prepare the entire batch again and re-analyze.*
	Duplicate	Each group of samples of similar matrix (≤ 20) Alkalinity, Dissolved Solids, Total Solids, Turbidity each group of similar matrix (≤ 10)	Ensure that LFB meets acceptance criteria.
	Matrix Spike/ Matrix Spike Duplicate	Each group of samples of similar matrix (≤ 20) (not for Turbidity)	Ensure that LFB meets acceptance criteria.
Bromide (IC) Chloride (IC) Cyanide (total & free) Fluoride (IC) Nitrogen (TKN) Nitrate/Nitrite Sulfate (IC) Total Phosphorus TOC	Blank	Each group of samples of similar matrix (≤ 20)	Prepare the entire batch again and re-analyze.
	Laboratory Fortified Blank	Each group of samples of similar matrix (≤ 20)	Prepare the entire batch again and re-analyze.*
	Duplicate	Each group of samples of similar matrix (≤ 10)	Ensure that LFB meets acceptance criteria.
	Matrix Spike	Each group of samples of similar matrix (≤ 10)	Ensure that LFB meets acceptance criteria.
Phenols	Blank	Each group of samples of similar matrix (≤ 20)	Prepare the entire batch again and re-analyze.
	Laboratory Fortified Blank/Laboratory Control Sample	Each group of samples of similar matrix (≤ 20)	Prepare the entire batch again and re-analyze.*
	Matrix Spike/ Matrix Spike Duplicate	Each group of samples of similar matrix (≤ 10)	Ensure that LFB meets acceptance criteria.
pH Moisture	Laboratory Fortified Blank	Each group of samples of similar matrix (≤ 20)	Re-analyze samples.
	Duplicate	Each group of samples of similar matrix (≤ 10)	Ensure that LFB meets acceptance criteria.
Microbiology	Organism control (+)	Each lot of media (minimum of one per month)	Investigate cause
	Negative control (-)	Each lot of media (minimum of one per month)	Investigate cause

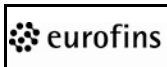
*LFBs that fail high and associated samples are ND can be reported.

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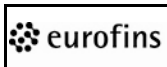
QC Table for Drinking Water Methods: 507, 508, 515.1, 531.1		
Type of QC	Frequency	Corrective Action
Blank	Each batch of (≤ 20) samples	Inject a solvent blank to check for analytical system contamination. Re-inject the blank. If the re-injected blank is acceptable then any samples with positive results must be re-injected. If the re-injected blank is unacceptable, all associated samples must be re-extracted.
Surrogate 507 – 2-NMX 508 – DCB 515 – DCAA 531 – BDMC	Added to each field and QC sample during the extraction.	Recovery must be within specifications unless matrix-related problems are evident, in which case report results and comment.
Matrix Spike/Matrix Spike Duplicate Spike all compounds of interest, except multippeak compounds	Each batch (≤ 20) of samples if sample volume is available.	Evaluate in conjunction with the LFB.
Laboratory Fortified Blank (LFB) Spike all compounds of interest, rotate multippeak compounds	Each batch of (≤ 20) samples. LCSD may be used if insufficient sample for MS/MSD is submitted.	If LFB compounds are outside of acceptance limits, re-extract and re-analyze the batch. Compounds that fail high in the LFB and are ND in the samples can be reported.

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 <div> Lancaster Laboratories Environmental </div>	Document Title: Quality Control Types, Frequency, and Corrective Action	Eurofins Document Reference: 1-P-QM-GDL-9015387
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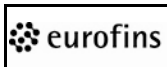
QC Table for Drinking Water Method: 524.2		
Type of QC	Frequency	Corrective Action
Blank	One blank for each 12-hour period or batch of ≤20 samples	Reanalyze blank and associated samples if blank is unacceptable.
Surrogate 4-Bromofluorobenzene 1,2-Dichlorobenzene-d ₄	Added to each field and QC sample prior to analysis	Reanalyze sample if outside limits. If reanalysis confirms original, document on report.
Matrix Spike/Matrix Spike Duplicate Spike all compounds of interest	At client request.	Evaluate in conjunction with the LFB.
Laboratory Fortified Blank (LFB) Spike all compounds of interest	One LFB for each 12 hour period.	If target compounds are outside of acceptance limits, re-analyze the LFB. If second LFB fails, recalibrate instrument, re-analyze LFB and any associated samples. Compounds that fail high in the LFB and are ND in the samples can be reported.
Internal standard (ISTD) Fluorobenzene	Added to each field and QC sample prior to analysis	Reanalyze sample if outside limits. If reanalysis confirms original, document on report.

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 Lancaster Laboratories Environmental	Document Title: Quality Control Types, Frequency, and Corrective Action	Eurofins Document Reference: 1-P-QM-GDL-9015387
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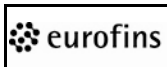
EPA 624 Quality Control GC/MS Volatiles		
Type	Frequency	Corrective Action
Surrogates: 4-Bromofluorobenzene 1,2-Dichloroethane-d ₄ Fluorobenzene	Each sample, MS, MSD, LCS, and blank	Reanalyze sample if outside limits; if reanalysis is within limits, the reanalysis data is reported. If surrogates confirm original, document on report and/or case narrative
Matrix Spikes: Spike all compounds of interest	Each batch (≤ 20) of samples	Evaluated by analyst in conjunction with the LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Samples: Spike all compounds of interest	Each batch (≤ 20) of samples	Reanalyze LCS and associated samples for compounds outside acceptance limits that are also outside MS/MSD acceptance limits. Compounds that fail high in the LCS and are ND in the samples can be reported.
Matrix Spike Duplicates (RPD): Spike all compounds of interest	Each batch (≤ 20) of samples	Evaluated by analyst in relationship to other QC results
Blanks:	Once every 24-hour tune period and/or 20 samples, which ever comes first	Reanalyze blank and associated samples if blank outside QC limits
Internal Standards (ISTD): Bromochloromethane 2-Bromo-1-chloropropane 1,4-Difluorobenzene	Each sample, MS, MSD, LCS, and blank	Reanalyze sample if outside limits; if reanalysis is within limits, the reanalysis data is reported. If internals confirm original, document on report and/or case narrative

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

 <div> Lancaster Laboratories Environmental </div>	Document Title: Quality Control Types, Frequency, and Corrective Action	Eurofins Document Reference: 1-P-QM-GDL-9015387
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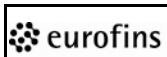
EPA 625 Quality Control GC/MS Semivolatiles		
Type	Frequency	Corrective Action
Surrogate: Nitrobenzene-d ₅ 2-Fluorobiphenyl Terphenyl-d ₁₄ Phenol-d ₆ 2-Fluorophenol 2,4,6-Tribromophenol	Each sample, MS, MSD, LCS, and blank	Re-extract and reanalyze if more than one surrogate out per fraction (acid/base) or any recovery <10%; if re-extraction and reanalysis confirms originals, document on report and/or case narrative
Matrix Spikes: Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Evaluate in conjunction with the LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Sample: Spike all compounds of interest	Each group (≤20) of samples per matrix/level	Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples can be reported.
Matrix Spike Duplicates (RPD): Same as for matrix spikes	Each group (≤20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	Once per extraction group (≤20) of samples, each matrix, level, instrument	Re-extract and reanalyze blank and associated samples
Internal Standards (ISTD): 1,4-Dichlorobenzene-d ₄ 2-Fluoronaphthalene Acenaphthene-d ₁₀ Phenanthrene-d ₁₀ Chrysene-d ₁₂ Perylene-d ₁₂	Each sample, MS, MSD, LCS, and blank	Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

 <div> Lancaster Laboratories Environmental </div>	Document Title: Quality Control Types, Frequency, and Corrective Action	Eurofins Document Reference: 1-P-QM-GDL-9015387
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EPA 608 Quality Control Pesticides/PCBs		
Type	Frequency	Corrective Action
Surrogate: Organochlorine Pesticides & PCBs DCB TCMX	Each sample, MS, MSD, LCS, and blank	Repeat extraction and analysis if reanalysis confirms original report results and comment in case narrative
Matrix Spikes: <u>Organochlorine Pesticides:</u> Spike all compounds of interest, except PCBs, chlordane, and toxaphene <u>PCBs:</u> Aroclor 1016 and Aroclor 1260	Each batch (≤ 20) of samples	Evaluate in conjunction with LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Matrix Spike Duplicates (RPD): <u>Organochlorine Pesticides:</u> Spike all compounds of interest, except PCBs, chlordane, and toxaphene <u>PCBs:</u> Aroclor 1016 and Aroclor 1260	Each batch (≤ 20) of samples	Evaluated by analyst in relationship to other QC results
Laboratory Control Sample: <u>Organochlorine Pesticides:</u> Spike all compounds of interest, except PCBs, chlordane, and toxaphene <u>PCBs:</u> Aroclor 1016 and Aroclor 1260	Each batch (≤ 20) of samples	Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds in the LCS that fail high and are ND in the samples can be reported.
Blanks:	Each batch (≤ 20) of samples	Inject a hexane or solvent blank first to be sure the analytical system is clean then reinject the blank itself. If the reinjected blank is acceptable, any samples extracted with this blank should be reinjected if they, too, contain the analyte which was contaminating the blank. If the reinjected blank is unacceptable, any affected samples must be reextracted.

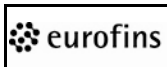
Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

 Lancaster Laboratories Environmental	Document Title: Quality Control Types, Frequency, and Corrective Action	Eurofins Document Reference: 1-P-QM-GDL-9015387
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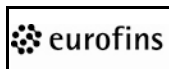
EPA Method 602 Petroleum Analysis Acceptance Criteria		
Type	Frequency	Corrective Action
Surrogate: α,α,α -Trifluorotoluene (PID)	Each sample, MS, MSD, LCS, and blank	Reanalyze if the surrogate recovery is outside the limits unless matrix-related problems are evident.
Matrix Spike: Spike all compounds of interest	Each group (≤ 20) of samples	Evaluate in conjunction with LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD.
Laboratory Control Sample: Spike all compounds of interest	Each group (≤ 20) of samples. LCSD analyzed if sufficient volume is not available for MS/MSD	Reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds in the LCS that fail high and are ND in the samples can be reported.
Matrix Spike Duplicates (RPD): Same compounds as the matrix spike	Each group (≤ 20) of samples	Evaluated by an analyst in relationship to other QC results
Blanks:	At least once per 24 hours	Reanalyze blank and associated samples if blank is outside limits
Internal Standards (ISTD): 1-Chloro-3-fluorobenzene (PID)	Each sample, MS, MSD, LCS, and blank	Reanalyze samples; if reanalysis confirms original result, document on report or case narrative. In cases where the sample matrix is elevating the ISTD recovery, a dilution and reanalysis may be performed.

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change

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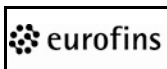
EPA Method 600 Series (Method 200.8 for ICP/MS) Quality Control Inorganics (Metals)		
Type	Frequency	Corrective Action
Internal Standard:	Each sample, standard and QC (Unspiked, Dup., MS, LCS, dilution, Post Digestion Spike and blank)	If the internal standard response falls outside the specified range, then the samples would be reanalyzed.
Matrix Spikes:	Each group of samples of similar matrix/level (≤ 10) each method	Analyze post-digestion spike sample
Matrix Spike Duplicate (RPD):	Not required	N/A
Duplicates (RPD):	Each group of samples of similar matrix/level (≤ 10) each method	Flag the data
Blanks: Initial Calibration (ICB) Continuing Calibration (CCB) Preparation Blank	Each wavelength immediately after calibration verification at 10% frequency or every 2 hours (beginning and end of run min.) Each SDG or batch (≤ 10 samples)	Correct problem, recalibrate, and rerun Redigest and reanalyze blank and associated samples if sample result is greater than the LOQ and $< 10 \times$ blank result
Serial Dilutions:	Each group of (≤ 10) of similar matrix/level	Flag the data
Interference Check Sample:	Each wavelength after Initial Calibration Verification at beginning and end of the run or min. of 2 times per 8 hour	Correct for interference, recalibrate the instrument
Laboratory Control Sample:	Each SDG or batch (≤ 10 samples), each method	Redigest and reanalyze LCS and associated samples. Elements in the LCS that fail high and are ND in the samples can be reported.
Post Digestion Spike:	When matrix spikes are outside 70% to 130% range or within the statistical window (whichever is tighter)	Flag the data
Analytical Spike:	One per 10 field samples	ICP-MS – flag the data

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Quality Control for Miscellaneous 600 Series Water Tests			
Test	QC Type	Frequency	Corrective Action
Alkalinity Ammonia (ISE) Ammonia (Distill.) Dissolved Solids Fluoride (ISE) Hardness Sulfate (turb) Sulfide Total Solids Turbidity	Blank	Each batch (≤ 20) of samples	Prepare the entire batch again and re-analyze.
	Laboratory Control Sample	Each batch (≤ 20) of samples	Prepare the entire batch again and re-analyze.*
	Duplicate	Each batch (≤ 20) of samples	Ensure that LCS meets acceptance criteria.
	Matrix Spike/ Matrix Spike Duplicate	Each batch (≤ 20) of samples (not for turbidity)	Ensure that LCS meets acceptance criteria.
Bromide (IC) Chloride (IC) Sulfate (IC) Cyanide (total & free) Fluoride (IC) Nitrogen (TKN) Nitrate/Nitrite Total Phosphorus TOC	Blank	Each batch (≤ 20) of samples	Prepare the entire batch again and re-analyze.
	Laboratory Control Sample	Each batch (≤ 20) of samples	Prepare the entire batch again and re-analyze.*
	Duplicate	Each batch (≤ 10) of samples	Ensure that LCS meets acceptance criteria.
	Matrix Spike	Each batch (≤ 10) of samples	Ensure that LCS meets acceptance criteria.
Phenols	Blank	Each batch (≤ 20) of samples	Prepare the entire batch again and re-analyze.
	Laboratory Control Sample	Each batch (≤ 20) of samples	Prepare the entire batch again and re-analyze.*
	Matrix Spike/ Matrix Spike Duplicate	Each batch (≤ 10) of samples	Ensure that LCS meets acceptance criteria.

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

*LCSs that fail high and associated samples are ND can be reported.

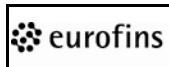
 Lancaster Laboratories Environmental	Document Title: Quality Control Types, Frequency, and Corrective Action	Eurofins Document Reference: 1-P-QM-GDL-9015387
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TO-15 Volatile Organics in Air		
Type	Frequency	Corrective Action
Laboratory Control Sample: Spike all compounds of interest	Each group (≤ 20) of samples	Reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples, can be reported.
Blanks:	Once for each 24-hour time period or ≤ 20 samples	Reanalyze blank and associated samples if blank outside limits
Internal Standards (ISTD): Bromochloromethane 1,4-Difluorobenzene Chlorobenzene-d ₅	Each sample, LCS, and blank	Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

TO-14A Volatile Organics in Air		
Type	Frequency	Corrective Action
Laboratory Control Sample: Spike all compounds of interest	Each group (≤ 20) of samples	Reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples, can be reported.
Blanks:	Once for each 24-hour time period or ≤ 20 samples	Reanalyze blank and associated samples if blank outside limits
Internal Standards (ISTD): Bromochloromethane 1,4-Difluorobenzene Chlorobenzene-d ₅	Each sample, LCS, and blank	Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative

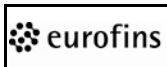
Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

 eurofins Lancaster Laboratories Environmental	Document Title: Microbiological Testing	Eurofins Document Reference: 1-P-QM-GDL-9015388
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Eurofins Document Reference	1-P-QM-GDL-9015388	Revision	3
Effective Date	Jan 13, 2015	Status	Effective
Historical/Local Document Number	DOD - Environmental Quality Policy Manual Appendix K		
Local Document Level	Level 1		
Local Document Type	POL - Policy		
Local Document Category	ES - Environmental Sciences		

Prepared by	Barbara F. Reedy
Reviewed and Approved by	Robert Strocko;Review;Tuesday, December 30, 2014 10:09:14 AM EST Duane Luckenbill;Review;Tuesday, December 30, 2014 12:59:11 PM EST Dorothy Love;Approval;Tuesday, December 30, 2014 1:18:10 PM EST

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 <div>Lancaster Laboratories Environmental</div>	<p>Document Title: Microbiological Testing</p>	<p>Eurofins Document Reference: 1-P-QM-GDL-9015388</p>
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MICROBIOLOGICAL TESTING

1. MICROBIOLOGICAL SAMPLE HANDLING

1.1. Microbiological Sample Collection

The containers for environmental microbiology are typically sterile, screw-cap plastic bottles. A minimum of 100 mL of sample is required. The sampling containers are purchased with a sterility certification. The sterility, absence of autofluorescence, and volume of each purchased lot of containers is verified by randomly selecting a container from each purchased lot and inoculating it with approximately 100 mL of sterile tryptic soy broth and placing it in incubation for 24 hours at $35^{\circ} \pm 0.5^{\circ}\text{C}$. Each lot of bottles is also checked for absence of autofluorescence with a 366-nm UV light with a 6-Watt bulb. The 100-mL calibration line on the container is verified using a 100-mL Class A graduated cylinder to 2.5% tolerance.

Samples collected for microbiological analyses must follow a specific protocol:

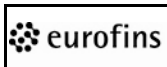
- The sampling taps are to be free of aerators, strainers, hose attachments, and purification devices; they should not be mixing type faucets, and avoid leaky faucets.
- Maintain a steady water flow for 3 to 5 minutes before collecting the sample.
- Using aseptic techniques, fill the container to just above the 100-mL mark on the container. This will allow for mixing and chlorine residual analysis.
- Do not overfill the container.
- If another environmental microbial analysis is required, or if the water is discolored (to act as a color standard), a separate container will be required.

1.2. Microbiological Sample Storage

Because sample integrity can be compromised by improper storage, the environmental microbiology samples are refrigerated with the temperature monitored until requested by the microbiologist for analysis.

Holding times for samples are monitored and analysis is scheduled accordingly. For Safe Drinking Water Act (SDWA) compliance purposes, no sample (for total coliform analysis) with over 30 hours elapsed time from collection will be analyzed. HPC samples from SDWA surface water systems must be tested within 8 hours of collection. Fecal coliform tests on effluents for National Pollutant Discharge Elimination System (NPDES) compliance purposes must be transported to the laboratory within 6 hours of collection. Samples that arrive past 6 hours of when they were collected cannot be tested. Whenever possible, the sample should be tested within 2 hours of receipt.

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1.3. Microbiological Sample Return/Disposal

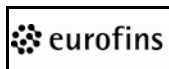
All solid wastes generated from the microbiological analyses are disposed of in bags designated as "BioHazard", sterilized via autoclave and disposed of by incineration. The laboratory uses a sophisticated, laboratory information management system (LIMS), which includes programming to assist in the identification of hazardous wastes at time of discard. In most cases, a sample for coliform testing is collected in a container that will also be the test vessel. When this occurs, samples are discarded in the laboratory immediately after analysis is completed. When samples are not tested in the sample container, the sample containers are returned to sample storage for disposal.

2. MICROBIOLOGICAL TECHNICAL REQUIREMENTS AND TRACEABILITY OF MEASUREMENTS

2.1. Media

- Within the microbiology laboratory, procedures are in place to address preparation, labeling, storage, expiration, documentation, and quality/sterility evaluation requirements for these materials. Only commercially prepared or manufactured dehydrated media is used for SDWA water work. Media may not be formulated from basic ingredients. Each new lot of dehydrated or commercially prepared medium is checked against positive and negative culture controls. Each purchased lot of MMO-MUG media is tested for performance using *E. coli*, *K. pneumoniae*, and *Ps. aeruginosa*, or equivalent organisms following a standard operating procedure. The positive/negative organism check is performed on each new lot of purchased or prepared media for QC purposes.
- Each analytical method includes a list of media needed for the test. These are fully described, including name, purity, and description of preparation. Where applicable, shelf life and storage conditions are also listed.
- The Microbiology Department is responsible for maintaining an inventory of the media needed. New supplies of media are checked by the Purchasing Department to ensure that they match the purchase order. The laboratory is responsible for checking that new supplies meet the method requirements.
- In addition to the name and concentration, the media containers are labeled with the storage conditions, the date opened, and an expiration or re-evaluation date. Subsequent media preparations at the laboratory are fully documented in a logbook and are traceable to, or labeled to include:
 1. Name of media
 2. Concentration, as appropriate
 3. Date prepared
 4. Name of analyst preparing or reference to logbook
 5. Storage conditions
 6. Expiration/re-evaluation date
 7. Manufacturer name and lot #
 8. Sterilization time and temperature
 9. Final pH, where required
 10. Sterility check result

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2.2. Microbiological Standard Sources, Calibration, and Preparation

Microbial Control Species - Where required, laboratory cultures are obtained from the American Type Culture Collection (ATCC). Cultures used in testing are no more than five transfers from ATCC freeze-dried cultures.

2.3. Microbiological Equipment Maintenance

Equipment maintenance and calibration is addressed in instrument-specific Operation, Maintenance, and Calibration Procedures (OMC) or instrument-specific instruction manuals located within the department.

The general process for sterilization procedures are outlined below:

2.3.1. All autoclaving is done at $121^{\circ} \pm 1^{\circ}\text{C}$, with times as specified below (in minutes):

Carbohydrate media	25
Rinse water	60
Contaminated materials	minimum of 70

2.3.2. Sterile disposable single use membrane filter units or sterile glass filter funnels are used for methods that require filtration.

2.4. Microbiological Labware Cleaning

Sterile disposable plastic ware is primarily used for microbiological analysis. However, procedures are in place to outline the washing process for each type of labware used in the laboratory. Most glassware is machine-washed. Labware that is washed by hand is either air dried or dried in specifically designed ovens and sterilized appropriately. Each new lot, or at least annually, of detergents used to wash glassware for Environmental Microbiology labware, is tested using the Inhibitory Residue Test, as outlined in SM20 9020.B.4.a.2).

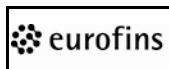
MICROBIOLOGICAL INTERNAL QUALITY CONTROL CHECKS

2.5. Microbiological Laboratory Quality Control Samples and Acceptance Criteria

Quality control (QC) samples are analyzed with each batch of samples or new lot of reagents, as required by the referenced methods, to demonstrate that all aspects of the analysis are in control within established limits of precision and accuracy. Chromofluorogenic media QC tests are lot-specific and performed on each newly received lot.

Each laboratory analytical method specifies (or includes cross-references to) the type of QC sample, frequency of analysis, acceptance criteria for QC sample results, and corrective action to be taken if QC sample results fall outside of the acceptance range. The handling of QC data is described in section 9.2 of the Environmental Quality Policy Manual. The types of QC samples and the information each provides are discussed in the following paragraphs.

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- 2.5.1. Negative System Control - The QC on this is method specific and can be found in 1-P-QM-PRO-9018209, Quality Control/Quality Assurance Procedure for Environmental Microbiology.
- 2.5.2. Positive and Negative Organism Controls - Each lot/batch of media is tested using positive and negative organism controls.
- 2.5.3. Duplicate Counting (Test Variability/Reproducibility) - duplicate counting is performed monthly on HPC and fecal MF plates. Each analyst who counted samples for a month, counts the plates and their results are evaluated. Counts must be within 10% difference of the total average for all analysts to be acceptable.
- 2.5.4. Duplicates - For heterotrophic plate count samples, a duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test. The plate counts are averaged.
- 2.5.5. Serial Dilutions - Fecal coliform, biosolids analyses, and heterotrophic plate counts may require serial dilution of the sample.

2.6. Microbiological Quality Control Sample Frequency and Corrective Action

Each analytical method defines the frequency for the required QC samples, where appropriate. The corrective action required when a QC result fails to meet the acceptance criteria is also given, where appropriate.

The QC acceptance criteria are available to analysts in the laboratory. If the results are not within the acceptance criteria, corrective action suitable to the situation must be taken. This may include, but is not limited to, checking calculations, examining other quality control analyzed with the same batch of samples, qualifying results with a comment stating the observed deviation, and invalidating results. It should be noted that resampling may be required in the case of invalidated results for SDWA, Environmental Protection Agency (EPA), Pennsylvania Department of Environmental Protection (PADEP), or Pennsylvania Department of Health (DOH) compliance samples due to the short hold-times in microbiological analysis.

2.7. Microbiological Water Systems

Laboratory Reagent Water Suitability Testing - On an annual basis, a sample is sent to a PADEP certified laboratory for suitability analyses. These serve as confirmation of our analyses, as well as to supply additional data on the water suitability.

2.8. Microbiological Reporting Limits

For microbiological analysis, the limits are method-specified and/or project-specific. This information is programmed into the LIMS for reporting purposes.

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 <div>Lancaster Laboratories Environmental</div>	Document Title: Preparation of Vials for Field Preservation of Soils for Volatile Analysis	Eurofins Document Reference: 1-P-QM-WI -9015073
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Eurofins Document Reference	1-P-QM-WI -9015073	Revision	15
Effective Date	May 12, 2015	Status	Effective
Historical/Local Document Number	Analysis DOD - 0388, 6119, 6169, 6647, 0405, 1169, 6171, 6172, 6173, 6645, 2392, 6176, 7579, 0069, 11014, 11764		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

Prepared by	Chad Wettig
Reviewed and Approved by	Anneliese Owen;Review;Tuesday, April 28, 2015 10:18:14 AM EDT Christiane Sweigart;Approval;Tuesday, April 28, 2015 10:30:16 AM EDT

 Lancaster Laboratories Environmental	Document Title: Preparation of Vials for Field Preservation of Soils for Volatile Analysis	Eurofins Document Reference: 1-P-QM-WI -9015073
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Revision Log:

Revision: 15		Effective Date:	This version
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Throughout Document	Clarification	Replaced references of Parallax with LIMS	
Cross Reference	1-P-QM-QMA-9017363 was made obsolete	Deleted 1-P-QM-QMA-9017363 and added 1-P-QM-QMA-9015389	
Procedure	Reflects the current procedure.	Note section added to reference the use of purchased pre-tarred vials	

Revision: 14		Effective Date:	Mar 29, 2013
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Throughout Document	Reflect re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers	
Apparatus and Equipment	Reflects current automated programs capturing data	Added Reagent, Solution, and Balance Applications.	
Procedure	Not applicable to the procedure	Removed references to manually recording data in logbooks.	

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Reference:

1. Massachusetts Department of Environmental Protection Method for the Determination of Volatile Petroleum Hydrocarbons, May 2004.
2. Test Methods for Evaluating Solid Wastes, SW-846 Method 5035, November 2004.
3. Test Methods for Evaluating Solid Wastes, SW-846, Method 5035A, July 2002.
4. *Method for the Field Extraction/Preservation of Soil Samples with Methanol for Volatile Organic Compounds*, New Jersey DEP, February 1997.
5. Method AK101 for the Determination of Gasoline Range Organics, April 8, 2002.
6. *Instructions for EPA Reference Method 25D - Interlaboratory Comparison*, Research Triangle Institute, October 1991.
7. WI PVOC PUBL-SW-140 09/95, *Wisconsin DNR Modified GRO*.
8. *Chemical Hygiene Plan*, current version.

Cross Reference:

Document	Document Title
1-P-QM-FOR-9008289	Field Preserved Vial Preparation for Volatile Soils
1-P-QM-PRO-9015516	Preservation and Bottles Room Preservative Traceability
1-P-QM-PRO-9015517	Pipette Dispenser Calibration Procedure
1-P-QM-PRO-9018271	Glassware Cleaning
1-P-QM-QMA-9015389	Balance, Syringe, Pipette Verification

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Purpose:

The purpose of this SOP is to provide detailed instructions for the preparation of vials used for field-preservation of soil samples to be analyzed for volatiles.

Scope:

This procedure applies to analysts who prepare pre-preserved containers used in the field for soil sampling of volatile analyses.

Basic Principles:

An aliquot of preservative is placed in a volatile-free container and weighed. The weight of the container and preservative is then captured using the Volatile Preparation program in LIMS. When requested, the container is sent to the client for use in field preservation of a solid sample. When the container and the soil sample are returned to the lab, it is re-weighed and the actual sample weight is calculated. Samples are then spiked with the appropriate surrogate as determined by the analysis being performed.

Definitions:

1. Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) – A sample of known composition analyzed with each batch of samples to demonstrate laboratory accuracy. The samples either naturally contain the analytes of interest or are clean samples fortified with known concentrations used to demonstrate laboratory accuracy. A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test.
2. VOA Prep Summary and VOA Prep Summary by SDG are reports that reside on the LIMS database. Using the Volatile Prep application and moisture results pulled from LIMS, the report is populated and calculations are performed to achieve a Final Extraction volume to be used when necessary by the appropriate Groups.

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Interferences:

Sample contamination can occur if the vial preparation is not performed in a volatile-free environment; therefore, this process must be performed in one of the designated volatile-free laboratories. Samples also become contaminated if volatiles diffuse through the sample vial septum. A trip blank carried through sampling, storage and handling acts as a check of such contamination.

Safety Precautions and Waste Handling:

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

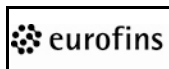
Methanol is flammable. Containers of this solvent must be kept away from any sources of open flames or sparks. Due to the potentially toxic nature of samples received from clients for analysis, safety precautions must be observed when handling samples. Safety glasses, lab coats, and gloves are required. Weighing out of the samples must always take place in a hood.

The solvents utilized in this procedure are disposed of in a solvent waste container which is transferred to the lab-wide disposal facility. Expired standards in methanol are disposed of as hazardous waste. Bulk sample containers and methanolic sample preparations are returned to the sample storage area for future disposal. Other wastes generated by Lancaster Labs are disposed of via incineration at EPA licensed facilities.

Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding and agreeing to follow the current version of this SOP.

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The initial training consists of observing the procedure being carried out by an experienced analyst/technician. Next, the trainee performs the procedure while the experienced person watches, answers questions, and gives feedback. Following the initial training, experienced individuals are available as a resource until no longer required. Analysts are considered proficient when they are able to perform the procedure independently.

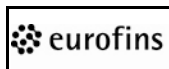
Sample Collection, Preservation, and Handling:

Sample containers must be refrigerated at 0° to 6°C, not frozen, after preparation. Containers containing surrogates are not kept for more than 2 weeks before being discarded or sent into the field for use in sample collection. Packaging of sample containers must follow all DOT regulations. When returned, samples must be preserved and refrigerated unfrozen at 0° to 6°C or frozen in reagent water at -10° to -15°C within 48 hours of collection. See individual technical area SOPs for method specific hold times.

Apparatus and Equipment:

1. 40-mL vials with Teflon™-lined septa and screw caps
2. 40-mL vials with stir bars, Teflon™-lined septa, and screw caps, SciSpec Catalog #376740-MB or equivalent
3. 125-mL amber glass wide mouth jar with Teflon™-lined septa and screw caps
4. Pipette capable of dispensing up to 25 ± 0.25 mL. Refer to 1-P-QM-PRO-9015517 (SOP-SS-018) for calibration procedures.
5. 50-µL syringe
6. 1000-mL volumetric flask, class A

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7. Analytical balance capable of weighing ± 0.01 g. Refer to 1-P-QM-QMA-9015389 (LOM-SOP-ES-235) for calibration procedures.
8. Label printer/labels
9. LIMS VOA prep application and Reagent, Solution, and Balance Applications which integrates a PC with an analytical balance to collect data directly from the balance. It organizes the data, performs calculations, and stores final results in the Laboratory Information Management System (LIMS).

Reagents and Standards:

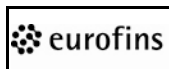
NOTE: A rinse using reagent water followed by methanol must be performed on the pipette dispensers before adding a new lot of solution or standards.

1. Methanol – Purge and trap grade.
 - a. Store at room temperature and re-analyze yearly.
 - b. Use methanol that has been previously tested and approved for use by the labs. See 1-P-QM-PRO-9015516 (SOP-SS-017) for further information.
2. 8260A/B Surrogate Mix, Restek Catalog #30340 (2500 $\mu\text{g/mL}$) or equivalent.
 - a. Store at -10° to -15°C for up to 1 year.
 - b. Use standard as is, or diluted in methanol to a final concentration of 2.5 $\mu\text{g/mL}$. Diluted standard must be stored at -10° to -15°C for up to 6 months.
 - c. This standard is used for the GC/MS analyses.

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3. Custom α,α,α -trifluorotoluene (TFT), Restek Catalog #54357 (15,000 $\mu\text{g/mL}$) or equivalent.
 - a. Dilute standard in methanol to a final concentration of 750 $\mu\text{g/L}$ for the working solution. A prep dilution of 0.5 mL of TFT to 10 mL of methanol is used when spiking returned field preserved containers.
 - b. Store at -10° to -15°C for up to 30 days.
 - c. This standard is used for the GC analyses.
4. Sodium hydrogen sulfate anhydrous powder, Fluka, Catalog #2316657 or equivalent.
 - a. Store at room temperature and re-analyze yearly.
 - b. If compounds are detected above the method detection limit (MDL), prepare another vial and repeat the analysis. If compounds are still detected above the MDL, a new container must be tested and used.
5. Sodium Bisulfate Solution –
 - a. Prepare by diluting 200 ± 0.5 g of the Sodium hydrogen sulfate anhydrous into 1000 mL of reagent water in 1000-mL volumetric flask. Cap and invert at least 10 times to mix.
 - b. Store at room temperature and re-analyze every 6 months if supply remains.
 - c. If compounds are detected above the method detection limit (MDL), repeat the analysis. If compounds are still detected above the MDL, remake the solution and test before using.

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6. Reagent water – water in which target analytes are not detected at or above the reporting limit for parameters of interest. In general, the deionized water supplied at the taps in the laboratory meets criteria. If the reagent water does not meet the requirements, see your supervisor for further instructions.
7. Polyethylene glycol (PEG) – Average molecular weight 400 amu, EM Science preferred.
 - a. Any lot/vendor must meet a cleanliness level of <50 mg/kg volatile content.
 - b. Store at room temperature and re-analyze each year if supply remains.

Calibration:

Not applicable to this procedure.

Procedure:

Use the VOA Prep application whenever possible for this procedure to facilitate data transfers and other tracking. However, it is also allowable to record data traditionally in a logbook.

A. Prepare preservative containers

1. Check to make sure the pipette calibration has been performed.
2. Use the pipette to add the appropriate amount of preservative to a clean container (see 1-P-QM-FOR-9008289, Form 4580). A 40-mL vial is used unless otherwise indicated on Form 4580.
 - a. For analyses 6119 and 6172 the appropriately diluted surrogate solution must be added at this time using a pipette.

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- b. For analysis 1169 use a syringe to add the ampulated 8260A/B surrogate standard plus methanol into a 40-mL vial. Use 1 μ L of 8260A/B surrogate for every 1 mL of methanol in the vial.
3. Seal the container with a screw cap and septum seal.
4. Label the container with the tracking number.
5. Check to make sure the balance has been calibrated each day before use.
6. Place the container on a zeroed balance and capture the weight electronically to the nearest 0.01 g using the VOA Prep application.
7. Store the prepared containers in the designated area in the Volatile Prep room. Vials containing surrogates must be stored in the refrigerator, vials containing just methanol are stored at room temperature or refrigerated.
8. Pull vials as requested via e-mail from client services and place on the designated shelf in the bottles room storage area. The containers are now ready to be sent into the field for sample collection.
9. Send a reply e-mail to the client service representative to notify them that the order has been completed.

B. Re-weigh preservative containers after return from the field

1. Using the Volatile Prep application, scan the tracking number on the container. This brings up the information documented from the preparation step described above.

NOTE: If using purchased pre-tarred vials insert the vial ID, preservative, and tare weight information on the Pre-Tarred tab within the Volatile Prep Application.

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2. Check to make sure the balance has been calibrated each day before use. Place the container on a zeroed balance and capture the second weight electronically using the VOA Prep application.
3. The Volatile Prep application calculates the net weight. (weight of vial, solution, and soil minus the weight of the vial and solution).
4. If there are any holding-time issues or if weights are outside of the Action Requirement listed on 1-P-QM-FOR-9008289 (Form 4580), the VOA Prep application automatically sends an e-mail to Client Services.
5. Record any unusual observations about the sample in the comment section.

C. Sample spiking

NOTE: Analyses 11014 and 11764 do not require a surrogate to be spiked into the methanol.

A 1:1 ratio of μL to mL is required when spiking surrogate into methanol, except for analysis 0388 MA-VPH samples which require 30 μL to the 15 mL of methanol.

1. Determine the amount of methanol in the sample. This is determined by the analysis number and the mL of methanol printed on the tracking number.
2. Fill the syringe with the appropriate surrogate slightly past the amount of μL needed.
 - a. Add the appropriate surrogate based on the bottle code entered and the department receiving the sample.
 - b. GC requires a TFT surrogate mix to be used, bottle code 64.
 - c. GC/MS requires an 8260A/B surrogate mix to be used, bottle codes 14 and 66.

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3. Dispense the surrogate from the syringe until the required level of μL is reached. This assures no air bubbles are present and the syringe contains surrogate.
 - a. Tilt the vial so the methanol comes toward the top of the vial, spike through the septa, submerging the tip of the syringe into the methanol.
 - b. Shake the vial to disperse the surrogate throughout the sample.
 - c. Put an "S" on the vial label to indicate surrogate has been added.
 - d. Clean the syringe according to 1-P-QM-PRO-9018271 (SOP-SS-026) before proceeding to the next sample.

D. Deliver samples to the labs

Once the sample containers have been re-weighed, they must be transported to the laboratory for analysis. Each department has a designated refrigerated drop-off spot. All trip blanks and field blanks submitted must follow the sample containing the same preservative. Blanks submitted as waters are to be stored in the designated volatile refrigerator.

NOTE: Any sample designated for prescreen must be taken to the appropriate refrigerator and placed in a box sorted in numerical order in groups of 21 or 42 when applicable. If a methanol sample is designated for prescreen and a corresponding methanol trip blank or field blank is submitted the blanks must follow the associated samples through the entire process including sample prescreen.

Calculations:

$$\text{Calculation of sample weight : } W_n = W_s - W_f$$

Where:

W_f = weight of container + solution (first weight)

W_s = weight of container + solution + soil (second weight)

W_n = net weight of soil sample

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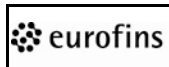
Statistical Information/Method Performance:

Not applicable to this procedure.

Quality Assurance/Quality Control:

The number of containers requested from Client Services includes the appropriate amount of extra bottles to serve as matrix quality control (QC) for volatile analyses requested. The matrix QC spiking for this process is noted in Procedure C. All other QC samples such as the LCS, LCSD, and method blanks are prepared as outlined in the individual technical areas SOPs.

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Eurofins Document Reference	1-P-QM-WI -9015067	Revision	15
Effective Date	Jun 16, 2015	Status	Effective
Historical/Local Document Number	Analysis DOD - 0259, 0159		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

Prepared by	Nina Haller
Reviewed and Approved by	Robert Strocko;Review;Monday, June 1, 2015 1:50:52 PM EDT Barbara Reedy;Approval;Tuesday, June 2, 2015 7:56:51 AM EDT

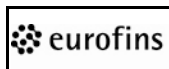
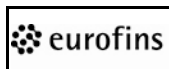
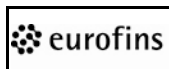
 <div>Lancaster Laboratories Environmental</div>	<p>Document Title: Mercury in Aqueous, Solid and Tissue Samples by Cold Vapor AA</p>	<p>Eurofins Document Reference: 1-P-QM-WI -9015067</p>
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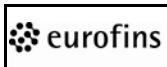
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Revision Log:

Revision: 15		Effective Date:	This version
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Throughout Document	No longer applicable	Removed CLP references.	
	Clarification	Added eLIMS-EP for Parallax.	
Table I and II	Clarification	Clarified the acceptance criteria for LCS/LCSD.	

Revision: 14		Effective Date:	Jun 19, 2013
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Throughout Document	Reflect re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers	
Sample Collection, Preservation, and Handling	Clarification	Added preservation pH requirements and changed storage requirements to 0° to 6°C not frozen.	
Sample Analysis	Clarification	Added information for hydroxylamine additions.	
Quality Assurance/Quality Control	Clarification	Included SPLP samples with TCLP MSA and adjusted requirements.	

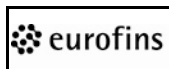
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Reference:

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 7470A, September 1994
2. Test Methods for Evaluating Solid Wastes, SW-846 Method 7471B, February 2007.
3. Test Methods for Evaluating Solid Wastes, SW-846 Method 7471A, September 1994
4. Method 245.1 (rev. 3), Determination of Mercury in Water by Cold Vapor Atomic Absorption Spectroscopy, USEPA 600/R-94/111 May 1994.
5. *Chemical Hygiene Plan*, current version.

Cross Reference:

Document	Document Title
Analysis #5711, 10638	Sample Preparation of Soil, Sediment, Sludge, Oils, and Tissues for Total Mercury Analysis by Atomic Absorption Cold Vapor Technique
Analysis #5713, 5714	Digestion of Aqueous Samples by SW-846 Method 7470A, EPA 254.1.
1-P-QM-FOR-9007858	Nonconformance Form
1-P-QM-FOR-9008921	Working Instructions for Preparation of Mercury Solutions and Standards
1-P-QM-QMA-9017325	Instrument and Equipment Maintenance and Calibration

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Purpose:

The purpose of this SOP is to describe the proper analysis of aqueous, solid and tissue samples for Mercury by Cold Vapor Atomic Absorption.

Scope:

This method is used for determination of mercury in aqueous and solid samples. The optimum concentration range for this method is 0.2 to 5.0 ppb.

Matrices - EPA 7470A is applicable to water analysis. EPA 7471A and EPA 7471B are applicable to soil and tissue analysis. EPA 245.1 is applicable to water analysis.

LOQs are based on annual statistical evaluation of laboratory data and are subject to change. The current MDLs and LOQs are maintained in the LIMS.

Limits of Quantitation are subject to change without notification.

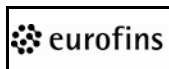
Background Information:

Not applicable

Basic Principles:

The Leeman Labs Mercury Analyzer utilizes continuous flow technology with drying of the sample vapor for the analysis of mercury by automated vapor generation. The reaction for the mercury analysis is a simple reduction reaction. The mercury is reduced with stannous chloride to liberate mercury metal and Tin (IV) chloride. An inert gas is used to sweep the volatile mercury into the absorption cell in the optical path of the atomic absorption spectrophotometer. The dry vapor enters one path of the optical cell, which has been optimized for fast response (small diameter), and sensitivity (long length).

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Mercury is measured using a solid state detector with a wide dynamic range and a mercury source that delivers a stable source of emission at 254 nm. The signal is referenced to the simultaneous absorbance of the pure carrier gas flowing through the second optical path under identical conditions.

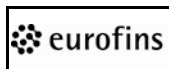
Reference Modifications:

SW-846 Methods 7470A, 7471A, 7471B and EPA 245.1 are manual procedures. This SOP is written for an automated determination. The chemistry used to perform the mercury determination is the same. This modification does not impact the quality of the data generated.

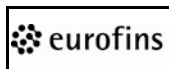
Definitions:

1. 0.15% HNO₃ – 0.15% Nitric Acid Solution
2. ACS – American Chemical Society
3. Calibration Blanks – includes ICBs and CCBs
4. CCB – Continuing Calibration Blank
5. CCV – Continuing Calibration Verification
6. CRA – Low Level Check Standard
7. D – Sample Duplicate
8. DOC – Demonstration of Capability
9. ICB – Initial Calibration Blank
10. ICV – Initial Calibration Verification
11. IDOC – Initial Demonstration of Capability

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12. LCS/LCSD – Laboratory Control Sample/ Laboratory Control Sample Duplicate
13. LCSW/LCSS – Laboratory Control Sample Water/Laboratory Control Sample Solid
14. LIMS – Laboratory Information Management Systems
15. LLI Sample ID – unique 7-digit number assigned to a client sample.
16. LOQ – Limit of Quantitation
17. M – Sample spike duplicate
18. MDL – Method Detection Limit
19. MS/MSD – Matrix spike/matrix spike duplicate
20. PB/PBW/ PBS –Preparation Blank/ Preparation Blank Water/Preparation Blank Solid.
21. QC – Quality Control
22. R – sample spike
23. RPD – Relative Percent Difference
24. Leeman Labs Envoy software – a windows based program to help navigate the software.

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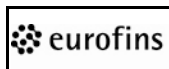
25. Method Blank - equivalent to a Preparation Blank. A designated sample designed to monitor for sample contamination during the analysis process. A volume of reagent laboratory water is typically used to monitor water sample analysis, while solids blanks consist of a purified solid matrix or just the reagents used in the test. The blank demonstrates that no artifacts were introduced during the analysis process.
26. MSA – Method of Standard Additions
27. eLIMS-EP (Parallax) – The computer system that is used for Environmental work to track client samples and report results for those samples, unless spreadsheets or certificates of analysis reports are attached by the technical department. Also referred to as the LIMS.
28. SOP- Standard Operating Procedure
29. SPLP - Synthetic Precipitation Leaching Procedure
30. TCLP – Toxicity Characteristic Leaching Procedure
31. U or US – unspiked background sample

Interferences:

Potassium permanganate is added to samples to eliminate possible interference from sulfide. Concentrations as high as 20 mg/L of sulfide as sodium sulfide do not interfere with the recovery of added inorganic mercury from reagent water.

Samples high in chlorides require additional permanganate (as much as 25 mL) because, during the oxidation step, chlorides are converted to free chlorine, which also absorbs radiation of 253.7 nm. Take care to ensure that free chlorine is absent before the mercury is reduced and swept into the cell by using an excess of hydroxylamine sulfate (or chloride) reagent.

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Copper has been reported to interfere; however, copper concentrations as high as 10 mg/kg had no effect on recovery of mercury from spiked samples.

Safety Precautions and Waste Handling:

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Preparing samples for inorganic analysis involves working with concentrated acids and other chemicals which are dangerous if not handled carefully:

Nitric acid (HNO₃) – This acid can cause skin burns. Add nitric acid to samples in a hood to avoid exposure to toxic fumes.

Sulfuric acid (H₂SO₄) – This acid is a strong oxidizing agent and can cause severe burns. Sulfuric acid spills are extremely slippery, adding to the danger. Always use in a fume hood. Never mix with concentrated HCl or concentrated KMNO₄ to avoid a violent reaction (explosive splattering and extreme heat).

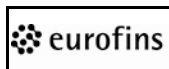
Hydrochloric acid (HCl) – This acid can cause skin burns. Never mix HCl with concentrated H₂SO₄ to avoid a violent reaction. Always use in a fume hood.

When diluting strong acids, never add water to acid; always add acid to water.

Store concentrated acids in the prep room acid lockers. Only acids are to be stored in these lockers. (Store solvents in the flammable liquid storage cabinet.) Some concentrated acids are kept in the acid reagent bottles on prep room counters. Fill reagent bottles in an operating fume hood using caution to avoid spills.

Perform acid digestions in hoods that are turned on and have active alarms. Notify a supervisor immediately if the hood is malfunctioning or the alarm sounds.

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Samples that contain dust may be hazardous. Open in a fume hood.

Samples that may contain cyanide require special precautions to avoid exposure to hydrogen cyanide gas. Contact your supervisor prior to adding acid. Always open these samples and add the acid in a hood.

Use spill pillows to absorb large acid spills (small spills are cleaned with wet paper towels.) Use SPILL-X-A powder or equivalent to neutralize any remaining acid and then rinse the area thoroughly with water. Spill pillows and SPILL-X-A are stored on the prep room shelf.

Dispose of acid waste properly. Collect all acid digestions, waste solutions, and expired reagent solutions in waste containers. When the acid waste containers are full, a designated acid waste handler transfers the waste to the acid neutralization tank.

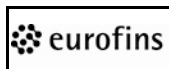
Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability (DOC).

Initially, each analyst performing the instrumental analysis must work with an experienced analyst for a period of time until they can independently calibrate the instrument, use the system to set up sequences, perform the calculations, interpret raw data, and enter data into the LIMS. Proficiency is measured through documented audits of the tasks listed and over checking of data as well as an Initial Demonstration of Capability (IDOC).

The IDOC and the DOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation.

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Sample Collection, Preservation, and Handling:

Aqueous samples are collected in plastic or glass containers, preserved to a pH of <2 with nitric acid and stored at 0° to 6°C not frozen. Samples must be digested within 28 days of collection for SW-846 Methods 7470A, 7471A, 7471B.

Drinking Water samples are collected in 1-L plastic or glass containers, preserved to a pH of <2 with nitric acid and stored at 0° to 6°C not frozen. Samples must be digested and analyzed within 28 days of collection for EPA 245.1

Solid samples are collected in glass containers and stored at 0° to 6°C not frozen. Samples must be digested and analyzed within 28 days of collection.

Dissolved Mercury: Samples to be analyzed for soluble mercury requiring filtration at the lab must be submitted unpreserved. The sample is run through a 0.45 micron filter within 5 days of receipt and then for aqueous samples, samples are collected in plastic containers and preserved to a pH of <2 with HNO₃.

Store sample digestates in plastic bottles at room temperature. Store standards and digestates separately.

Apparatus and Equipment:

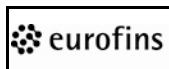
Hydra II Mercury Analyzer with Envoy instrument software.

Reagents and Standards:

- A. Store all standards and reagents in polyethylene or glass containers at room temperature. Label the container with the solution name, lot number, date prepared, the expiration date, the initials of the person preparing the solution, and the storage conditions.

NOTE: Standard/ spiking concentration and reagent vendors are subject to change without notification.

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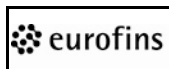
B. Reagents use the following or equivalent:

1. Nitric acid, 70.0% to 71.0% HNO₃, Fisher Trace Metal Grade reagent, 1.428 g/mL; Store in glass container at room temperature. Follow manufacturer's expiration date.
2. Sodium chloride, NaCl, J.T. Baker, Certified ACS. Store in plastic container at room temperature. Follow manufacturer's expiration date.
3. Hydroxylamine hydrochloride, NH₂OH•HCl, J.T. Baker, Certified ACS. Store in plastic container at room temperature. Follow manufacturer's expiration date.
4. Reagent Water
5. Stannous chloride solution, 10% SnCl₂, Baker Analyzed reagent, ACS. Store in plastic container at room temperature. Follow manufacturer's expiration date.
6. Hydrochloric acid, HCl, 36.5% to 38.0%, Fisher Trace Metal Grade reagent, 1.194 g/mL or equivalent. Store in glass container at room temperature. Follow manufacturer's expiration date.

C. For the preparation of calibration blanks, ICBs, CCBs, calibration standards, ICVs, CCVs, CRAs, Method Blanks, LCSs and Matrix Spikes solutions, see Form 1-P-QM-FOR-9008921.

D. General solutions - See Form 1-P-QM-FOR-9008921.

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Calibration:

A. Leeman Labs Hydra II Mercury Analyzer

1. The software program has been developed to check the correlation coefficient of the curve, run appropriate ICV and CCVs at proper intervals, and check the percent recoveries of the ICV and CCVs.
2. A recalibration and reread of any associated samples is required for any checks that fall outside the windows.

B. Initial Calibration.

1. For the preparation of calibration blanks and calibration standards see Form 1-P-QM-FOR-9008921.
2. For the frequency, acceptance criteria and corrective action see tables I and II.

NOTE: The low standard must be at or below the LOQ.

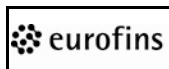
C. Initial Calibration Verification (ICV).

1. For the preparation of ICV standard see Form 1-P-QM-FOR-9008921.
2. For the frequency, acceptance criteria and corrective action see tables I and II.

D. Continuing Calibration Verification (CCV).

1. For the preparation of CCV standard see Form 1-P-QM-FOR-9008921.
2. For the frequency, acceptance criteria and corrective action see tables I and II.

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E. Low Level Check Standard (CRA)

1. For the preparation and concentrations of CRA standard see Form 1-P-QM-FOR-9008921.
2. For the frequency, acceptance criteria and corrective action see tables I and II.

Procedure:

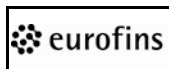
A. Sample preparation

1. Aqueous samples are digested according to Analysis #5713, 5714.
2. Solid samples are digested according to Analysis #5711, 10638.

B. Leeman Labs Hydra II Mercury Analyzer

1. Instrument Setup
 - a. Turn ON the power to the instrument (switch in the back) and computer.
 - b. Ensure that Argon supply is set to 15 psi.
 - c. Double click the Envoy icon on the desktop to initialize the instrument software.
 - d. Loosen all the peristaltic pump cassettes.
 - e. Place levers in the 1 o'clock position to avoid stalling the pump.
 - f. Check that the rinse bottle is full and Luer connections are tight. Only a 'light' finger tightening is required. Refill the rinse tank with a 2.0% Hydrochloric Acid (HCl) solution. For preparation of 2.0% HCl solution, see Form 1-P-QM-FOR-9008921.

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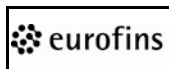
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- g. Check that the 10% stannous chloride bottle is full and Luer connections are tight. Only a 'light' finger tightening is required. For preparation of 10% stannous chloride, see Form 1-P-QM-FOR-9008921.
- h. Click the start icon on the Tool Bar to turn on the peristaltic pump and set the gas flow to method programmed conditions.
- i. Check to see that the lamp, pump and gas turn on. If necessary, open the Method/Instrument Control Panel and turn them on and set appropriate parameters.
- j. When the pump is turning, tighten the cassettes by lowering the levers to a horizontal position. Allow 10 minutes for lamp and pump equilibration.
- k. Inspect all system connections for leaks.
- l. The system is now ready to be optimized for automated analysis.

2. Autosampler and Run Setup

- a. Click on the Sequence Tab to display the automated sequence page.
- b. Click the Sequence menu item on the Menu bar and select "Create" from the displayed options to display a spreadsheet of empty locations consisting of 3 racks with sample locations equal to the rack capacity (24, 60 or 90).
 - (1) Each row represents a cup location on one of the racks and its graphical representation updates in the lower "Rack" graphic whenever the Update button is clicked.
 - (2) Enter only laboratory sample numbers into the sample list table. The standards and Quality Control samples are automatically populated.

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- (3) Click the “Update” button to when all samples are entered to populate the navigation tree to the left with the proposed run sequence.

Sample Analysis:

A. Leeman Labs Hydra II Mercury Analyzer

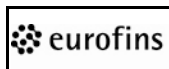
1. Analysis of samples with Leeman Labs Hydra II Mercury Analyzer

a. Prior to analysis:

- (1) For soils remove cover, add 6 mL of sodium chloride/hydroxylamine hydrochloride solution to reduce excess permanganate. Adjust volume to the 100 mL mark with reagent water, and mix.
 - (2) For waters remove cover, add 2.4 mL of sodium chloride/hydroxylamine hydrochloride solution to reduce excess permanganate. Adjust volume to the 40 mL mark with reagent water, and mix.
- b. Click the “Run Sequence” icon to start the run. If a dialog appears after the Run Sequence icon is clicked, follow the instructions of those prompts to resolve issues before running the sequence.
 - c. The system adds Stannous chloride to the samples via a “Y” connection in the pump tubing. The peristaltic pump then carries the sample/stannous mix to the liquid gas separator. Argon gas is bubbled through the liquid and used to transport the volatile mercury into the detector. The mercury is reduced with stannous chloride to liberate mercury metal and Tin (IV) chloride.

NOTE: Detailed instructions for the complete instrument setup are found in the *Leeman Labs Hydra II Automated Mercury Analyzer Manual*.

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2. Dilutions

- a. Dilute samples when necessary to yield a response that falls within the calibration range.
- b. Report the results for the least dilute sample where the concentration measured is within the acceptable calibration range.

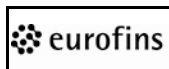
3. Instrument shutdown and cleanup

a. Overnight Shutdown

- (1) Click on the “sleep” icon to stop argon flow and pump.
- (2) In sleep mode the pump is cycled on periodically to relieve pressure points where the rollers contact the tubing.
- (3) Never leave bottle of reductant and rinse connected to the instrument if the pump clamps are released because siphoning can occur and cause damage to the instrument.

b. Long-term shutdown (more than 3 days of no operation).

- (1) Place reductant tubing and rinse tubing into a beaker of reagent water.
- (2) Run pump until system is flushed of reagents. Send autosampler tip to air.
- (3) Remove reductant and rinse tubing from beaker to allow the aspirating of air. Run pump until system is flushed of liquid. Some liquid does remain in the liquid/gas separator.
- (4) Turn OFF the pump.

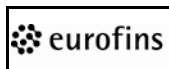
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- (5) Close Envoy program and power down the instrument.
- (6) Shut OFF the power to the computer and monitor.
- (7) Shut down argon gas flow.

4. Maintenance

- a. Replace the pump tubing as needed under normal daily usage.
- b. On an as needed basis, check the optical cell and windows, and if needed, clean the optical cell.
 - (1) Wipe the optical cell with a soapy solution (one drop of liquid Ivory soap to 500 mL reagent water) and warm tap water.
 - (2) Rinse with reagent water and dry. To speed the drying of the optical cell, connect the heater plug to the optical cell with the windows off for several minutes.
 - (3) Clean the quartz windows with methanol and a piece of lens paper.
 - (4) Document any maintenance in the Mercury maintenance logbook located next to the instrument.

NOTE: Detailed instructions for the maintenance and troubleshooting of the Leeman Labs Mercury Analyzer can be found in the *Leeman Labs Hydra II Mercury Analyzer Manual*.

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Calculations:

1. Final result

a. Water sample

$$\frac{\text{Instrument Reading}}{\text{Reading}} \times \frac{\text{Dilution Volume}}{\text{Aliquot Volume}} \times \frac{\text{Final Volume}}{\text{Sample Volume}}$$

b. Solid sample (mg/kg)

$$\frac{\text{Instrument Reading}}{\text{Reading}} \times \frac{\text{Dilution Volume}}{\text{Aliquot Volume}} \times \frac{\text{Final Volume}}{\text{Sample Weight (grams)}}$$

All dilution factors must be recorded and used in the calculation. [To enter dilution data into the LIMS when multiple dilutions are used, a factor must be formed (Ex. 1), which contains no more than three figures for the volume or the aliquot (Ex. 2).]

$$\text{Ex. 1. } 50/.5 \times 10/1 = 500/.5$$

$$\text{Ex. 2. } 50/.5 \times 25/.5 = 1250/.25 = 125/.025$$

NOTE: The default units are µg/L

2. Relative percent different (RPD)

$$RPD = \frac{S - D}{(S + D)/2} \times 100$$

Where:

S = first sample value

D = duplicate sample value

3. Spike recovery

$$\% Recovery = \frac{SSR - SR}{SA} \times 100$$

Where:

SSR = spiked sample result

SR = sample result

SA = spike added

4. Correlation Coefficient

$$r = \frac{\sum XY - \frac{\sum X \sum Y}{N}}{\sqrt{(\sum X^2 - \frac{(\sum X)^2}{N})(\sum Y^2 - \frac{(\sum Y)^2}{N})}}$$

Where :

X = the known concentration

Y = the instrument response

N = the total number of data points

5. Serial Dilution

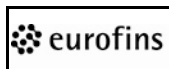
$$\% Difference = \frac{(5 \times SDR) - SR}{SR} \times 100$$

Where:

SDR = serial dilution result

SR = sample result

6. Methods of standard additions (MSA)

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Take 4 identical aliquots of the same sample. Leave one unspiked. Spike the other 3 aliquots with different levels of a standard solution. Add blank solution to sample aliquots so that the final volume is the same for all. Use small volumes of spiking solution to avoid diluting the sample more than 10%. Analyze the 4 aliquots and record the instrument readings in absorbance. Use the readings and spike values to find the slope and x- and y- intercepts. The x- intercept is the result.

$$\text{Slope} = m = \frac{\sum x_i y_i - (\sum x_i \sum y_i) / n}{\sum x_i^2 - (\sum x_i)^2 / n}$$

$$\text{Y-Intercept} = b = \bar{y} - m\bar{x}$$

$$\text{Result} = -\frac{b}{m}$$

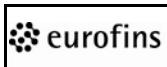
$$\text{Correlation Coefficient} = r = \frac{\sum \{(x_i - \bar{x})(y_i - \bar{y})\}}{\sqrt{[\sum (x_i - \bar{x})^2][\sum (y_i - \bar{y})^2]}}$$

The correlation coefficient (r) for the least squares fit must be ≥ 0.995 . If the r value is < 0.995 , the MSA must be repeated at the same dilution. If the r value is again low, the result with the higher r value is verified and both are flagged with a "+" in the data package. If the r value is < 0.990 , the sample is run at an interference dilution to overcome matrix effects. This usually requires a raised limit of quantitation. If a client requests a particular limit of quantitation that prohibits further dilution, then the sample is repeated at the same dilution and the best of the two results is verified.

Statistical Information/Method Performance:

Generate MDLs and LOQs according to 1-P-QM-QMA-9017309. Perform an MDL study on each instrument used for the analysis. Determine the MDL by taking seven spiked replicates through the entire digestion and analysis procedure. Compare and pool results to determine the final reporting MDL. The department supervisor maintains annual study data. The department supervisor requests that a Quality Assurance Specialist update to the LIMS as needed. Update the department database via a download from the LIMS.

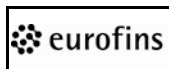
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Quality Assurance/Quality Control:

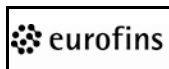
- A. For 7470A, 7471A, and 7471B, each digestion batch (up to 20 samples) must contain a method blank, LCS, and either an US, D, MS, MSD or an LCS/LCSD.
- B. For 245.1, each digestion batch (up to 10 samples) must contain a method blank, LCS, and either an US, D, MS or an LCS/LCSD.
- C. QC limits for MS/MSD, and LCS/LCSD are established through statistical analysis of historical data.
 1. The limits are maintained in the LIMS for the relevant analysis numbers.
 2. The limits are evaluated every 6 months and updated as needed.
 3. The limits are subject to change without notification.
- D. Batch Quality Control
 1. For the preparation and concentrations of Batch Quality Control see Form 1-P-QM-FOR-9008921.
 2. For the frequency, acceptance criteria and corrective action see tables I and II.
- E. Raw data quality checks
 1. Confirm that the batch and cover sheets are correctly labeled, dated, and signed where necessary. Review the batch sheet, project notes and lab notes with the incomplete list for special comments and due dates. Check that the run protocol has been selected correctly.
 2. Refer to the calculation section of this SOP for calculations used for Hg analysis.

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3. Refer to Tables I and II for run and batch calibration and QC frequency, acceptance criteria and corrective action. For information on statistical limits see 1-P-QM-QMA-9017313.
4. Each analytical run must have a QC review attached. All samples on the run must be listed on the QC review with notation as to whether the sample was verified or needed to be redigested/reanalyzed. The verifier must document on the QC review if any sample(s) were selected/deselected.
5. For spike levels of run and batch QC, see Form 1-P-QM-FOR-9008921.
6. LOQs are available to analysts in the LIMS.
7. Check to make sure that all results are within the calibrations range. If a sample reading is above the calibration range, then reread the sample at an appropriate dilution.
8. Check that the **absolute** value of all nondetected analytes is less than the LOQ. A technical decision must be made as to whether a reread is warranted for readings \leq LOQ.
9. For TCLP and SPLP samples, an MSA (method of standard additions) is required if:
 - a. The sample concentration falls between 80% to 100% of the regulatory limits.
 - b. If the TCLP and SPLP matrix spike (QA) recovers <20%, all samples in the leachate batch must be reanalyzed using the method of standard additions for that analyte.
10. For all EW samples (samples from public drinking water sources); check the results against the MCL (maximum contaminant level). If an analyte **exceeds** the MCL, notify a verifier at once so that the supplier can be notified. The verifier must contact the Client Service Representative, who must then notify the Supplier. Suppliers must be notified within 24 hours.

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<u>Analyte</u>	<u>MCL (mg/L)</u>
Hg	0.002

F. When raw data checks are complete, check the following:

1. All samples requiring redigestion are listed on the redigestion schedule.
2. Redigest request forms are clipped to the front of the run.
3. The data are uploaded to eLIMS-EP via IDAT by reviewer then verified from eLIMS-EP by a verifier.
5. The data packet is placed in the verification bin.

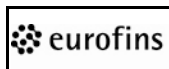
G. Instrument detection limits are performed on a quarterly basis and method detection limits are performed on a yearly basis for each analytical instrument.

H. Taking an instrument/analysis out of service/returning an instrument/analysis to service.

NOTE: The following information is taken from 1-P-QM-QMA-9017325. In the event of an equipment failure, perform the following steps:

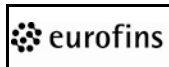
1. Document the nature of the failure in the maintenance logbook.
2. Document how and when the defect was discovered.
3. Notify a supervisor or experienced analyst to determine a person who can decide on appropriate action to take.
4. The instrument must be clearly tagged as *Out of Service*. The tag must contain the following information:
 - a. Date taken out of service.

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- b. Employee who took the instrument out of service.
 - c. Reason for tagout.
 5. The date taken out of service and the date returned to service must be documented in the logbook.
 6. Document any corrective action that was taken and the result of that corrective action (i.e., system calibration within specifications, etc.) to bring the equipment back into service.
 7. Supervisory personnel must perform a documented evaluation and review of instrumentation/equipment where a major or uncommon failure has occurred to assess the potential impact the failure could have on the calibration and/or qualification of the instrument.
 8. After a repair, document whether the function has been fixed. Calibration or verification activities are to be performed before the instrumentation is put back into service.
- I. Verification process
1. Confirm that all required pieces of QC have been uploaded to eLIMS-EP and are within specification. If there is partial QC on the current run and the samples have been analyzed more than once, check to see if there are associated runs in the hold bin waiting on additional QC to be verified.
 2. In eLIMS-EP, choose method of verification. (Metals verification by run or verify by individual element).
 3. Ensure that all lab notes and project notes were followed.
 4. Non-compliant data can be reported only after all required corrective actions have been taken. Document the nonconformance using Form 1-P-QM-FOR-9007858.

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5. Once all of the elements are verified for a digest, verify the digest number. Associated tracking numbers or suite numbers will be auto-verified after all of the metals are verified.

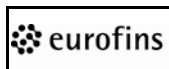
 <p>Lancaster Laboratories Environmental</p>	<p>Document Title: Mercury in Aqueous, Solid and Tissue Samples by Cold Vapor AA</p>	<p>Eurofins Document Reference: 1-P-QM-WI -9015067</p>
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Table I
QC Requirements for EPA600 245.1 (Mercury) for (PW, EW) and (WW)

	Frequency	Acceptance	Corrective Action
Calibration	The calibration contains a blank and 5 standards. Due to the instrument software limitations, the calibration blank must be included in the correlation coefficient calculation.	Correlation coefficient >0.995	<p>If the correlation coefficient is not met, confirm instrument conditions (i.e. check pump tubing and gas liquid separator). Reanalyze the curve, if the correlation coefficient is acceptable, proceed with sample analysis.</p> <p>If the correlation coefficient is not met after reanalysis, redigest and reanalyze the curve and all associated samples.</p>
Initial Calibration Verification (ICV)	Must be analyzed immediately following the calibration.	±5% of True Value	<p>If the ICV is out of specification high report the elements that are < LOQ.</p> <p>For elements > LOQ, data cannot be reported.</p> <p>Confirm instrument conditions (i.e. check pump tubing and gas liquid separator). Reanalyze the ICV, if the recovery is acceptable, proceed with sample analysis.</p> <p>If the acceptance criteria are not met after reanalysis, redigest and reanalyze the curve and all associated samples.</p>
Initial Calibration Blank (ICB)	Must be analyzed immediately following the ICV	Must be <LOQI	Data cannot be reported from the run (reanalyze).
Contract Required Detection Limit (CRA)	Must be analyzed immediately after the ICB	±50% of the true value	Data cannot be reported from the run (reanalyze).
Continuing Calibration Verification (CCV)	Must be analyzed immediately following the CRA and at the frequency of every 10 samples.	±10% of the true value	<p>If the CCV is out of specification high and the sample is not < - LOQ, accept samples that report as non-detect. Data bracketing the CCV cannot be reported from other samples on the run (reanalyze).</p> <p>If the CCV is out of specification, it is read in duplicate. If both CCVs are within specification, the data from the last good CCV is reanalyzed. If one or both CCVs are still out of specification, then the run is terminated and the samples after the last good CCV must be analyzed on a new run.</p>
Continuing Calibration Blank (CCB)	Must be analyzed immediately following CCVs at a frequency of every 10 samples.	Must be <LOQI	<p>Data bracketing the CCB cannot be reported from the run (reanalyze)</p> <p>If the CCB is out of specification, it can be read in duplicate. If both CCBs are within specification, the data from the last good CCB is reanalyzed. If one or both CCBs are still out of specification, then the run is terminated and the samples after the last good CCB must be reanalyzed on a new run.</p>

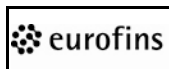
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Table I (Continued)

	Frequency	Acceptance	Corrective Action
Preparation Blank (PB)	Must be prepped at a frequency of 1 per analytical batch of 10 samples or less.	Must be < ILOQ! Not applicable if analyte reading in the sample is >10× the PB reading or < LOQ	Redigest all associated samples.
Laboratory Control Standard (LCS)	Must be prepped at a frequency of 1 per analytical batch of 10 samples or less.	Use statistical limits, or the method limit of ±15%, as indicated by the client requirement. If the LCS is out of specification high and the sample result is less than the LOQ the data can be taken.	Redigest all associated samples if the LCS is out of specification low. If the LCS is out of specification high, redigest samples that are greater than the LOQ.
Laboratory Control Standard Duplicate (LCSD)	If insufficient sample volume is submitted to perform batch QC then a LCSD is prepped at a frequency of 1 per analytical batch of 10 samples or less.	Use statistical limits, or the method limit of ±15% As indicated by the client requirement. If the LCSD is out of specification high and the sample result is less than the LOQ the data can be taken. RPD must be <20%.	Redigest all associated samples if the LCSD is out of specification low. If the LCSD is out of specification high, redigest samples that are greater than the LOQ. Redigest if RPD is out of specification
Matrix Spike (MS)	Must be prepped at a frequency of 1 per analytical batch of 10 samples or less.	Use statistical limits or the method limit of ±30% whichever is tighter. (PW,EW) Use statistical limits or the method limit of ±20% whichever is tighter (WW)	The data is flagged in the QC Summary and/or in the data package.
Duplicate (D)	Must be prepped at a frequency of 1 per analytical batch of 10 samples or less.	If the samples are >5× the LOQ the RPD must be <20%. If either the sample or duplicate is <5× the LOQ the difference between the two values must be <LOQ.	The data is flagged in the QC Summary and/or in the data package.

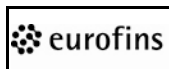
 <p>Lancaster Laboratories Environmental</p>	<p>Document Title: Mercury in Aqueous, Solid and Tissue Samples by Cold Vapor AA</p>	<p>Eurofins Document Reference: 1-P-QM-WI -9015067</p>
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Table II
QC Requirement for EPA SW846 7470A, 7471A and 7471B (Mercury)

Frequency	Acceptance	Corrective Action
Calibration	Correlation coefficient >0.995	If the correlation coefficient is not met, confirm instrument conditions (i.e. check pump tubing and gas liquid separator). Reanalyze the curve, if the correlation coefficient is acceptable, proceed with sample analysis. If the correlation coefficient is not met after reanalysis, redigest and reanalyze the curve and all associated samples.
Initial Calibration Verification (ICV)	±10% of True Value	If the ICV is out of specification high report the elements that are < LOQ. For elements > LOQ, data cannot be reported. Confirm instrument conditions (i.e. check pump tubing and gas liquid separator). Reanalyze the ICV, if the recovery is acceptable, proceed with sample analysis. If the acceptance criteria are not met after reanalysis, redigest and reanalyze the curve and all associated samples.
Initial Calibration Blank (ICB)	Must be <LOQI	Data cannot be reported from the run (reanalyze).
Contract Required Detection Limit (CRA) Limit of Quantitation Check Standard	For 7470A and 7471A: ±50% of the true value For 7471B: 30% of the True Value	Data cannot be reported from the run (reanalyze).
Continuing Calibration Verification (CCV)	±20% of the true value	If the CCV is out of specification high and the sample is not < - LOQ accept elements that report as non-detect. Data bracketing the CCV cannot be reported from other samples on the run (reanalyze) If the CCV is out of specification, it is read in duplicate. If both CCVs are within specification, the data from the last good CCV is reanalyzed. If one or both CCVs are still out of specification, then the run is terminated and the samples after the last good CCV must be reanalyzed on a new run or redigested if there is not enough CCV (or any other run standard) to reanalyze with a new calibration.
Continuing Calibration Blank (CCB)	Must be <LOQI	Data bracketing the CCB cannot be reported from the run (reanalyze) If the CCB is out of specification, it is read in duplicate. If both CCBs are within specification, the data from the last good CCB is reanalyzed. If one or both CCBs are still out of specification, then the run is terminated and the samples after the last good CCB must be reanalyzed on a new run or redigested if there is not enough CCB (or any other run standard) to reanalyze with a new calibration

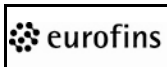

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Table II (Continued)

	Frequency	Acceptance	Corrective Action
Preparation Blank (PB)	Must be prepped at a frequency of 1 per analytical batch of 20 samples or less.	Must be <LOQ! For 7470A and 7471A: Not applicable if analyte reading in the sample is >20× the PB reading or <LOQ. For 7470B and 7471B: Not applicable if analyte reading in the sample is >10× the PB reading or <LOQ.	Redigest all associated samples.
Laboratory Control Standard (LCS)	Must be prepped at a frequency of 1 per analytical batch of 20 samples or less.	Use statistical limits or the method limit of ±20%, as indicated by the client requirement. If the LCS is out of specification high and the sample result is less than the LOQ the data can be taken.	Redigest all associated samples if the LCS is out of specification low. If the LCS is out of specification high, redigest samples that are greater than the LOQ.
Laboratory Control Standard Duplicate (LCSD)	If insufficient sample volume is submitted to perform batch QC then a LCSD is prepped at a frequency of 1 per analytical batch of 20 samples or less.	Use statistical limits or the method limit of ±20%, as indicated by the client requirement. If the LCSD is out of specification high and the sample result is less than the LOQ the data can be taken. RPD must be <20%.	Redigest all associated samples if the LCSD is out of specification low. If the LCSD is out of specification high, redigest samples that are greater than the LOQ. Redigest if RPD is out of specification
Matrix Spike (MS)	Must be prepped at a frequency of 1 per analytical batch of 20 samples or less.	Use statistical limits or the method limit of ±20% whichever is tighter.	The data is flagged in the QC Summary and/or in the data package.
Duplicate (D)	Must be prepped at a frequency of 1 per analytical batch of 20 samples or less.	If the samples are >5× the LOQ the RPD must be <20%. If either the sample or duplicate is <5× the LOQ the difference between the two values must be <LOQ.	The data is flagged in the QC Summary and/or in the data package.

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Eurofins Document Reference	1-P-QM-WI -9014309	Revision	12
Effective Date	Sep 19, 2014	Status	Effective
Historical/Local Document Number	Analysis 7786		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		


Prepared by	Kerrie Freeburn
Reviewed and Approved by	Susan Goshert;Review;Friday, July 18, 2014 4:27:05 PM EDT Richard Karam;Review;Monday, September 15, 2014 2:15:35 PM EDT Kathryn Brungard;Approval;Monday, September 15, 2014 2:38:26 PM EDT

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Revision Log:

Revision: 12		Effective Date:	This version
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Document Title	Enhancement	Add methods to title and keep only the acronyms: Microextraction by Method 504.1 or 8011 for EDB, DBCP, and TCP in Water	
Sample Collection, Preservation and Handling	Reflects current industry standard	Updated refrigeration conditions from 4° ± 2°C.	
Reagents and Standards	Reflects the required numeric expression as per 1-P-QM-QMA-9017328	Throughout section updated 1 month to 30 days	
Procedure A.5.	Study was prepped showing tumbling samples for 15 minutes yielded equivalent recovery to minute shake	Removed reference to shake and added 15 minute tumble.	
Procedure B.8.	Study was prepped showing tumbling samples for 15 minutes yielded equivalent recovery to minute shake	Removed reference to shake and added 15 minute tumble.	
Procedure D.4.	Study was prepped showing tumbling samples for 15 minutes yielded equivalent recovery to minute shake	Removed reference to shake and added 15 minute tumble.	
Procedure C.2.	Reflects current process.	Removed reference to 5 mLs and replaced it with 6 mLs.	

Revision: 11		Effective Date:	Apr 12, 2013
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Throughout Document	Reflect re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers	
Reference	Correction	Updated the year of the method reference for 8011.	
	Enhancement	Elaborated information on the 504.1 method.	
Cross Reference	Reflects current document.	Updated document numbers and title for Analysis #1034, 7934, 10398	

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Reference:

1. USEPA Method 504.1, Revision 1.1, "EDB, DBCP, and TCP in water by Microextraction and Gas Chromatography", 1995.
2. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 8011, July 1992.
3. *Chemical Hygiene Plan*, current version.

Cross Reference:

Document	Document Title
Analysis #1034, 7934, 10398	DB/DBCP and TCP by Method 504.1 or 8011 in Waters using Microextraction and GC-ECD
1-P-QM-PRO-9015490	Organic Extraction Standards Storage and Handling

Scope:

This analysis applies microextraction for the determination of 1,2-Dibromoethane (EDB), 1,2-Dibromo-3-chloropropane (DBCP), and 1,2,3-Trichloropropane (TCP). These are the List 2 Unregulated VOCs from the National Primary Drinking Water Regulations established in July 1987. These are also recognized as Group SOC1 by PA DEP.


Basic Principles:

A 35 mL aliquot of sample is extracted in the 40 ml sampling vial with 2 mL hexane (micro-extraction). Surrogate standards are added to each sample to monitor recovery. The solvent layer is drawn off and ready for analysis (see Analysis #1034, 7934, 10398).

Reference Modifications:


See modifications throughout the Procedure section.

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Definition:

1. Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) – A sample of known composition analyzed with each batch of samples to demonstrate laboratory accuracy. The samples either naturally contain the analytes of interest or are clean samples fortified with known concentrations. Used to demonstrate laboratory accuracy. A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test.
2. Matrix spike/matrix spike duplicate (MS/MSD) – A sample created by fortifying a second aliquot of a water or soil sample with some or all of the analytes of interest. The concentration added is known and compared to the amount recovered to determine percent recovery. Matrix spike recoveries provide information about the accuracy of the method in light of the matrix analyzed. A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test.
3. Method Detection Limit (MDL) Check Standard – An aliquot of reagent water to which known quantities of method analytes are added in the laboratory. The MDL check sample is treated exactly as a sample. The MDL check is used to determine whether the laboratory is capable of making accurate and precise measurements at or near the required method detection limit.
4. Surrogates – Organic compounds which are similar to the analytes of interest but are not naturally occurring in environmental samples. Surrogates are spiked into all standards and every field and QC sample prior to extraction and analysis to provide information regarding the effects of the sample matrix.

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Interferences:

Method interferences may be caused by impurities in solvents, reagents, glassware, or other hardware used in sample processing. A method blank is performed with each batch of samples to demonstrate that the extraction system is free of contaminants.

Safety Precautions and Waste Handling:

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

All laboratory waste is accumulated, managed and disposed of in accordance with all federal, state, and local laws and regulations.


The toxicity of all compounds used in this method has not been established. Each compound must be treated as a potential health hazard. Care must be taken when handling the neat analyte standards. Gloves must be worn and the reagents must be prepared in a hood to avoid skin or respiratory contact. EDB and DBCP have been tentatively classified as known or suspected carcinogens. Avoid skin contact with methanol as it is absorbed through the skin. Material Safety Data Sheets (MSDS) are available from the Safety Officer.

All solvent waste generated from this preparation must be collected in designated containers. These will then be transferred to the lab-wide disposal facility. Any solid waste material (disposable pipettes, broken glassware) is disposed of in the normal solid waste collection containers.

Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the technicians training records.

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Initially, each technician performing the extraction must work with an experienced employee for a period of time until they can independently perform the extraction. Proficiency is measured through a documented Initial Demonstration of Capability (IDOC).

The IDOC and the DOC consists of four laboratory control samples (or alternatively, one blind sample for the DOC) that is carried through all steps of the extraction and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation.

Sample Collection, Preservation and Handling:


Samples are collected in duplicate with no headspace in 40-mL vials equipped with Teflon-lined silicone septa and preserved with approximately 3 mg of sodium thiosulfate. Hydrochloric acid preserved vials can also be used for 8011. The samples are stored at 0° to 6°C and extracted within 14 days of collection. Extracts are stored frozen at -10° to -15°C.

In accordance with Method 504.1, a field reagent blank (FRB) must be sampled for each sample set collected.

Apparatus and Equipment:

1. 40-mL glass vials with screw-on tops containing Teflon inserts
2. 10-mL Class A volumetric flasks
3. Glass syringes in 100, 50, 25, and 10 µL volumes
4. Volumetric, Class A pipettes in 0.5, 1, 2, and 5 mL volumes
5. Disposable Pasteur pipettes and bulbs
6. Analytical balance capable of weighing to 0.01 g

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7. GC autosampler vials


Reagents and Standards:

1. Hexane – Optima grade or equivalent. Store at room temperature for up to 1 year.
2. Methanol – OmniSolv, gas chromatography, residue analysis grade, or equivalent. Store at room temperature for up to 1 year.
3. Sodium chloride – Reagent grade crystal or equivalent, baked at 400°C for a minimum of 4 hours in a shallow pan prior to use to remove organic contaminants. Store in a glass jar for up to 1 year after baking.
4. Reagent water – water in which an interferent is not observed at or above the reporting limit for parameters of interest. In general, the deionized water supplied at the taps in the laboratory meets this criterion. If the reagent water does not meet the requirements, see your supervisor for further instructions.
5. Sodium sulfate – Reagent grade crystal or equivalent, baked at 400°C for a minimum of 4 hours in a shallow pan prior to use to remove organic contaminants. Store in a glass jar for up to 1 year after baking.
6. Potassium iodide starch paper
7. Diethyl -P-phenylenediamine (DPD) powder. Follow manufacturer's storage conditions and expiration dates.
8. Sodium thiosulfate. Follow manufacturer's storage conditions and expiration dates.
9. 1, 1, 2, 2- Tetrachloroethane – Accustandard M-502-44, or equivalent. Follow manufacturer's storage conditions and expiration dates.

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10. 504.1 Calibration mix – Accustandard M-504.1- CS or equivalent. Follow manufacturer’s storage conditions and expiration dates.
11. 1, 2, 3- Trichloropropane – Ultra scientific PPS-250 or equivalent. Follow manufacturer’s storage conditions and expiration dates.
12. 540.1 QC stock – Ultra scientific DWM-514 or equivalent. Follow manufacturer’s storage conditions and expiration dates.
13. All QC standards added during extraction process are prepared by Organic Extractions using instructions generated by the standards database.
14. Standards Preparation:
 - a. Prepare a 504.1 calibration intermediate by combining the following into 10.0 mL with methanol:
 - (1) 0.125 mL of 1, 1, 2, 2-tetrachloroethane (200 ppm)
 - (2) 0.25 mL of 504.1 calibration mix (200 ppm)
 - (3) 0.092 mL of 1, 2, 3-trichloropropane (100 ppm)
 - (4) This solution is stored in the freezer (-10 to -15°C) and is stable for 30 days.
 - b. Prepare the 504.1 calibration High Spike by diluting 0.5 mL of 504.1 calibration intermediate into 10.0 mL with methanol. This solution is stored in the freezer (-10 to -15°C) and is stable for 30 days.
 - c. Prepare the 504.1 calibration Low Spike by diluting 0.1 mL of 504.1 calibration intermediate into 10.0 mL with methanol. This solution is stored in the freezer (-10 to -15°C) and is stable for 30 days.

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- d. Prepare the EDB surrogate by diluting 0.0125 mL of 1, 1, 2, 2-tetrachloroethane into 100.0 mL with methanol. This solution is stored in the freezer (-10 to -15°C) and is stable for 30 days.
- e. Prepare the 504.1 matrix spike by diluting 0.015 mL of 504.1 QC stock into 25.0 mL with methanol. This solution is stored in the freezer (-10 to -15°C) and is stable for 30 days.

Calibration:

Not applicable to this procedure.

Procedure:

A. Calibration standards prep (weekly for Method 8011 or daily for Method 504.1)

1. Calibration standards are prepped in seven 40-mL vials.
2. Add 35 mL of reagent water to each vial.
3. Add approximately 6 g of sodium chloride to each vial. Swirl the vials until salt is dissolved.

EPA SW-846, Method 8011 Deviation: We use 6 g of sodium chloride rather than 7 g due to limited space in sample vials.

4. Add the appropriate calibration standard to each vial as follows:

NOTE: Be sure to use a syringe size that is close to the amount being measured.

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<u>Vial</u>	<u>Amount Used (µL)</u>	<u>Standard Used</u>
Level 6 (EDB/DBCP - 0.36 µg/L, TCP - 1.29 µg/L)	50	504.1 Calib High
Level 5 (EDB/DBCP - 0.25 µg/L, TCP - 0.9 µg/L)	35	504.1 Calib High
Level 4 (EDB/DBCP - 0.14 µg/L, TCP - 0.52 µg/L)	20	504.1 Calib High
Level 3 (EDB/DBCP - 0.07 µg/L, TCP - 0.26 µg/L)	50	504.1 Calib Low
Level 2 (EDB/DBCP - 0.04 µg/L, TCP - 0.13 µg/L)	25	504.1 Calib Low
Level 1 (EDB/DBCP - 0.02 µg/L, TCP - 0.072 µg/L)	14	504.1 Calib Low
MDL (EDB/DBCP - 0.02 µg/L, TCP - 0.072 µg/L)	14	504.1 Calib Low

5. Add 2 mL hexane to each vial. Cap the vials and tumble for 15 minutes.
6. Set vials aside and allow water and hexane to separate.
7. The hexane layer is removed with a disposable Pasteur pipette and is divided into three clear GC vials containing a very small amount of sodium sulfate and securely capped.
 - a. Each vial is marked with the appropriate vial number.
 - b. The extracts are stored in a freezer (-10 to -15°C) until ready to analyze.
 - c. The second vial is for confirmation, and the third vial is to be used as a continued calibration standard.

EPA Method Deviation: A small amount of sodium sulfate is added to each GC autosampler vial to remove any water that might have been inadvertently transferred into the vial.

B. QC sample prep

1. QC samples are prepped in three 40-mL vials.
2. Each vial contains 3 mg of sodium thiosulfate.
3. Add 35 mL of reagent water to each vial for Blank, LCS, and LCSD.
4. Add approximately 6 g of sodium chloride to each vial. Swirl the vials for approximately 20 seconds until salt is dissolved.


EPA SW-846, Method 8011 Deviation: We use 6 g of sodium chloride rather than 7 g due to limited space in sample vials.

5. Add the appropriate standard to each vial as follows:

NOTE: Be sure to use a syringe size that is close to the amount being measured.

<u>QC Type</u>	<u>Amount Used (μL)</u>	<u>Standard Used</u>
LCS	70	EDB/DBCP/TCP Matrix Spike
LCSD	70	EDB/DBCP/TCP Matrix Spike
MS	70	EDB/DBCP/TCP Matrix Spike
MSD	70	EDB/DBCP/TCP Matrix Spike
Blank	None	None
Duplicate	None	None

6. If sufficient sample is sent by the client or the client designates QC samples, a **sample** is used to prepare an MS and MSD.
 - a. A minimum of three 40-mL vials would be needed.
 - b. If three vials are not available for any sample, prepare an MS on one sample and a DUP on another sample.

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- c. The MS, MSD, and DUP samples will be weighed following Part D, Step 2.
 - d. See 1-P-QM-PRO-9015490 (SOP-OE-017) for storage and handling of spikes.
7. Add 0.1 mL of EDB surrogate to each QC sample.

EPA SW-846, Method 8011 Deviation: Surrogate is added to each sample, blank, and spike to satisfy a state specific requirement.

- 8. Add 2 mL of hexane, cap the vials, and tumble them for 15 minutes.
- 9. Set the vials aside and allow the hexane and water to separate.
- 10. The hexane layer is removed with a disposable Pasteur pipette and is divided into two clear GC vials with inserts containing a very small amount of sodium sulfate and securely capped.
 - a. The blank needs to be divided into three clear GC vials with inserts.
 - b. Each vial is marked with the appropriate QC name.
 - c. The extracts are stored in a freezer (-10 to -15°C) until ready to analyze.
 - d. The second vial is for confirmation.

EPA Method Deviation: A small amount of sodium sulfate is added to each GC autosampler vial to remove any water that might have been inadvertently transferred into the vial.

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C. Chlorination Check


1. Allow all samples to reach ambient temperature.
2. Use a volumetric pipette to remove 6 mL of sample from the vial and place the aliquot in a medicine cup.
3. Dip a potassium iodide starch paper test strip into the medicine cup.
4. If the paper turns blue (very faint gray or purple for low concentration), chlorine may be present and further testing is required. If the paper does not change color, chlorine is not present.
5. If chlorine may be present, add a packet of DPD powder to the medicine cup.
6. If no color change takes place, there is no chlorine. If a color takes place, chlorine is present.
7. Document the results on the extraction log.
8. If chlorine is present, add approximately 3 mg of sodium thiosulfate to the original sample vial.

D. Sample prep

1. Weigh the remaining sample and the vial with the cap on. Record the weight on the data log sheet in the "Initial Weight of Vial (g)" column.
2. Add approximately 6 g of sodium chloride to the vial. Cap and swirl the vial for approximately 20 seconds until salt is dissolved.

EPA SW-846, Method 8011 Deviation: We use 6 g of sodium chloride rather than 7 g due to limited space in sample vials.

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3. Add 0.1 mL of each surrogate to each sample.

EPA SW-846, Method 8011 Deviation: Surrogate is added to each sample, blank, and spike to satisfy a state specific requirement.


4. Add 2 mL of hexane to the vial. Cap and tumble for at least 15 minutes.
5. Set vial aside until hexane and water separate.
6. The hexane layer is removed with a disposable Pasteur pipette and is divided into two clear GC vials with inserts containing a very small amount of sodium sulfate and securely capped.
 - a. Each vial is marked with the appropriate sample number.
 - b. The extracts are stored in a freezer (-10 to -15°C) until ready to analyze.
 - c. The second vial is for confirmation.

EPA Method Deviation: A small amount of sodium sulfate is added to each GC autosampler vial to remove any water that might have been inadvertently transferred into the vial.

7. If emulsion forms, less hexane will be able to be removed. Centrifuge vial for at least 5 minutes to clear any emulsion.
8. After the hexane layer is removed from the 40-mL vial, empty the vial, shaking out any excess salt, hexane, or sediment.
9. Weigh the empty vial with the cap on. Record this weight on the data log sheet in the "Empty Vial Weight (g)" column.
10. Calculate the weight difference as follows:

$$\text{Weight of (sample + vial)} - \text{Weight of vial only}$$

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This value is written in the “Sample Weight” column.

11. Record the weight difference on the data log sheet as the initial volume.
Record 2 mL as the final volume.

Calculations:

Weight difference calculation:

$$\text{Weight of (sample + vial)} - \text{Weight of vial only}$$

Statistical Information/Method Performance:

See analytical method.

Quality Assurance/Quality Control:

For each batch of samples extracted, a blank, LCS, LCSD, a randomly selected MS, and MSD must be extracted. If there is limited sample which prevents the preparation of the MS/MSD, then an MS must be performed on one sample, and a DUP on another sample. If the batch contains only field or equipment blank samples, an LCS/LCSD QC pairing is used.

A batch is defined as the samples to be extracted on any given day but not to exceed 20 field samples. If more than 20 samples are prepared in a day, an additional batch must be prepared.

If any client, agency, or state has more stringent QC or batch requirements, these must be followed instead. See the GC analysis method for specifics on compounds in the spiking solution.

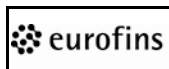
An MDL determination must be done on a weekly basis.

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Effective Date	Jul 29, 2014	Status	Effective
Historical/Local Document Number	Analysis 4181		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

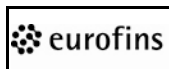
Prepared by	Heidi Roberts
Reviewed and Approved by	Susan Goshert;Review;Thursday, July 10, 2014 10:42:25 AM EDT Richard Karam;Review;Monday, July 14, 2014 4:46:49 PM EDT Dorothy Love;Approval;Tuesday, July 15, 2014 8:48:00 AM EDT

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Revision Log:

Revision: 10		Effective Date: This version
Section	Justification	Changes
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version
Throughout Document	Reflect re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers
Procedure 4.b.	Reflects current procedure	Corrected spiking requirements.
Procedure 25.b(11)	Clarification	Added hold time for extracts.

Revision: 09		Effective Date: May 02, 2012
Section	Justification	Changes
Revision Log	Formatting requirements per LOM-SOP-LAB-201	Removed revision logs up to the previous version.
Reference Modifications	Reflects modifications to Method 8151	Added modifications 2, 4, and 5.
Apparatus and Equipment	Reflects current apparatus	Replaced the Whatman #3 filter with the Fisher G6 filter.
Procedure 1.	Reflects current procedure	Replaced acetone with 1:1 acetone/hexane.
Procedure 2.	Reflects current procedure	Specified that the sodium sulfate used is acidified.
Procedure 9.	Reflects current practices	Replaced Whatman #3 with Fisher G6.
Procedure 14.	Reflects current procedure	Removed need to use graduated cylinder to add water.
Procedure 18.	Clarification	Removed the word graduated associated with the pipette.
Procedure 23.	Reflects current procedure	Replaced boiling chips with glass beads.
Procedure 25.b.(6)	Clarification	Step added to pour the extract into a 12-mL vial.
Procedure 25.b.(8) and (9)	Clarification	Steps reordered.

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Reference:

1. Test Methods for Evaluating Solid Wastes, SW-846 Methods 3550C & 8151A, February 2007.
2. Test Methods for Evaluating Solid Wastes, SW-846 Methods 3550B & 8151A, December 1996.
3. *Sonicator Ultrasonic Processor and Cell Disruptor Operations Manual*, Sound Heat Systems, Inc., 1985.
4. *Chemical Hygiene Plan*, current version.

Cross Reference:

Document	Document Title
Analysis #2487	Food and Tissue Preparation
Analysis #5592, 10401	Analysis of Chlorinated Herbicides by 8151A in Soil
1-P-QM-PRO-9015405	Ultrasonic Processor Maintenance and Tuning
1-P-QM-PRO-9015475	Glassware Cleaning for Organic Extractions
1-P-QM-PRO-9015490	Organic Extraction Standards Storage and Handling

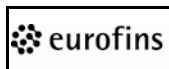
Scope:

This method is used for the extraction of chlorinated herbicides in soils and solid wastes.

Basic Principles:

A portion of sample is placed in a beaker. Acidified sodium sulfate is added to absorb any water present. The mixture is acidified with hydrochloric acid. Surrogate standards are added to each sample to monitor recovery. An aliquot of solvent is then added to the sample. The sample is subjected to sonic disruption to disperse the soil and force solvent contact. The organic compounds present in the soil dissolve in the solvent that is then removed. The sample is extracted two additional times with fresh solvent. The solvent fractions are filtered into a flask containing acidified sodium sulfate. The filtrate

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is then poured through a funnel containing glass wool to remove the sodium sulfate and into a Kuderna-Danish (K-D) assembly. The sample is concentrated on a steam bath, then 37% KOH and reagent water are added and the sample is again concentrated to remove all solvent.

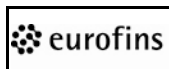
The aqueous solution is transferred to a separatory funnel and extracted with methylene chloride. The solvent is discarded and the aqueous solution is acidified with sulfuric acid, and extracted with ethyl ether. The ether fractions are placed in a flask containing acidified sodium sulfate and left to sit for at least 2 hours. Then the solvent is transferred to a K-D apparatus and concentrated to 10 mL.

Methanol is added and the sample is subjected to esterification. The extract is then concentrated to 2 mL using nitrogen blow down technique. Hexane is added to adjust the final volume and the extract is florisiled.

Reference Modifications:

1. EPA Method Deviation from section 7.2.1.5: (Prior to Procedure Step 12)
The 2-hour wait at this point is not necessary since samples always go through the hydrolysis step. The sample is not centrifuged since the extract is vacuum filtered through filter paper. This eliminates fine particles in the extract.
2. Fisher G6 filter paper is used in place of Whatman #1 filter paper. Fisher G6 is a glass fiber filter paper that is baked at 400°C. This ensures inertness of filter paper.
3. This extraction is sufficient to force the herbicide salts into the aqueous solution. Additional extraction with methylene chloride has been found to be unnecessary and results in a loss of hexachlorophene.
4. Room temperature sulfuric acid is added in place of cold sulfuric acid. There has been no benefit found using cold sulfuric acid in place of room temperature sulfuric acid.

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5. Refluxing the samples for 30 minutes at 80° - 85°C has been found to be sufficient to drive off the solvent while providing acceptable recoveries in Procedure Step 15.
6. Isooctane is not added since the final volume is 10 mL, not 4 mL as written in the method. The isooctane is added to prevent solvent from “blowing off” during methylation. However, since the final volume is greater than the EPA method volume, the isooctane is not needed.

Definitions:

1. LCS – Laboratory Control Sample
2. LCSD – Laboratory Control Sample Duplicate
3. MS – Matrix Spike
4. MSD – Matrix Spike Duplicate

Interferences:

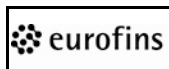
Method interferences are caused by impurities in solvents, reagents, glassware, or other hardware used in sample processing. All glassware must be rinsed with solvent before use. A method blank is performed with each batch of samples to demonstrate that the extraction system is free of contaminants.

Safety Precautions and Waste Handling:

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

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Always add acid to water to reduce fuming and bumping. The 37% KOH gets hot when prepared. Always wear gloves when handling this solution. In order to reduce the heating of the solutions, the deionized water is chilled in an ice bath prior to preparation of these reagents.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined; however, each chemical compound must be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as fume hoods, lab coats, safety glasses, and gloves.

Always wear gloves when handling the diazald and avoid inhaling diazomethane gas. Both are extremely toxic, severely irritating, and have been cited as carcinogens. See specific safety instructions for this procedure listed in the esterification section.

Since the extracts are concentrated on a steam bath, caution must be exercised while working around this apparatus.

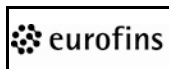
All solvent waste generated from this preparation must be collected for recycling (if applicable) or disposed of in the designated containers. These are then transferred to the lab-wide disposal facility. Any solid waste material (disposable pipettes, broken glassware, pH paper) is disposed of in the normal solid waste collection containers. All waste generated from esterification must be placed in a beaker in the hood and only be added to the solvent waste stream in the lab-wide disposal facility.

Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each technician performing these techniques must work with an experienced technician for a period of time until they can independently perform the procedure. Proficiency is measured through an Initial Demonstration of Capability (IDOC).

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The IDOC and the DOC consists of four laboratory control samples (or alternatively, one blind sample for the DOC) that are carried through all steps of the procedure and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation.

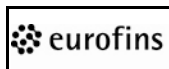
Sample Collection, Preservation, and Handling:

Samples are collected in wide-mouth glass jars with PTFE-lined lids and stored refrigerated at $\leq 6^{\circ}\text{C}$ prior to extraction. Samples must be extracted within 14 days of collection.

Apparatus and Equipment:

1. Sonic Probe apparatus (with a minimum of 300W output) for extracting organic components from a soil matrix
2. Kuderna-Danish (K-D) assembly with appropriate ampule for concentrating the solvent used during concentration
3. Steam bath – VWR/LLI Model #1127 or equivalent
4. Filter paper – Fisher G6 or equivalent. The filter paper is baked at 400°C for 4 hours.
5. N-Evap with nitrogen supply
6. 125-mL separatory funnel
7. pH meter or paper – assorted ranges
8. Diazomethane generator
9. Boiling chips, Teflon® and glass beads
10. Vials – assorted sizes

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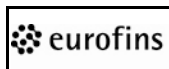
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11. Beakers – Stainless steel, assorted sizes
12. Pipettes – Class A, assorted sizes
13. Graduated cylinders, Class A, assorted sizes
14. Solvent dispenser – Brinkmann, adjustable
15. Pipettes – disposable
16. Balance – capable of weighing to 0.01 g
17. Wash bottles – Teflon®
18. Volumetric flasks – Class A, assorted sizes
19. Erlenmeyer flasks – assorted sizes
20. Syringes – assorted sizes
21. Micropipetter
22. Test Tubes

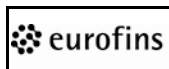
Reagents and Standards:

1. Methylene Chloride – pesticide grade or equivalent. Store at room temperature for up to one year.
2. Acetone – pesticide grade or equivalent. Store at room temperature for up to one year.
3. Hexane – pesticide grade or equivalent. Store at room temperature for up to one year.

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4. Ethyl ether, high purity, nonpreserved – Store at room temperature. Follow manufacturer’s expiration information.
5. 25% Sulfuric Acid – pesticide grade or equivalent. Store at room temperature for up to one year.
6. Hydrochloric Acid – ACS grade. Store at room temperature for up to one year.
7. Diazald (N-methyl-N-nitroso-p-toluenesulfonamide)
8. Alcohol GR
9. Potassium hydroxide, (KOH) (37% w/v)
 - a. Dissolve 37 g of ACS grade KOH into approximately 80 mL of reagent water in a 100-mL volumetric flask.
 - b. Shake until the KOH goes into solution.
 - c. Dilute to volume with reagent water.
 - d. Store at room temperature in a glass bottle. Reagent is stable 1 year.
 - e. Equivalent weights and volumes are acceptable as long as the ratio remains constant.
10. Sodium Sulfate (Na₂SO₄) - Reagent grade or equivalent. Bake at 400°C for a minimum of 4 hours in a shallow pan prior to use to remove organic contaminants. After baking, store in a glass jar at room temperature for up to 1 year.

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11. Acidified Sodium Sulfate

- a. Before use add 1.0 mL of concentrated sulfuric acid to 1 kg of baked sodium sulfate in a 2-L beaker and slurry with ethyl ether.
- b. Remove ethyl ether by placing the mixture on a steam bath.
- c. Confirm the mixture is below pH of 4 by adding 1 g of the resulting solid to 5 mL of reagent water and checking the pH.
- d. Store at approximately 130°C or in a dessicator.
- e. Up to 100 g per sample is needed. (Equivalent weights and volumes are acceptable as long as the ratio remains constant).

12. All QC standards added during extraction process are prepared by Organic Extractions using instructions generated by the standards database. Detailed instructions can be found in the corresponding Analysis #5592, 10401.

Preparation of Glassware:

See 1-P-QM-PRO-9015475.

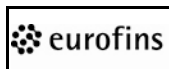
Calibration:

Not applicable to this procedure.

Procedure:

1. Use a wash bottles to rinse all glassware with 1:1 Acetone/Hexane.
 - a. This rinse reduces the amount of alkaline substances present preventing a reaction with the organic acids being extracted.

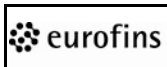
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- b. Be certain all solvent is completely evaporated before the glassware comes in contact with the samples or low recoveries of Dinoseb result.
2. Weigh 30 to 30.5 grams of sample into a stainless steel beaker.
 - a. Record the initial weight and any comments about the sample in the extraction log.
 - b. Use of alternate weights is acceptable if necessary due to client specifications, amount of sample available, or sample matrix.
 - c. Process all tissues using Analysis #2487 prior to extraction.
 - d. The blank, LCS, and LCSD (if applicable) are prepared by weighing 30 to 30.5 g of acidified sodium sulfate into a stainless steel beaker. Record the weight on the extraction log.

NOTE: The background, MS, and MSD are performed on three separate aliquots of a field sample.
3. Add approximately 20 g of acidified sodium sulfate and mix thoroughly.
 - a. Use a disposable pipette to add a full pipette of concentrated hydrochloric acid to produce a slurry.
 - b. Allow the sample to sit for 15 minutes.
 - c. Check the pH using narrow range pH paper (1.0 to 2.5).
 - (1) If the pH is not below 2, add more acid until this pH is achieved.
 - (2) Alternatively, add 10 mL of phosphate buffer.
 - (3) This results in a wetter sample; additional acidified sodium sulfate is needed.

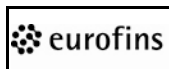
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4. Use pipettes to add surrogate standards and matrix spiking solutions.
 - a. Surrogates: Add 1.0 mL Herb Surrogate to all samples, blanks, and spikes.
 - b. Spiking Solutions: Spiking solutions are added to the laboratory control sample (LCS), LCSD if applicable, MS and MSD samples. Spike 1.0 ml of Herb spike into LCS, LCSD (if applicable), MS and MSD. If directed by client, spike 1.0 ml of Hexachlorophene spike along with the Herb spike.

NOTE: This is changed to accommodate client-specific requirements as needed.

 - c. If a sample requires any special compounds in addition to the standard list, an appropriate spike containing those compounds is added at this time.
 - d. See Analysis #5592, 10401 for spike details.
 - e. See 1-P-QM-PRO-9015490 for storage and handling of spikes.
5. Use a solvent dispenser to add approximately 100 mL of 50% acetone in methylene chloride.
6. Set up the sonic probe as described in the manual. (See 1-P-QM-PRO-9015405.)
7. Immerse the tip of the sonic probe approximately 1 to 2 cm below the surface of the liquid in the beaker containing the sample and above the sediment layer.
8. Disrupt the sample using a medium tip at full output of 10 and a process time/timer of 1:30. (This is a total time of 1:30 pulse on and 1:30 pulse off.)

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9. Remove the probe from the sample and decant the liquid through Fisher G6 filter paper into a vacuum flask.
10. Use a solvent dispenser to add 100 mL of fresh solvent to the sample and repeat Steps 7 through 9.
11. Use a solvent dispenser to add 100 mL of fresh solvent to the sample and repeat Steps 7 through 9 once more.
 - a. Pour the liquid and solids from the beaker onto the filter paper.
 - b. Rinse the beaker and filter paper with approximately 30 mL of 50% acetone in methylene chloride.

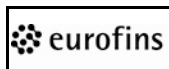
NOTE: Before placing the probe into another sample, wet a paper towel with reagent water and wipe the probe to remove any soil present from the previous sample. Use a wash bottle to rinse the probe with acetone to remove water.

12. Transfer the filtrate to a K-D apparatus and use a wash bottle to rinse the filter flask with approximately 30 mL of 50% methylene chloride and acetone to complete the transfer.
13. Add a boiling chip to the K-D apparatus and attach a Snyder column, wet the column with methylene chloride and concentrate to approximately 5 mL over a steam bath that is at 85° to 99°C.

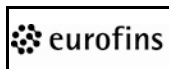
This steam bath temperature ensures concentration in a reasonable length of time.

14. Add 5 mL of 37% KOH solution. and 30 mL of reagent water to the KD apparatus.

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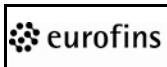
 <div>Lancaster Laboratories Environmental</div>	<p>Document Title: Extraction of Chlorinated Herbicides in a Soil Matrix</p>	<p>Eurofins Document Reference: 1-P-QM-WI -9013472</p>
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15. Reflux on a steam bath at 80° to 85°C (60° to 65°C for all samples from North Carolina) for approximately 30 minutes (1 to 2 hours for samples from North Carolina). This steam bath temperature ensures concentration in a reasonable length of time.
 - a. All methylene chloride must be evaporated.
 - b. Allow to cool approximately 10 minutes before transfer to 125-mL separatory funnel to avoid bubbling in separatory funnel when methylene chloride is added.
16. Transfer the aqueous solution to a 125-mL separatory funnel. Use a wash bottle to rinse the K-D with reagent water to complete the transfer.
17. Shake the sample for 1 minute and 30 seconds with 50 mL of methylene chloride. Discard the methylene chloride (lower) layer.
18. Use a pipette to acidify the solution to pH <2 with 25% sulfuric acid. This requires approximately 5 mL of the acid solution.
19. Perform a 1-minute ethyl ether extraction by shaking the sample with 40 mL of ethyl ether.
 - a. Drain the aqueous layer into a clean, acid rinsed flask.
 - b. Place the ethyl ether (top) layer into an acid rinsed flask containing at least 30 grams of acidified sodium sulfate. (Sodium sulfate must be in a quantity so that the sample is completely dried). More sodium sulfate is added if necessary.
 - c. Return the aqueous layer to the separatory funnel for the next extraction.

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20. Perform two additional 1 minute ethyl ether extractions by shaking the sample with 20 mL of ethyl ether.
 - a. Drain the aqueous layer into an acid rinsed flask.
 - b. Place the ethyl ether layer into the acid rinsed flask that contains 30 grams of acidified sodium sulfate.
 - c. Return the aqueous layer to the separatory funnel for the next extraction.
21. Allow the extract to remain in contact with the acidified sodium sulfate for a minimum of 2 hours while covered.
 - a. If the sodium sulfate is not free-flowing, add additional acidified sodium sulfate until all the water is removed.
 - b. Residual water hinders the methylation step and therefore must be removed with sodium sulfate before proceeding.
22. Transfer the extract into a K-D apparatus. Use a wash bottle to rinse the flask and funnel with two approximately 30-mL aliquots of ethyl ether to complete the transfer.
23. Add a glass bead to the K-D apparatus and attach a Snyder column, wet the column with ethyl ether and concentrate over a steam bath at 85° to 99°C until the apparent volume in the ampule reaches 1 mL.

This steam bath temperature ensures concentration in a reasonable length of time.
24. After the sample has cooled, use a squirt bottle to add approximately 0.5 mL of methanol.

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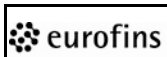
25. Set up diazomethane generator and esterify the extract as described below:

a. Safety precautions

- (1) Diazald is a carcinogen. Wear gloves at all times during this procedure. Perform esterification in a hood. Avoid inhalation of diazomethane.
- (2) Avoid using etched or scratched glassware and ground glass joints. **Do not heat over 90°C (explosion may result).** The generator must be set up in a hood containing no electrical appliances or steam baths. The additional heat and electrical hazard must be avoided.

b. Diazomethane Generator Procedure

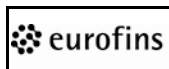
- (1) Prepare the diazomethane solution. Reagents **must** be mixed in the following order:
 - (a) Place 5 grams of KOH in a 125-mL Erlenmeyer flask.
 - (b) Use a pipette to add 8 mL of reagent water.
 - (c) Allow the solution to cool, and then use a graduated cylinder to add 25 mL of reagent alcohol and a reagent pump to add 25 mL of ethyl ether.
 - (d) Fill at least two 40-mL vials with ethyl ether for rinsing the generator between samples.
- (2) Just prior to starting the procedure (must be performed under hood) add approximately 3 grams of diazald to the KOH solution.
 - (a) Clamp the Erlenmeyer in place.

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- (b) The amount of diazald needed depends on the number of samples extracted. Use 3 g for eight to ten samples. If more than ten samples are extracted, prepare a second diazomethane solution for use during esterification.
- (3) Fill a beaker with hot water (80° to 85°C) from the steam bath and hold under the Erlenmeyer containing the diazomethane solution. At the same time, hold a rinse vial of ethyl ether at the end of the generator.
- (4) When the rinse vial begins to turn yellow, remove the vial and begin placing samples at the end of the generator.
 - (a) Using a rinse vial, rinse the generator between samples.
 - (b) Be sure each sample turns bright yellow before going on to the next sample. This is to ensure that esterification is complete.
 - (c) If the yellow color does not persist in all of the samples after methylation for the group is complete, remethylate the samples that are no longer yellow.
- (5) After esterification, N-Evap the samples to 2 mL. **Do not use heat above 40°C.**
- (6) Use a wash bottle to adjust the final volume to 10 mL with hexane.

Pour the extract into a clear 12-mL labeled vial.
- (7) Florisil the sample as follows:
 - (a) Prepare a 2-gram florisil cartridge by rinsing two times with 3 to 5 mL of hexane. Discard the rinseate.

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- (b) Use a pipette to add 2 mL of extract to the cartridge. Elute to just above the meniscus using gravity. Collect eluant in a test tube.
 - (c) Pour 5 to 6 mL of 50% ethyl ether in hexane into the cartridge. Collect the rinse in the test tube.
 - (8) N-Evap the extract to just below 2 mL.
 - (9) Add 100 µL of Herb Internal Standard to a 2-mL volumetric flask.
- Bring the extract to final volume in a 2-mL volumetric flask containing 100 µL of Herb Internal Standard with hexane.
- (10) Use a disposable pipette to bottle the extract in a clear autosampler vial labeled with the sample number and an "F." The remainder of the unflorisiled extract is in the labeled 12-mL vial.
 - (11) The extracts are stored in a freezer at -10° to -15°C and must be analyzed within 40 days of extraction.

Calculations:

See analysis method.

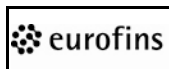
Statistical Information/Method Performance:

See analysis method.

Quality Assurance/Quality Control:

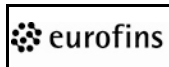
A batch is defined as the samples to be extracted on any given day but not to exceed 20 field samples. If more than 20 samples are prepared in a day, an additional batch must be prepared.

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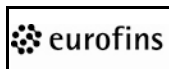
For each batch of samples extracted, a blank, LCS, MS and MSD must be extracted. If there is limited sample that prevents the preparation of the MS/MSD then an LCSD must be prepared instead.

If any client, agency, or state has more stringent QC or batch requirements, these must be followed instead.

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Eurofins Document Reference	1-P-QM-WI -9013125	Revision	11
Effective Date	Dec 8, 2014	Status	Effective
Historical/Local Document Number	Analysis 1333		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

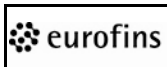
Prepared by	Michele Graham
Reviewed and Approved by	Erik Frederiksen;Review;Monday, November 17, 2014 9:15:29 AM EST Barbara Reedy;Approval;Monday, November 24, 2014 7:40:45 AM EST

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Revision Log:

Revision: 11		Effective Date:	This version
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Cross Reference	Reflect current documents referenced in procedure	Replaced 1-P-QM-QMA-9017363 with 1-P-QM-QMA-9015389 and replaced 1-P-QM-QMA-9017372 with 1-P-QM-QMA-9021767	
Sample Collection Preservation and Handling	Reflect current practice	Updated temperature to 0° to 6°C, not frozen	

Revision: 10		Effective Date:	Dec 3, 2012
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version.	
Title	New Requirement	Added methods that are referenced	
Throughout Document	Reflect re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers	
	Clarification	Reorganized and reworded; content did not change, but flow of activities was revised	
Reference	New Requirement/updated for Validation	Added item 1 – SM 21	
Reference Modifications	Updated for Validation/method requirement	Added No changes between EPA and SM20 or SM 21	

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Reference:

1. Standard Methods for the Examination of Water and Wastewater, 21st Edition, 2005, Method 4500 S2 F-2000.
2. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 4500 S2 F
3. Method 376.1, Methods for Chemical Analysis of Water and Wastes USEPA 600.
4. Test Methods for Evaluating Solid Wastes, SW-846 Method 9034 Modified, December 1996.
5. *Chemical Hygiene Plan*, current version.

Cross Reference:

Document	Document Title
1-P-QM-PRO-9015535	Quality Control Data for Wet Chemistry
1-P-QM-QMA-9015389	Balance, Syringe, Pipette Verification
1-P-QM-QMA-9017309	Determining Method Detection Limits and Limits of Quantitation
1-P-QM-QMA-9017313	Establishing Control Limits
1-P-QM-QMA-9017328	Reagents and Standards
1-P-QM-QMA-9021767	Laboratory Notebooks, Logbooks, and Documentation For Environmental Testing

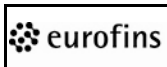
Scope:

This method is applicable to the measurement of all concentration ranges of total and dissolved sulfides in drinking, surface, and saline waters and domestic and industrial wastes.

Basic Principles:

Excess iodine is added to a sample. Under acidic conditions, the iodine oxidizes the sulfide in the sample to sulfur. The excess iodine is then back titrated with sodium thiosulfate to determine the concentration of sulfide in the sample.

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Reference Modifications:

There are no procedural differences between SM 20 4500- S2 F and EPA 376.1.

There are no procedural differences between SM 21 4500- S2 F and EPA 376.1.

There are no procedural differences between SM 20 4500- S2 F and SM 21 4500- S2 F.

Samples are decanted before analysis instead of filtering.

The scope listed in 9034 indicates that this reference is the determinative step following the distillation method 9030. This analysis is modified to use only the determinative titration method of 9034. Samples are not distilled.

Interferences:

Interfering substances such as sulfite, thiosulfate, iodide, and other soluble substances are removed with the addition of zinc acetate to form the precipitate, zinc sulfide.

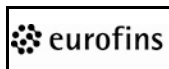
Safety Precautions and Waste Handling:

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

NOTE: Adding acid to samples that may contain high concentrations of sulfide must be done in a well-ventilated area to protect laboratory staff from accidental exposure to hydrogen sulfide gas.

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Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability.

Analysts are considered proficient when they have successfully completed a Demonstration of Capability. Demonstration of Capability consists of four check samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Demonstration of Capability is performed annually and is maintained in the analyst's training records.

Sample Collection, Preservation, and Handling:

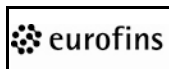
Collect samples for sulfide in a glass container containing zinc acetate, with no headspace. Preserve with 4 drops of 2N zinc acetate solution per 100 mL of sample. Adjust the pH to >9 with sodium hydroxide (NaOH). Refrigerate at 0° to 6°C, not frozen and analyze within 7 days of collection.

Preserve or analyze unpreserved samples as soon as possible after receipt at laboratory.

Apparatus and Equipment:

1. Analytical balance or equivalent. Refer to 1-P-QM-QMA-9015389.
2. Class A burette with burette stand or equivalent
3. 500-mL Erlenmeyer flasks
4. 100-mL volumetric Class A pipettes or equivalent.

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Reagents and Standards:

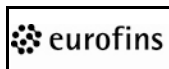
Alternate weights and volumes are acceptable as long as final concentrations remain the same. Refer to 1-P-QM-QMA-9017328 for the proper labeling and documentation of reagent preparations.

1. 2N zinc acetate solution – Purchased. Store at room temperature.
See manufacturer's label for expiration date.

2. 5N sodium hydroxide solution (NaOH)
 - a. Dissolve 200 ± 1 g of NaOH in approximately 800 mL of reagent water.
 - b. Stir well with stir bar. **(Solution will get very warm).**
 - c. Dilute to 1000 mL in a volumetric flask.
 - d. Store in plastic container at room temperature and re-evaluate yearly.

3. Sulfide stock solution
 - a. Dissolve 3.73 ± 0.01 g $\text{Na}_2\text{S} \cdot 9\text{H}_2\text{O}$ in reagent water and dilute to 500 mL in a volumetric flask.
 - b. **Prepare fresh daily.** (Concentration of solution is approximately 1000 mg/L).
 - c. Used as spiking solution.
 - d. For the MS/MSD add 2 mL of the 1000 mg/L sulfide standard to the sample aliquot in the flask.

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4. Intermediate sulfide solution

- a. Pipette 20.0 mL of sulfide stock solution into approximately 800 mL of reagent water in a 1000-mL volumetric flask.
- b. Preserve with NaOH to a pH >9 and add approximately 3 mL of 2N zinc acetate solution.
- c. Dilute with reagent water to 1000 mL.
- d. **Prepare fresh daily.** (Concentration of solution is approximately 20 mg/L).
- e. Used for the LCS - pipette 100 mL of the 20 mg/L sulfide standard.

5. Hydrochloric acid (1 + 1)

- a. Mix equal portions of concentrated hydrochloric acid (HCl) and reagent water.
- b. Store in glass or plastic container at room temperature and re-evaluate yearly.

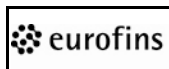
6. Starch indicator – Purchased. Store at room temperature.
See manufacturer's label for expiration date.

7. Potassium iodide (KI) crystals – Purchased. Store at room temperature and re-evaluate yearly.

8. 0.025N potassium bi-iodate

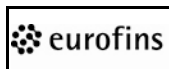
- a. Dry $\text{KH}(\text{IO}_3)_2$ for at least 2 hours at $104^\circ \pm 1^\circ\text{C}$ and cool approximately one hour in a desiccator.

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- b. Dissolve 0.8124 ± 0.0002 g $\text{KH}(\text{IO}_3)_2$ in reagent water and dilute to 1000 mL in a volumetric flask.
 - c. Store in amber glass bottle at room temperature.
 - d. Stable 1 year.
9. 0.1N sodium thiosulfate – Purchased. Store at room temperature. See manufacturer's label for expiration date.
10. 0.025N sodium thiosulfate ($\text{Na}_2\text{S}_2\text{O}_3$)
 - a. Dilute 250 mL of 0.1N $\text{Na}_2\text{S}_2\text{O}_3$ (purchased) to 1000 mL with reagent water.
 - b. Hold time is determined by the manufacturer's expiration date for 0.1N $\text{Na}_2\text{S}_2\text{O}_3$.
 - c. Store in glass or plastic container at room temperature.
 - d. **Standardize weekly** against 0.025N potassium bi-iodate.
11. 0.025N iodine solution
 - a. Dissolve 20 to 25 g KI in approximately 800 mL of reagent water and add 3.20 ± 0.05 g iodine.
 - b. Allow plenty of time to dissolve and then dilute to 1000 mL with reagent water in a volumetric flask.
 - c. Store in amber glass bottle at room temperature.
 - d. Stable for 1 year. Standardize weekly against 0.025N sodium thiosulfate.

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Calibration:

A. Balances must be calibrated each day before use. Refer to 1-P-QM-QMA-9015389.

B. Standardization:

Record all standardization in department's solution standardization logbook.

1. Sodium thiosulfate

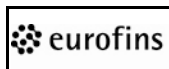
- a. Dissolve approximately 2.0 g KI in an Erlenmeyer flask with approximately 150 mL reagent water.
- b. Add a few drops of concentrated H₂SO₄. Swirl.
- c. Add by pipette 20 mL of 0.025N potassium bi-iodate.
- d. Dilute to approximately 200 mL with reagent water.
- e. Immediately titrate the liberated iodine with 0.025N Na₂S₂O₃ titrant to a pale yellow color.
- f. Then add a few drops of starch solution and titrate to the first colorless endpoint.
- g. Perform duplicate trials and average the results.

$$Na_2S_2O_3 \text{ } N = \frac{(20 \text{ mL } KH(IO_3)_2) \times (0.025N \text{ } KH(IO_3)_2)}{\text{mL of sodium thiosulfate titrated}}$$

2. Iodine

- a. Pipette 10 mL of 0.025N iodine solution into an Erlenmeyer flask and add approximately 90 mL of reagent water.

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- b. Titrate immediately with the $\text{Na}_2\text{S}_2\text{O}_3$ (previously standardized) to a pale yellow color.
- c. Then add a few drops of starch solution and titrate to the first colorless endpoint.
- d. Perform duplicate trials and average the results.

$$\text{Iodine } N = \frac{(\text{mL of } \text{Na}_2\text{S}_2\text{O}_3 \text{ titrated})(\text{standardized normality of } \text{Na}_2\text{S}_2\text{O}_3)}{10.0 \text{ mL iodine solution}}$$

Procedure:

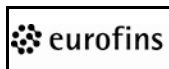
A. Sample Preparation Before Analysis:

Zinc acetate preserved samples for sulfide are prepared in the following manner:

1. If the sample bottle contains headspace, mark the volume of the sample with a line.
2. After the precipitate settles out and a clear liquid phase is **visible**, siphon down to the precipitated area (being careful not to pull any of the zinc sulfide precipitate out).
3. Refill to the original sample volume mark with reagent water. Resuspend the precipitate before withdrawing a portion for analysis.
4. Sample is no longer considered preserved and must be analyzed as soon as possible.
5. Samples without a visible precipitate layer are analyzed without this pretreatment step.

NOTE: Removing the supernatant and replacing the sample volume with reagent water in this manner eliminates many interferences.

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B. Titration Procedure

Record data in a raw data logbook following instructions in 1-P-QM-QMA-9021767.

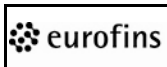
Add reagents to the Erlenmeyer flask in the exact order stated in this procedure to ensure no sulfide gas is liberated before the titration is performed.

1. Pipette 10 mL of the standardized iodine solution into a 500-mL Erlenmeyer flask. Bring the volume up to approximately 20 mL with reagent water.
2. Add approximately 2 mL of 1 + 1 HCl.
3. Pipette 200 mL, or a suitable portion diluted to 200 mL with reagent water, of well-mixed, precipitated sample into the flask.

For the method blank pipette 200 mL of reagent water.

4. Discharge the sample **under** the solution surface. Swirl.
5. **If precipitate remains**, add more 1 + 1 HCl until it disappears.
6. **If the iodine color disappears**, add more iodine until the color remains. Record the total amount of iodine solution used. Titrate as usual. Then perform a second trial, adding enough iodine before the sample to maintain the yellow color after the sample addition.
7. Titrate immediately with standardized Na₂S₂O₃ solution to a pale yellow.
8. Add a few drops of starch indicator and titrate to a colorless endpoint.
9. Record the amount of titrant used.

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Calculations:

$$mg\ sulfide/L = \frac{[(A \times B) - (C \times D)] \times 16,030}{mL\ sample}$$

Where:

- A = mL iodine solution
- B = Normality of iodine solution
- C = mL Na₂S₂O₃ titrant
- D = Normality of Na₂S₂O₃ titrant

Statistical Information/Method Performance:

The method detection limit (MDL) is determined annually by following the procedure outlined in 1-P-QM-QMA-9017309.

The quality control acceptance windows are generated annually by following the procedure outlined in 1-P-QM-QMA-9017313.

Quality Assurance/Quality Control:

Batch size is limited to 20 samples or less.

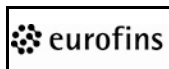
One method blank and a 20-mg/L LCS must be analyzed with each batch.

A matrix spike (MS), a matrix spike duplicate (MSD), and a sample matrix duplicate must be analyzed with each batch.

When sample volume does not permit the analysis of either a sample matrix duplicate or a MS and a MSD, then a 20-mg/L LCSD must be analyzed to demonstrate method precision.

A second sample matrix duplicate is not routinely required unless a batch contains an NPDES sample(s) from South Carolina and the batch contains more than 10 samples.

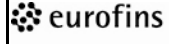
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Samples from West Virginia require a usable precision measurement for each batch. Analyzing one of the following on a batch containing a West Virginia sample fulfills this requirement: an MS/MSD, a non-program deleted duplicate, or an LCSD.

See LIMS for current quality control (QC) acceptance windows. Follow guidelines in 1-P-QM-PRO-9015535 for outlier QC data.

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Eurofins Document Reference	1-P-QM-WI -9013112	Revision	8
Effective Date	Jun 12, 2015	Status	Effective
Historical/Local Document Number	Analysis 12145, 12146, 12147, 12148, 12149, 12150, 12151, 12152, 12677, 12678, 12679		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

Prepared by	Michele Graham
Reviewed and Approved by	Erik Frederiksen;Review;Wednesday, June 10, 2015 12:31:41 PM EDT Barbara Reedy;Approval;Wednesday, June 10, 2015 2:05:08 PM EDT


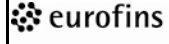

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Revision Log:

Revision: 8		Effective Date:	This version
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Reagents and Standards	Clarify and reflect current procedure	Added 10 mg/L fluoride working standard Added 4000 NTU for value of Turbidity Standard Added different source needed for Turbidity standard for curve and LCS/CCVs	
Calibration A.1 and A.2	Clarify and reflect current procedure	Added to refer to 1-P-QM-PRO-9015423 for preparation instructions for turbidity curve standards. Added different source needed for Turbidity standard for curve and LCS/CCVs	

Revision: 7		Effective Date:	Nov 17, 2014
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Throughout entire document	Updated procedure to include additional analyses	Added analyses 4530/13414 and 0475,0476 to SOP	

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Reference:

1. Analysis 12145-Turbidity

- a. Method 180.1 (1993), Methods for Chemical Analysis of Water and Wastes USEPA 600.
- b. Method 180.1, Methods for Chemical Analysis of Water and Wastes USEPA 600.
- c. Standard Methods for the Examination of Water and Wastewater, 21st Edition, 2005, Method 2130 B-2001.


2. Analysis 12146-Specific Conductance

- a. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 2510 B-1997
- b. Method 120.1, Methods for Chemical Analysis of Water and Wastes USEPA 600.
- c. Test Methods for Evaluating Solid Wastes, SW-846 Method 9050A, December 1996.

3. Analysis 12147-Total Hardness

- a. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 2340 C-1997
- b. Method 130.2 (modified), Methods for Chemical Analysis of Water and Wastes USEPA 600.

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4. Analysis 12148-Carbonate Alkalinity

Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 2320 B-1997

5. Analysis 12149-Bicarbonate Alkalinity

Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 2320 B-1997

6. Analysis 12150-Alkalinity

- a. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 2320 B-1997
- b. Method 310.1, Methods for Chemical Analysis of Water and Wastes USEPA 600.


7. Analysis 12151-Temperature of pH

Temperature EPA 170.1 Methods for Chemical Analysis of Water and Wastes USEPA 600.

8. Analysis 12152-pH

- a. Standard Methods for the Examination of Water and Wastewater, 21st Edition, 2005, Method 4500 H/B-2000
- b. Method 150.1, Methods for Chemical Analysis of Water and Wastes USEPA 600.
- c. Test Methods for Evaluating Solid Wastes, SW-846 Method 9040B.
- d. Test Methods for Evaluating Solid Wastes, SW-846 Method 9040C.

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9. Analysis 12677-Ammonia-Nitrogen

- a. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 4500 NH₃ D-1997
- b. Method 350.3, Methods for Chemical Analysis of Water and Wastes USEPA 600.

10. Analysis 12678-Fluoride


- a. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 4500-F C-1997
- b. Method 340.2, Methods for Chemical Analysis of Water and Wastes USEPA 600.

11. Analysis 12679-Ammonia-Nitrogen Distilled

- a. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 4500 NH₃ D-1997
- b. Method 350.3, Methods for Chemical Analysis of Water and Wastes USEPA 600.

12. Analysis 12707-Phenolphthalein Alkalinity

- a. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 2320 B-1997
- b. Method 310.1, Methods for Chemical Analysis of Water and Wastes USEPA 600.

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13. Analysis 4219-Ammonia Distillation

Standard Methods for the Examination of Water and Wastewater, 20th
Edition, 1998, Method 4500 NH₃ B-1997

14. Analysis 2593-Unionized Ammonia

Standard Methods for the Examination of Water and Wastewater, 20th
Editions, 8010 F-1997

15. Analysis 238-Free Carbon Dioxide


Standard Methods for the Examination of Water and Wastewater, 20th
Edition, 1998, Method 4500-CO₂ D-1997

16. Analysis 1456-Hydroxide Alkalinity

Standard Methods for the Examination of Water and Wastewater, 20th
Edition, 1998, Method 2320 B-1997

17. Analysis 2200-Fluoride (Distilled)

- a. Standard Methods for the Examination of Water and Wastewater, 20th
Edition, 1998, Method 4500-F C
- b. Method 340.2, Methods for Chemical Analysis of Water and Wastes
USEPA 600.
- c. Test Methods for Evaluating Solid Wastes, SW-846 Method 9214,
December 1996.

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18. Analysis 4530-Total Acidity

- a. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 2310 B-1997.
- b. Method 305.1, Methods for Chemical Analysis of Water and Wastes USEPA 600.

19. Analysis #0475, 0476 – Acidity to pH 3.7 and pH 8.3 (Titrimetric)

- a. Method 305.2, Methods for Chemical Analysis of Water and Wastes USEPA 600.
- b. Orion 960 Autochemistry System Instruction Manual, Orion Research, 1991.


20. ManTech Associates, Inc. PC-Titration Plus Instruction and Operation manual, January 25 2000.

21. *Chemical Hygiene Plan*, current version.

Cross Reference:

Document	Document Title
Analysis #1448	Bellack Distillation for Fluoride in Waters and Solids by SM 4500 F B–1997 or EPA 340.1 Procedure 6.1
1-P-QM-PRO-9015419	Accumet Model AB30 pH/Ion/Conductivity Meters
1-P-QM-PRO-9015421	pH Probes and Meters
1-P-QM-PRO-9015423	Calibration of Hach 2100AN Turbidimeter
1-P-QM-PRO-9015425	Fixed Volume Hand-Held Pipettes
1-P-QM-PRO-9015426	Adjustable Volume Handheld Pipettes
1-P-QM-PRO-9015428	Orion 960 Autotitration System
1-P-QM-PRO-9015530	Standardization of 0.02 and 0.1 Normal Sulfuric Acid
1-P-QM-PRO-9015535	Quality Control Data for Wet Chemistry
1-P-QM-QMA-9015389	Balance, Syringe, Pipette Verification
1-P-QM-QMA-9017309	Determining Method Detection Limits and Limits of Quantitation
1-P-QM-QMA-9017313	Establishing Control Limits
1-P-QM-QMA-9017328	Reagents and Standards
1-P-QM-QMA-9021767	Laboratory Notebooks, Logbooks, and Documentation for Environmental Testing

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Scope:

This SOP covers two options for analyzing samples for certain analytes (see table below for complete list). Option one is listed as a manual method and option two is listed as an automated method.


The automated method uses an instrument called the ManTech multi-parameter system. The manual method and the ManTech multi-parameter system (automated) method are used for the determination of the following analytes (see table below) in drinking waters, surface waters, and wastewater samples.

The table below lists the name and number of the analyses that are included in this SOP and the method references associated with each.

Table of Analyses and Reference Methods

Analysis Name and Number	Analysis Method
Turbidity, 12145	EPA 180.1 (1993) EPA 180.1
Specific Conductance, 12146	SM 2510B-1997, EPA 120.1, SW-846 9050A
Total Hardness, 12147	SM 2340C-1997, EPA 130.2 modified
Carbonate Alkalinity, 12148	SM 2320B-1997
Bicarbonate Alkalinity, 12149	SM 2320B-1997
Total Alkalinity, 12150	SM 2320B-1997, EPA 310.1
Temperature of pH, 12151	EPA 170.1
pH, 12152	SM 4500-H+B-2000, EPA 150.1, SW-846 9040B, SW-846 9040C
Ammonia-Nitrogen, 12677	SM 4500-NH3D-1997, EPA 350.3
Fluoride, 12678	SM 4500-F C-1997, EPA 340.2
Ammonia-Nitrogen Distilled, 12679	SM 4500-NH3D-1997, EPA 350.3
Phenolphthalein Alkalinity 12707	SM 2320B-1997, EPA 310.1

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Analysis Name and Number	Analysis Method
Ammonia Distillation, 04219	SM 4500-NH3 B-1997
Unionized Ammonia, 02593	SM 8010 F-1997
Free Carbon Dioxide, 00238	SM 4500-CO2 D-1997
Hydroxide Alkalinity, 01456	SM 2320 B-1997
Fluoride (distilled), 02200	SM 4500-F C-1997, EPA 340.2, SW-846 9214
Total Acidity, 04530	SM 2310-B-1997, EPA 305.1
Acidity to pH 3.7 and pH 8.3 (titrimetric)	EPA 305.2

Basic Principles:


If necessary, samples can be analyzed using a manual method.

Samples are analyzed using the ManTech multi-parameter system, which has been designed to test for specific analytes. The system is able to be configured in different ways to optimize sample volumes required, and analysis times. The ManTech system is able to analyze for one parameter or multi-parameters at the same time.

Reference Modifications:

The following analyses have reference modifications:

1. Analysis #12147-Total Hardness:
 - a. The procedures listed in SM 2340C and Method 130.2 are modified by using potassium cyanide (KCN) as the inhibitor instead of sodium cyanide (NaCN).
 - b. SM2340C and EPA 130.2 state to dilute 25 mL of sample to 50 mL with reagent water prior to titration. This procedure uses 50 mL sample.

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2. Analysis #12152 –pH

EPA 150.1 states to repeat measurement on successive volumes of sample until values differ by less than 0.1 pH units. However, SM 4500 H+ B does not require multiple readings.

3. Analysis #12678, 2200 – Fluoride and Distilled Fluoride

- a. The differences between SM 4500-F- C and EPA 340.2 are that SM 4500-F-C states that the electrodes are inserted before stirring the sample. For EPA 340.2 begin stirring the sample before the electrodes are inserted.
- b. This method uses less buffer than suggested by the manufacturer. The concentration ratio of sample to total ionic strength adjustment buffer (TISAB) is the same as EPA Method 340.2.

4. Analysis #12677, 12679– Ammonia-Nitrogen and Distilled Ammonia-Nitrogen


Instead of using NaOH in order to pH adjust the samples during the 12677 and 12679 ammonia analysis, this procedure uses alkaline reagent. Alkaline reagent is a purchased reagent containing NaOH that is currently recommended by the manufacturer of the ammonia electrode.

Interferences:

Sample matrix is likely to be the largest cause of interference for each analysis.

Samples containing oily layers, soaps, suspended solids, or precipitates may impede the electrode response. The electrode must be cleaned according to the manufacturer's instructions.

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Total Hardness – excessive amounts of heavy metals can interfere, causing a faded or indistinct endpoint by the stoichiometric consumption of EDTA. If this interference is not resolved after multiple dilutions on the ManTech automated procedure, then the sample must be analyzed using the manual procedure. See SM 2340C for more discussion on interferences and how to treat them.

Turbidity – the presence of floating debris and coarse sediments, which settle out rapidly, will give low turbidity readings. Finely divided air bubbles will affect the results in a positive manner.

Ammonia Nitrogen – volatile amines are a positive interference. Mercury and Silver also interfere with this procedure. Electrode responds slowly at levels <1 mg NH₃-N/L; use longer electrode immersion times.

Fluoride – several polyvalent cations, notably aluminum, iron and silicon interfere by forming complexes with fluoride. Adding TISABIII provides a uniform ionic strength background, adjusts pH and breaks up complexes so that the fluoride ion activity can be measured. Fluoborates are widely used in industrial processes. At concentrated levels, as in electroplating wastes, fluoborates do not hydrolyze to release fluoride without using the Bellack distillation (Analysis #1448) prior to analyzing the sample distillate by ISE.

Safety Precautions and Waste Handling:


All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability.

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Analysts are considered proficient when they have successfully completed a documented Demonstration of Capability. This consists of four laboratory control samples that are carried through all steps of the analysis and that meet the acceptance criteria for the LCS. Demonstration of Capability is performed annually and documentation is in each individual's training records.

Sample Collection, Preservation, and Handling:

Samples for pH, Temperature of pH, Specific Conductance, Turbidity, Fluoride, Total Alkalinity, Total Acidity, and Acidity to pH 3.7 and pH 8.3 are to be collected in unpreserved glass or plastic containers. Analyze Total Alkalinity, Total Acidity, and Acidity to pH 3.7 and pH 8.3 within 14 days of collection. Analyze Fluoride within 28 days of collection. All other analyses mentioned above are to be analyzed as soon as possible upon receipt at the laboratory.

Samples for Ammonia must be collected in a glass container, preserved with concentrated sulfuric acid to a pH < 2. Analyze within 28 days of collection.


Samples for Total Hardness must be collected in a glass or plastic container, preserved with nitric acid to a pH < 2. Analyze within 6 months of collection.

All samples must be stored at 0° to 6°C, not frozen. Prior to analysis, samples must be brought to room temperature.

Apparatus and Equipment:

1. pH Electrode
2. Fluoride ion selective electrode
3. Interface
4. Burivar I/2 (25 mL burette)

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5. TitraRinse pump
6. TitraRinse slow speed reagent addition pump
7. Turbidity meter – white light turbidity meter option
8. Reversible Peri-Max pump
9. Man-Tech photometric detector with a 620nm filter
10. Conductivity/TDS Meter, Model 4510
11. Ammonia electrode
12. Autosampler - MEGA, 197 sample locations
13. Analytical balance or equivalent. Refer to 1-P-QM-QMA-9015389

For Manual Methods:

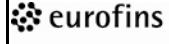
A. Analysis #4219 Distillation Apparatus and Equipment

1. Kjeldahl distillation rack
2. Refrigerated recirculator (Coolflow) with a recirculating pressure set at 20 psi and the temperature adjustment set at 10°C, or equivalent.

*Each distillation setup requires the following

3. Glass distillation apparatus with connector and 800 mL Kjeldahl flask
4. pH indicator strips, purchased
5. Porous boiling chips, purchased

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B. Analysis #12677, 12679 ISE Apparatus and Equipment:


1. Analytical balance, or equivalent. Refer to 1-P-QM-QMA-9015389
2. pH meter with expanded millivolt scale, or equivalent
3. Ammonia selective electrode (Thermo Orion 95-12) or equivalent
4. Stir plate with magnetic stirrer with Teflon-coated stirring bar, or equivalent
5. 100-mL class A graduated cylinder, or equivalent
6. Automatic pipette capable of dispensing 1 mL of liquid, or equivalent. Refer to 1-P-QM-PRO-9015425 and 1-P-QM-PRO-9015426

C. Analysis #12147-Total Hardness

1. Class A buret with buret stand, or equivalent
2. 125-mL Erlenmeyer flasks, or equivalent
3. Analytical balance or pan balance, or equivalent. Refer to 1-P-QM-QMA-9015389.
4. Adjustable hand-held automatic pipette, or equivalent. Refer to 1-P-QM-PRO-9015426

D. Analysis #12146-Specific Conductance

Conductivity meter (Accumet Model AB30)

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E. Analysis #12150, 12707 - Alkalinity

1. pH meter that reads to 0.05 pH units, with automatic temperature compensation and a glass electrode or equivalent. Refer to 1-P-QM-PRO-9015421.
2. Orion 960 Autotitration System or equivalent. Refer to 1-P-QM-PRO-9015428. (Automated Procedure only).
3. Microburet with reservoir or equivalent (Manual Procedure only).
4. Analytical balance, or pan balance, or equivalent.


F. Analysis #12678, #2200 –Fluoride and Distilled Fluoride

1. pH meter with expanded millivolt scale, or equivalent. Refer to pH meter manufacturer's Instruction Manual.
2. Fluoride electrode (Orion 94-09-00), or equivalent

If the fluoride electrode's performance degrades, consult the manufacturer's *User Guide* for cleaning and maintenance instructions. If performance does not improve after cleaning, then the electrode must be replaced.

The expected lifespan of a fluoride electrode is 3 years. Refer to the electrode's identification tag for in-service date.

3. Reference electrode (Ag/AgCl), or equivalent
4. Stir plate with magnetic stirrer
5. Timer
6. Class A graduated cylinder, or equivalent

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7. Analytical balance, or equivalent.
8. Assorted automatic pipettes, or equivalent. Refer to 1-P-QM-PRO-9015425 and 1-P-QM-PRO-9015426

G. Analysis #12152-pH

1. pH meter with automated temperature compensator (ATC) probe
2. Combination electrodes or equivalent
3. Stir bar and stir plate


H. Analysis #12145-Turbidity

1. Turbidimeter – Hach Model 2100AN or equivalent
2. Silicone oil and oiling cloth
3. Sample tubes, clear colorless glass

I. Analysis #4530/#13414 -Total Acidity/Prep

1. pH meter that uses a glass electrode and reads to .05 pH units
2. Magnetic stir bar and stir plate
3. Hot plate
4. 150-mL glass beakers and plastic cups
5. 10-mL microburet with reservoir
6. Analytical balance capable of weighing to .0001g

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7. Orion 960 Autotitrator system

J. Analysis #0475,0476 – Acidity to pH 3.7 and pH 8.3

1. pH meter that uses a glass electrode and is able to be read to 0.05 pH units. If automatic temperature compensation is not provided, make titration at 25° ±2°C.
2. Magnetic stirrer and stir plate
3. 100, 150 and 250-mL beakers
4. 10-mL microburet
5. Analytical balance capable of weighing to .0001 g. Refer to 1-P-QM-QMA-9017363
6. Orion 960 autotitration system


Reagents and Standards:

Alternative weights and volumes are acceptable as long as final concentrations remain the same. Refer to 1-P-QM-QMA-9017328 for proper labeling and documentation of reagent preparations.


A. Reagents and Standards needed for Manual and ManTech methods

1. Sulfuric acid, 0.02 N
 - a. Dilute 0.6 mL of concentrated sulfuric acid to 1000 mL with reagent water.
 - b. Store at room temperature in glass or plastic container and re-evaluate yearly.

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- c. Standardize according to 1-P-QM-PRO-9015530.
 - d. Re-standardize titrant before use if more than 30 days have passed since the last standardization date.
2. Total alkalinity standard (9400 mg/L as CaCO₃)
- a. Dry sodium carbonate (Na₂CO₃) for at least 4 hours at approximately 250°C.
 - b. Desiccate approximately 2 hours.
 - c. Dissolve 9.954g ± 0.002g Na₂CO₃ in reagent water and dilute to 1000 mL in a volumetric flask.
 - d. Stable 3 months.
 - e. Store in a glass container at 0° to 6°C, not frozen.
 - f. Dilute for other concentrations.
3. pH 4, 7, and 10 buffer solutions- purchased; see container for shelf life information.
- NOTE: A second source 7.00 pH buffer solution that is from ISO 17025 approved vendor must be purchased; see container for shelf life information. This is to be used for analysis 12152 LCS. It is also to be used for analysis 12152 and 12150 CCV's.**
4. Turbidity standard; 4000 NTU – purchased; see container for shelf life information.

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NOTE: The Turbidity standard used to prepare the calibration curve must be prepared using a **different source Primary Formazin Standard than that used for LCS/CCVs.**

5. Total Ionic Strength Adjustment Buffer (TISAB) –purchased; see container for shelf life information.
6. 10N Sodium hydroxide (NaOH) - Purchased; see shelf life for information. Or prepare:
 - a. Prepared - Dissolve 400 g NaOH pellets in 1000 mL volumetric flask containing approximately 800 mL reagent water. Solution becomes very warm.
 - b. Cool to room temperature and dilute to 1000 mL with reagent water.
 - c. Store at room temperature in plastic or glass container and re-evaluate yearly.
7. 0.1 M KCl (12,900 $\mu\text{ohms/cm}$)
 - a. In a 1 L glass volumetric flask, dissolve $7.4555 \pm .0001$ g predried KCl (2 hours at $105^\circ \pm 2^\circ\text{C}$) in approximately 500 mL reagent water.
 - b. Dilute to volume with reagent water.
 - c. Stable 3 months.
 - d. Store at room temperature in a glass container.
 - e. Dilute for other concentrations.

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8. 5 umhos/cm low-level check standard

- a. In a 1 L glass volumetric flask, containing approximately 500 mL reagent water, dissolve 0.0025 g of NaCL.
- b. Prepare fresh before use.

9. Fluoride standard stock solution (100 mg/L)

- a. Dissolve $0.2210 \pm .0005$ g of anhydrous sodium fluoride (NaF) in reagent water and dilute to 1000 mL in a volumetric flask.
- b. Stable for 6 months.
- c. Store in a plastic container at room temperature.
- d. Dilute for other concentrations.

10. Fluoride working standard (10 mg/L)


- a. Pipette 10 mL of Fluoride stock solution (100 mg/L) into a 100 mL volumetric flask.
- b. Dilute to volume using reagent water.
- c. Prepare daily each day calibration curve is analyzed.

NOTE: A separate standard fluoride stock solution must be prepared using a **different source of NaF** when preparing a calibration curve.

10. Ammonia nitrogen standard (100 m/L NH₃-N)

- a. Dry ammonium chloride (NH₄Cl) at 103°C to 105°C for approximately 2 hours.

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- b. Desiccate approximately 1 hour.
- c. Dissolve 0.3819 ± 0.0002 g NH_4Cl in approximately 800 mL reagent water.
- d. Once dissolved, preserve the solution with concentrated sulfuric acid to a $\text{pH} < 2$. Dilute to 1000 mL in a volumetric flask.
- e. Stable for 6 months.
- f. Store at $0^\circ - 6^\circ \text{C}$, not frozen in a glass or plastic container.
- g. Dilute as needed for other concentrations.

NOTE: The Ammonia nitrogen standard used to prepare the calibration curve must be prepared using a **different source** of NH_4Cl .


11. Ammonia electrode storage solutions

- a. Storage between runs – mix 1ppm ammonium chloride solution with pH 4 buffer 1:1.
- b. Overnight storage – mix 10 ppm ammonium chloride solution with pH 4 buffer 1:1.


12. Standard EDTA titrant (0.02N) - Purchased; see container for shelf life information. Or prepare:

- a. Dissolve $3.723 \text{ g} \pm 0.005 \text{ g}$ of disodium EDTA in reagent water and dilute to 1000 mL with reagent water in a volumetric flask.
- b. Stable for 3 months.
- c. Store at room temperature in plastic bottle.

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- d. Standardize daily before use. Refer to Analysis #12147 for instructions for standardizing.
13. pH 10 hardness buffer solution – purchased; see container for shelf life information. Or prepare:
 - a. Dissolve 16.9 g ammonia chloride (NH_4Cl) in 143 mL of concentrated ammonium hydroxide (NH_4OH).
 - b. Separately, dissolve 1.179 ± 0.0005 g of disodium EDTA and 0.78 ± 0.005 g of ($\text{MgSO}_4 \cdot 7 \text{H}_2\text{O}$) in 50 mL of reagent water (this solution becomes turbid).
 - c. Combine the above two solutions and dilute to 250 mL with reagent water in a volumetric flask.
 - d. Solution is stable 30 days.
 - e. Store at room temperature in plastic container.
 14. Calmagite indicator solution (0.1 % w/v) – Purchased; Store at room temperature. See manufacturer's label for expiration date.
 15. Calcium reference standard (1000 mg/L Ca = 2497 mg/L CaCO_3) – Purchased; store at room temperature. See manufacturer's label for expiration date.
 16. 1000 mg/L CaCO_3 intermediate calcium standard
 - a. Pipette 20.0 mL of purchased reference standard into 50 mL volumetric flask and dilute to volume with reagent water.
 - b. Stable for 6 months.

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- c. Store at room temperature in glass or plastic container.
17. 15% Sodium Acetate Solution – dissolve 15.0 g of sodium acetate anhydrous in 85 mL of reagent water in a 150 mL beaker. Prepare fresh before use.
 18. Total acidity standard (5000 mg/L as CaCO₃)
 - a. In a 1-L glass volumetric flask containing approximately 500 mL of reagent water; add 20.4000 ± .0005 g potassium hydrogen phthalate.
 - b. Allow to dissolve and dilute solution to volume.
 - c. Store at 0° to 6°C, not frozen, in a glass container.
 - d. Solution expires 6 months from the date of preparation.
 19. Sodium hydroxide, 1 N
 - a. In a 1-L glass volumetric flask containing approximately 500 mL reagent water, dissolve 40.00 ± .05 g NaOH.
 - b. Cool and dilute to volume.
 - c. Store in a plastic bottle at room temperature.
 - d. Solution expires 1 year from date of preparation.
 20. Standardized sodium hydroxide, 0.02 N
 - a. In a 1-L glass volumetric flask, add approximately 500 mL reagent water.
 - b. Add 20 mL of 1 N NaOH to the flask and dilute to volume with reagent water.


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- c. Re-standardize titrant before use if more than 30 days have passed since the last standardization date. Standardize using instructions as per 1-P-QM-PRO-9015531.
 - d. Store at room temperature in a plastic or glass container.
 - e. Solution expires 1 year from the date of preparation.
21. Hydrogen peroxide (H₂O₂, 30% solution) – purchased. Store at room temperature. See label for expiration date.
22. pH 8.00 buffer Solution; purchased. Store at room temperature. See container for shelf life information.

B. Reagents needed for 4219 analysis:

1. Borate buffer solution – Dissolve 19.0 ± 0.1 g sodium borate, 10-hydrate (Na₂B₄O₇·10 H₂O) in approximately 1000 mL of reagent water. Add 176 mL of 0.1N NaOH to the solution and dilute to 2000 mL with reagent water in a volumetric flask. Store at room temperature in a glass container. Solution stable for 6 months.
2. 0.1N H₂SO₄ – Dilute 3.0 mL of concentrated sulfuric acid to 1000 mL with reagent water in a volumetric flask. Store at room temperature in a glass or plastic container and re-evaluate yearly.
3. 4% H₂SO₄ Solution – Dilute 380 mL of 0.1N H₂SO₄ to 1000 mL with reagent water in a volumetric flask. Store at room temperature in a plastic container and re-evaluate yearly.
4. Antifoam B (purchased). Store at room temperature. See manufacturer's label for expiration date.

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5. Sodium hydroxide, 5N – Dissolve 200 ± 0.5 g sodium hydroxide (NaOH) pellets in approximately 800 mL of reagent water. Solution becomes very warm. Cool to room temperature and dilute to 1000 mL with reagent water in a volumetric flask. Store at room temperature in plastic container and re-evaluate yearly. (This is used to pH adjust samples.)
6. Sodium hydroxide, 0.1N – Dilute 40 mL of 5N NaOH solution to 2000 mL with reagent water in a volumetric flask. Store at room temperature in a plastic container and re-evaluate yearly. (This is used in borate buffer solution.)
7. Dilute Hydrochloric (HCl) acid – To prepare, add 50 mL of concentrated HCl to approximately 3.5 liters of reagent water. Slowly invert. Store at room temperature in a plastic container. (This is used to rinse tubing prior to steam cleaning the distillation apparatus.)
8. Ammonia-nitrogen standard, 500 mg/L NH₃-N – In a 1 L volumetric flask containing approximately 500 mL reagent water, dissolve $1.9095 \pm .0002$ g NH₄Cl (which has been dried at $105^\circ \pm 2^\circ\text{C}$ for at least 2 hours). Dilute to 1 L using reagent water. Preserve the solution with concentrated sulfuric acid to a pH <2. Store the standard at 0° to 6°C , not frozen in a glass or plastic container. Standard expires 6 months from the date of preparation.


Calibration:

Calibration is preformed daily. It is only necessary to calibrate for analyses that will be performed on that day.

A manual calibration and automated calibration section is given for each analysis.

Balances must be calibrated each day before use. Refer to 1-P-QM-QMA-9015389.

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NOTE: When Calibrating using ManTech : For all calibrations, 50 mL of standard is poured into a sample tube. For each analysis, a predetermined and programmed sample volume is used (to be taken from the 50 mL in the sample tube).

NOTE: Recalibration is necessary for each analysis if acceptance criteria is not met.

A. Analysis #12145 Turbidity Calibration

1. Manual Calibration:

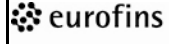
- a. Quarterly Calibration of turbidimeter – Every 90 days prepare a series of calibration standards covering the range 0 to 4000 NTU. Prepare the calibration standards as per instructions in 1-P-QM-PRO-9015423. If the standards are purchased no preparation is necessary. The Turbidity standard used to prepare the calibration curve must be prepared using a different source Formazin Primary standard than that used for the LCS/CCVs. Calibrate the instrument as per the instructions in 1-P-QM-PRO-9015423.
- b. Daily Calibration of turbidimeter- Read the Gelex secondary turbidity standards including a stray light standard, as per the instructions in 1-P-QM-PRO-9015423 each day the analysis is performed. Record the values in the maintenance logbook for the Hach 2100AN Turbidimeter.

2. Automated Calibration:

NOTE: The Turbidity standard used to prepare the calibration curve must be prepared using a different source Formazin Primary standard than that used for the LCS/CCVs.

- a. Dilute the 4000 NTU stock standard to obtain the following concentrations (1.0, 2.5, 5.0, 10.0, 20.0 NTU) and place calibration standards in ascending order in autosampler rack.

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- b. Sampler moves to rinse station and reagent water is pumped through flow cell to rinse tubing and cell.
- c. Sampler moves into first standard and 25 mL of standard is pumped through flow cell.
- d. Turbidity meter stabilizes for 60 seconds and turbidity reading recorded.
- e. Sample is pumped back into tube and sampler moves to rinse station to rinse flow cell and tubing.
- f. Steps b. – e. are repeated for remaining calibration standards.
- g. Acceptance criteria: Correlation coefficient of curve must be ≥ 0.995 .

B. Analysis #12146 Conductivity Calibration – determining cell constant; daily.

1. Manual Calibration:

- a. Determine cell constant daily, according to 1-P-QM-PRO-9015419.
- b. Conductivity Meter Linearity Check:
 - (1) Linearity check of the conductivity meter must be performed on the instrument at least once per year using the following concentrations below. Refer to 1-P-QM-PRO-9015419 for preparation instructions.

.0001M, .0005M, .001M, .005M, .01M, .02M, .05M, .1M
 - (2) Correlation Coefficient must be $\geq .995$. If this acceptance criteria is not met, the linearity check must be repeated.

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2 Automated Calibration:

a. Determine cell constant daily:

- (1) Place 1413 μ homs/cm calibration standard into autosampler rack.
- (2) The conductivity cell is rinsed with reagent water in the rinse station.
- (3) The cell moves to the 1413 μ homs/cm standard and is dipped 3 times in the solution, remaining fully immersed on the third dip.
- (4) Solution stabilizes for 25 seconds. The meter prompts to press calibration key twice.
- (5) The cell constant is displayed. Record cell constant in maintenance logbook.

b. Conductivity Meter Linearity Check:

- (1) Linearity check of the conductivity meter must be performed on the instrument at least once per year using the following concentrations below. Refer to 1-P-QM-PRO-9015419 for preparation instructions.


.0001M, .0005M, .001M, .005M, .01M, .02M, .05M, .1M

- (2) Correlation Coefficient must be $\geq .995$. If this acceptance criteria is not met, the linearity check must be repeated.

C. Analysis #12147, Total Hardness Calibration:

1. Manual Calibration:

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*Standardization of EDTA Titrant:

- a. Weigh 1.000 ± 0.0005 g CaCO_3 and transfer to a 500-mL Erlenmeyer flask.
- b. Add 1 + 1 HCl gradually until the CaCO_3 dissolves.
- c. Add 200 mL reagent water and boil for a few minutes to expel CO_2 .
- d. Allow the flask to cool.
- e. Add a few drops of methyl red indicator and adjust to an intermediate orange color with 3 N NH_4OH or 1 + 1 HCl, as needed.
- f. Dilute to 1000 mL with reagent water in a volumetric flask. (This solution is 1000 mg/L CaCO_3 .)
- g. Dilute 5.0 mL (pipette) of this solution to 50 mL and titrate to a blue endpoint following the steps in the Procedure Section of this analysis.
- h. Perform duplicate trials. Use the average of two trials to calculate the constant.

$$\text{EDTA constant} = \frac{5\text{mL CaCO}_3}{\text{mL of EDTA titrant}}$$


2. Automated Calibration: Not Applicable to this analysis

D. Analysis #12707, 12150: Alkalinity Calibration:

1. Manual Calibration:

The pH meter must be calibrated each day before use. Refer to 1-P-QM-PRO-9015421 for manual calibration instructions.

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2. Automated Calibration:

The pH meter must be calibrated each day before use. See Section E2.
under Calibration section

E. Analysis # 12152: pH Calibration:


1. Manual Calibration:

The pH meter must be calibrated each day before use. Refer to
1-P-QM-PRO-9015421 for manual calibration instructions.

2. Automated Calibration:

- a. Place pH 4, 7, and 10 buffers into autosampler rack and run a schedule to calibrate pH probe.
- b. Sampler moves to rinse station where the sample transfer line and Titrasis vessel are rinsed with reagent water.
- c. Sampler moves to pH 4 buffer position and sample transfer line is primed with pH 4 buffer solution.
- d. 10 mL of buffer solution is pumped into Titrasis cell and stirrer is turned on.
- e. pH of buffer solution is measured and recorded.
- f. Steps b. to e. are repeated for pH buffers 7 and 10.
- g. Acceptance criteria: Slope of pH calibration must be within the range of -65 to -53.

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F. Analysis #12678, 2200 Fluoride Calibration:

1. Manual Calibration:

a. Meter Calibration


Each day that samples are analyzed for fluoride, the meter must be zeroed prior to use with a 2.0-mg/L calibration standard.

Record data in a raw data logbook following instructions in 1-P-QM-QMA-9021767.

- (1) Connect fluoride electrode and reference electrode to the pH meter.

NOTE: The current pH meter in use with an expanded millivolt scale is a VWR pH meter (SB301). The following meter instructions are for it.


- (2) Turn on the power. Press the mode key until "RmV" is displayed
- (3) Place 20 mL of a 2-mg/L calibration standard into a 50-mL plastic beaker.
- (4) Add 2 mL of TISAB III and place electrodes under the surface of the sample.
- (5) Begin stirring at a slow, steady rate.
- (6) Wait while the standard stirs for 3 minutes.
- (7) **After at least 3 minutes**, press the "cal" key. When the reading is stable the display will flash "ready."

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- (8) Press the “OK” key to set the meter to zero.
- (9) Withdraw the electrodes and rinse with reagent water.
- (10) **Gently** blot electrodes with clean, dry tissues between readings.
- (11) Place 20 mL of the 0.5 mg/L CCV into a 50-mL plastic beaker.
- (12) Add 2 mL of TISAB III buffer and place electrodes under the surface of the sample.
- (13) Begin stirring at a slow, steady rate.
- (14) Stir solution for at least 3 minutes.
- (15) When the mV reading is stable, record the mV reading.
- (16) On each batch, at least one 0.5-mg/L CCV must be analyzed to validate the curve.

b. Curve:

- (1) Using the fluoride concentrations listed below, analyze a new calibration curve every 3 months **or** when a bottle having a new lot number of TISAB III is opened.
- (2) After analyzing, plot calibration curve of F^- concentration vs. Rel mV under log plot using statistics program in LIMS.
- (3) The calibration curve must have a correlation coefficient of ≥ 0.995 .

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- (4) When analyzing samples from the state of North Carolina, each analyst performing the analytical procedure must produce a standard curve (Ref 15A NCAC 2H .0805 (a) (7) (I)).

Concentration (mg/L)	mL Working Standard (10 mg/L)	Final Volume (mL)
2.00	20	100
1.50	15	100
1.00	10	100
0.50	5	100
0.10	1	100

2. Automated Calibration:

NOTE: Before analyzing for analysis 2200, add 1 mL of 15% of Sodium Acetate to all curve standards.

- a. Dilute Stock standard to obtain the following concentrations: concentrations of 2.0, 1.5, 1.0, 0.5, 0.1 mg/L and place calibration standards into autosampler rack in ascending order and run a schedule to calibrate fluoride probe.
- b. Sampler moves to rinse station where sample transfer line and Titrasiip vessel are rinsed with reagent water.
- c. Sampler moves to first standard position.
- d. Sample transfer line is primed with standard solution.
- e. 30 mL of standard and 3 mL of TISAB is pumped into the Titrasiip vessel, and stirrer is turned on.
- f. Fluoride concentration is measured and recorded.
- g. Steps b. – f. are repeated for remaining standards.

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h. Acceptance criteria: Correlation coefficient of curve must be ≥ 0.995 .

G. Analysis #12677, 12679 Ammonia Calibration

1. Manual Calibration:

Curve:


Prepare a calibration curve daily using the concentrations listed below. (Dilute 100 mg NH₃-N /L stock solution with reagent water in 100-mL volumetric flasks.) After analyzing, plot calibration curve of mg NH₃-N /L vs. Rel mV using the log plot program in LIMS. The correlation coefficient of the curve must be $\geq .995$ and the slope of the curve must range from 54 to 60 mV. The curve must be analyst specific.

<u>Conc. (mg/L NH₃-N)</u>	<u>mL 100 mg/L → 100 mL</u>
0.1	0.1
0.5	0.5
2.5	2.5
5.0	5.0
10.0	10.0

Refer to Procedure I or J for instructions on analyzing curve.

2. Automated Calibration:

- a. Ensure electrode is filled to line with appropriate fill solution (NH₄Cl).
- b. Dilute stock standard to obtain the following concentrations: 0.1, 0.5, 2.5, 5.0, 10.0 mg/L and place calibration standards into the sampler rack in ascending order, and pH 4 buffer into dip rinse (second rinse) position.
- c. Sampler moves to flowing rinse station where electrode is rinsed with reagent water.

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- d. Sampler moves to dip station and electrode remains immersed in pH 4 buffer for 15 seconds.
- e. Sampler moves to flowing rinse station where electrode is rinsed again with reagent water.
- f. Sampler moves to first calibration standard position and stirrer is turned on.
- g. 0.45 mL of ISA (10 N NaOH) is added to sample to adjust pH to 11 or greater, ensuring all NH_4 is converted to NH_3 .
- h. Ammonia electrode is allowed to stabilize and reading is recorded.
- i. Steps c. - h. are repeated for remaining calibration standards.
- j. Acceptance criteria: The slope of the curve must range from -55 to -63 mV and the correlation coefficient of the curve must be ≥ 0.995 .

H. Analysis #4530/#13414 - Total Acidity/Prep


1. Manual Calibration:

The pH meter must be calibrated each day before use. Refer to 1-P-QM-PRO-9015421 for manual calibration instructions.

2. Automated Calibration:

The pH meter must be calibrated each day before use. See Section E2. under Calibration section.

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I. Analysis #0475, 0476 - Acidity to pH 3.7 and pH 8.3

1. Manual Calibration:

The pH meter must be calibrated each day before use. Refer to 1-P-QM-PRO-9015421 for manual calibration instructions.

2. Automated Calibration:

The pH meter must be calibrated each day before use. See Section E2. under Calibration section.


Procedure:

I. Manual Procedures:

A. Analysis #12145, Turbidity

1. Turn on the instrument and allow at least ½ hour for warm up.
2. Install the USEPA filter module.
3. Select NTU units by pressing the Units key.
4. Read the Gelex secondary turbidity standards including a stray light standard, as per the instructions in 1-P-QM-PRO-9015423 each day the analysis is performed. Record the values in the maintenance logbook for the Hach 2100AN Turbidimeter.
5. Analyze blank, standard, or sample by filling the sample cell to the line, wipe to remove any water or fingerprints, and apply a thin layer of silicone oil to the sample cell.
6. Place the sample cell in the instrument compartment and close the lid.


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7. Select automatic ranging by pressing the Range key.
8. Enable ratio on by pressing the RATIO key until a green light appears next to the Ratio key.
9. Read and record the results.
10. Dilute the sample with deionized water if the NTU reading is greater than 40 NTU.

B. Analysis #12146, Specific Conductance

1. Turn meter on.
2. Determine cell constant daily, according to 1-P-QM-PRO-9015419.
3. Rinse probe with reagent water and place probe in a reagent water blank sample.
4. Read and record the conductivity value when the meter stabilizes.
5. Repeat steps 3 and 4 with a LCS, check standards, samples and CCV recording the final value for each.
6. If the sample exceeds 12.9 mS/cm, then the appropriate dilution must be made so that the reading falls within the verifiable range of the electrode.

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C. Analysis #12147, Total Hardness

Record data in a raw data logbook following instructions in 1-P-QM-QMA-9021767.

1. Place 50 mL of sample into a 125-mL Erlenmeyer flask, or equivalent (low hardness samples).

NOTE: If greater than 10 mL of EDTA titrant is needed, re-analyze the sample using a smaller aliquot of sample diluted to 50 mL with reagent water.

2. Add **2 mL** of buffer solution to achieve a pH of 10.0 ± 0.1 .
3. Add **1 mL** of Calmagite indicator solution. The solution color changes to wine red indicating the pH is in the range of 10.0 ± 0.1 .
4. Titrate slowly with continuous stirring with standardized EDTA titrant until the last reddish tint disappears. The solution is normally blue at the endpoint. Complete the titration within 5 minutes of adding the buffer.
5. If the endpoint is not sharp, re-analyze the sample. Add approximately 0.66 ± 0.05 g KCN inhibitor per 50 mL of sample **after adding the buffer solution** and follow steps 3 and 4 in the procedure section.


NOTE: Add additional buffer if needed to achieve the pH 10.0 ± 0.1 .

D. Option #1 - Analysis #12707, Alkalinity to pH 8.3 (titrimetric) and Analysis #12150, Alkalinity to pH 4.5 (titrimetric)

Record data in a raw data logbook following instructions in 1-P-QM-QMA-9021767.

1. Calibrate the pH meter each day before use.
2. Analyze a CCV to confirm meter calibration.

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3. Measure 50 mL of well-mixed sample or a smaller portion diluted to 50 mL if the sample matrix dictates. Pour into a beaker containing a stir bar.


The blank is prepared by measuring 140 mL of reagent water. Analyze using the low alkalinity method (Procedure D.11.)

The LCS is prepared by pipetting 1 mL of the 9400 mg/L stock into a 150 mL beaker and diluting to 50 mL with reagent water.

The MS is prepared by adding an appropriate volume of the 9400 mg/L stock to an aliquot of field sample.

NOTE: Although this method is suitable for all concentration ranges of alkalinity, use appropriate aliquots to avoid a titration volume >50 mL.

4. Rinse electrodes with reagent water and gently blot dry with clean tissues between each use.
5. Place beaker on stir plate. Immerse electrode in liquid and gently stir at a constant rate. Do not let the stir bar bump the electrode.
6. **Record pH of sample.** If pH is >8.3, titrate with 0.02 N or 0.1 N sulfuric acid to a pH of 8.30 ± 0.02 . Record the volume of titrant used (analysis 12707).
7. After 8.30 ± 0.02 endpoint is reached, continue titrating to a pH of 4.50 ± 0.02 . Record the total volume of titrant used to reach second endpoint (analysis 12150).
8. When initial pH is ≤ 8.3 , titrate with 0.02 N or 0.1 N sulfuric acid to a pH of 4.50 ± 0.02 . Record the volume of titrant used (analysis 12150).
9. As each endpoint is approached, add smaller amounts of titrant and confirm that pH equilibrium is reached before adding more titrant.

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10. For 50 mL of sample, if the need for a large volume of 0.02 N sulfuric acid titrant is anticipated, analyze the sample using 0.1 N sulfuric acid titrant. Avoid using >50 mL of titrant to reach the pH 4.5 endpoint.

11. For 50 mL of sample, if the total volume of 0.02 N sulfuric acid titrant used to reach the pH 4.5 endpoint is <1 mL (i.e., <20 mg/L total alkalinity), repeat titration using the following steps. **(Low Alkalinity Method)**.
 - a. Measure 140 mL of well-mixed sample.
 - b. Titrate with 0.02 N sulfuric acid to a pH of 4.50 ± 0.02 .
 - c. Record the volume of titrant used in the comment section of the raw data logbook as "A".
 - d. Carefully continue titrating to a pH of 4.20 ± 0.02 .
 - e. Record the total volume of titrant used to reach second endpoint in the comment section as "B".
 - f. Calculate the total alkalinity titrant volume as (2A-B), record this calculated value as the titrant volume in the appropriate column in the raw data logbook and use this same calculated value as the "Total mL of titrant" in the pH to 4.5 alkalinity calculation on page 11.

12. Analyze a CCV after every 10 samples and at the end of a batch to confirm meter calibration.

- E. Option #2: Autotitrator Procedure - Analysis #12707, Alkalinity to pH 8.3 (titrimetric) and Analysis #12150, Alkalinity to pH 4.5 (titrimetric)
 1. The pH meter must be calibrated each day before use.

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2. Before beginning the analysis, flush the dispenser with the appropriate titrant, following the cleaning instructions in 1-P-QM-PRO-9015428.
3. Under “Analyze,” at the “Autosample Standby” prompt, press <YES>.

Display Reads

1: Chan 1 2: Chan 2
3: No Cal

1: Methods
2: Sequences

1: Different
2: Same method

Use method 1?

2 beaker wash?

10 sec wash?

After analysis, keep electrode
in beaker?

Samples = 13?

Start with Beaker 1?

Use Sequence 1 for Beaker 1?

Sample ID # = ?

Begin analysis?

Action

Press < 3 >

Press < 1 or 2>

Press < 1 or 2 >

Enter Method #,
and then press <YES>

Press <YES>

Press <YES>

Press <YES>

Enter number of samples,
and then press <YES>

Press <YES>

Press <YES>


Enter Sample ID #,
and press <YES>

Press <YES>

4. Analyze a CCV to confirm meter calibration using stored *Method #1*.
5. Measure 50 mL of well-mixed sample. Initially, analyze all samples at 50 mL volume on Sequence #2.


The LCS is prepared by pipetting 1 mL of the 9400 mg/L stock to into a 150 mL beaker and diluting to 50 mL with reagent water.

The MS is prepared by adding an appropriate volume of the 9400 mg/L stock to an aliquot of field sample.

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6. Pour into a 150-mL beaker and place in the sample carousel.
7. Using stored Method #1, analyze a CCV after every 10 samples and at the end of a batch to confirm meter calibration.
8. Determine if the sample must be reanalyzed.
 - a. For 50 mL of sample, if the total volume of 0.02 N sulfuric acid titrant used to reach the pH 4.5 endpoint is <1 mL (i.e., <20 mg/L total alkalinity), repeat titration using 140 mL of sample and stored Sequence #1. See Step E.9.
 - b. Any sample using more than 50 mL of 0.02N titrant must be reanalyzed using 0.1N titrant. See Step E.10.
9. Low Alkalinity Sequence
 - a. Measure 140 mL of well-mixed sample.

The blank is analyzed using this sequence. Prepare by measuring 140 ml of reagent water.
 - b. Follow Steps E.3. – E.7. using stored Sequence #1 instead of stored Method #1.
10. 0.1 N Titrant Sequence
 - a. Reprogram the auto titrator Sequence #1. See 1-P-QM-PRO-9015428.
 - b. Analyze a CCV and a check LCS
 - c. Measure 50 mL of well-mixed sample and pour into a 150-mL beaker placed in the sample carousel.

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- d. Analyze samples using Sequence #1.
 - e. Using stored Method #1, analyze a CCV after every 10 samples and at the end of a batch to confirm meter calibration.
11. After completing the analysis, flush the dispenser with reagent water following the cleaning instructions in 1-P-QM-PRO-9015428.

NOTE: The Orion 960 autotitrator system presently has three stored methods for alkalinity and one stored method for pH.

Method #1 – This method is programmed to take the pH of the sample.

Method #2 – This method is programmed for 0.02 N acid titrant and 50 mL of sample and the programmed endpoints are pH 8.3 and 4.5

Method #3 – This method is programmed for 0.1 N acid titrant and 50 mL of sample and the programmed endpoints are 8.3 and 4.5


Method #4 – This method is programmed for 0.02 N acid titrant and 140 mL of sample and the programmed endpoints are pH 4.5 and 4.2

The Orion 960 autotitrator system presently has two stored sequences for alkalinity.

Sequence #1 – This sequence is programmed to run *Method #1* followed by *Method #4*.

Sequence #2 – This sequence is programmed to run *Method #1* followed by *Method #2*.

Sequence #1 can be re-programmed to run *Method #1* followed by *Method #3*, as needed using steps in the manufacturer's instruction manual.

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F. Analysis #12148, 12149, and 1456 Carbonate, Bicarbonate and Hydroxide Alkalinity

Refer to Calculations section

G. Analysis #12151 and 12152, Temperature of pH and pH

1. 40 CFR Part 136 states that water pH is to be analyzed within 15 minutes or less of collection. Samples are analyzed as soon as possible after the sample is received in the laboratory.
2. Place enough sample in a clean beaker to immerse the sensing elements of the electrodes (approximately 30 mL).
3. Rinse and shake off any water on the electrode. Immerse the calibrated electrode in the sample and stir at a constant rate, being careful not to let the stir bar bump the electrode.
4. When the meter has stabilized, obtain the pH reading and temperature of the sample. Record each reading and temperature in the Laboratory Data Notebook.

NOTE: If pH reading is < 4.00 or >10.00, then the pH result will be reported with a qualifying flag.

5. Analyze a CCV after every 10 samples and at the end of the batch.


H. Analysis #12678 and 2200 Fluoride and Distilled Fluoride

NOTE: Analysis 2200 is applicable for the determination of fluoride in liquid and solid samples that have been previously distilled using Analysis #1448.

Analysis #1448 is required for NPDES monitoring prior to analyzing by ISE.

1. Allow samples to equilibrate to room temperature prior to analysis.

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2. Calibrate the meter. See Meter Calibration in Calibration section
3. Pipette sample volumes or measure using a Class A graduated cylinder.
4. Place 20 mL or a suitable portion diluted to 20 mL in a 50-mL plastic beaker.
5. Add 2 mL of TISAB III buffer and place electrodes under the surface of the sample.
6. Begin stirring at a slow, steady rate.


For samples referencing EPA Method 340.2, analyze as in procedural step 5, except begin stirring the sample before the electrodes are inserted.

7. Stir the solution for at least 3 minutes.
8. When the mV reading is stable, record the mV reading.

NOTE: The 3-minute guide is a minimum time limit — record the mV reading when a stable reading is observed. This statement is applicable to mV readings above the limit of quantitation (LOQ) because samples with fluoride concentrations less than the LOQ may have continued slight fluctuation.

9. Withdraw the electrodes and rinse with reagent water.

Gently blot electrodes with clean, dry tissues between readings.

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NOTE: If the mV reading drops below 0.0 (a negative Rel mV reading), immediately withdraw the electrodes from the sample, rinse with reagent water and store electrodes in a reagent blank while a sample dilution is made. Prior to re-analyzing the sample at a higher dilution, analyze a continuing calibration verification (CCV) standard to insure calibration was not lost. If necessary, recalibrate and begin again by analyzing another CCV prior to the sample.


I. Analysis #12677, Ammonia - Nitrogen in Water by Ion-Selective Electrode Method (ISE)

Record data in raw data logbook following instructions in LOM-SOP-LAB-220.

1. Connect ammonia electrode to pH/ISE meter.
2. Place 100 mL aliquot of sample (or a suitable portion diluted to 100-mL with reagent water) into a 150-mL glass beaker.
3. Rinse electrode with reagent water. Immerse electrode into liquid and mix gently with a magnetic stirrer. Stir at a slow, steady rate so air bubbles do not become trapped on the electrode membrane surface. Continue stirring during analysis.
4. Add **1 mL** alkaline reagent to raise pH to above 11. Add the alkaline reagent down the side of the glass beaker (into the sample) very slowly in order to minimize the formation of air bubbles. Document that the pH of the sample is greater than 11 in the raw data logbook.
5. Keep electrode in solution until a stable millivolt reading is obtained.

NOTE: Do not add alkaline reagent before immersing the electrode; it is possible to lose ammonia from a basic solution.

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NOTE: If necessary, allow standards and samples containing ≤ 1 mg $\text{NH}_3\text{-N/L}$ additional time for stabilization.


NOTE: Dilute samples with reagent water if they are more concentrated than the highest standard on the curve.

6. Record the stabilized mV reading of each sample in a raw data logbook and convert the reading to the ammonia concentration using the standard curve.
 7. Dip the electrode into the pH 4.0 buffer solution and then rinse the electrode with reagent water.
- J. Analysis #12679, Ammonia – Nitrogen by Ion-Selective Electrode Method (ISE), Analysis #4219, Ammonia Distillation and Analysis #2593, Un-ionized Ammonia

1. Analysis 4219 Distillation Procedure:

Record data in raw data logbook following instructions in 1-P-QM-QMA-9021767.

- a. Before each distillation, rinse tubes with dilute HCl. Add approximately 500 mL of reagent water to an 800-mL Kjeldahl flask to steam clean the distillation apparatus.
- b. Connect Kjeldahl flask to glass adapter and hose. Turn on the Coolflow. Turn on the temperature control and distill until approximately 150 mL of water is collected in the beaker at the bottom of the setup. Remove distillate from delivery tube immediately after turning off heat source to avoid back wash during the cool-down phase.
- c. Measure 500 mL of sample (or an aliquot diluted to 500 mL with reagent water) using a Class A graduated cylinder. Pour into a beaker and adjust the pH of the sample to 9.5 to 12 with 5N NaOH. Check pH with purchased pH strips, and then add 25 mL of borate buffer solution.


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- d. Transfer the solution to an 800-mL Kjeldahl flask. Add a pinch of boiling chips and approximately 5 mL of antifoam B to the solution. Connect flask to glass adapter and hose. Turn on the Coolflow.
- e. Measure 50 mL of 4% H₂SO₄ solution into a 400-mL beaker. Make sure the delivery tube is below the level of the 4% H₂SO₄ solution (receiving solution).
- f. Begin heating. Collect approximately 220 mL of distillate. Turn off heat and immediately remove the distillate beakers from the delivery tube. Turn off the Coolflow.
- g. Pour the distillate into a 500-mL Class A graduated cylinder and dilute to final volume of 500 mL with reagent water. Store distillate at 0°C - 6°C; not frozen, prior to analyzing
- h. Analyze distillate for NH₃-N according to Analysis #12679 procedure.

2. Analysis 12679 ISE Procedure:

Record data in raw data logbook following instructions in 1-P-QM-QMA-9021767.

- a. Connect ammonia electrode to pH/ISE meter.
- b. Place 100 mL aliquot of sample (or a suitable portion diluted to 100-mL with reagent water) into a 150-mL glass beaker.
- c. Rinse electrode with reagent water. Immerse electrode into liquid and mix gently with a magnetic stirrer. Stir at a slow, steady rate so air bubbles do not become trapped on the electrode membrane surface. Continue stirring during analysis.

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d. Add **1 mL** alkaline reagent to raise pH above 11. Add the alkaline reagent down the side of the glass beaker (into the sample) very slowly in order to minimize the formation of air bubbles. Document that the pH of the sample is above 11 in the raw data logbook.

e. Keep electrode in solution until a stable millivolt reading is obtained.

NOTE: Do not add alkaline reagent before immersing the electrode; ammonia is lost from a basic solution.

NOTE: Standards and samples containing ≤ 1 mg $\text{NH}_3\text{-N/L}$ require extra time for stabilization.


NOTE: Dilute samples with reagent water if they are more concentrated than the highest standard on the curve.

f. Record the stabilized mV reading of each sample in a raw data logbook and convert the reading to the ammonia concentration using the standard curve.

g. Dip the electrode into the pH 4.0 buffer solution and then rinse the electrode with reagent water.

K. Option #1 – Analysis #4530 - Total Acidity

1. Calibrate the pH electrode by following the directions under 1-P-QM-PRO-9015421.
2. Pour 50 mL of the sample into a 150-mL beaker. Read the initial pH of the sample and record the result in the laboratory data notebook.
3. If the pH is above 4.0, add standard sulfuric acid in 5.0-mL increments to lower the pH to 4.0 or less. If initial pH is less than 4.0, addition of sulfuric acid is not required.

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4. Add 5 drops of H₂O₂ (in hood).
5. Heat the sample to boiling and boil for 2 to 4 minutes.
6. Cool the sample to room temperature and titrate with standardized sodium hydroxide to pH 8.3. If more than 50 mL of titrant is used, repeat procedure using less sample.

L. Option #2: Autotitrator Procedure – Analysis #4530 - Total Acidity

This method utilizes the Orion 960 autotitrator system.

1. Calibrate the pH electrode by following the directions under 1-P-QM-PRO-9015421.
2. Place 50 mL of each standard or sample in a 150-mL beaker and place in sample carousel.
3. In order to record the initial pH of the blank, standard, or sample, at the “Autosample Standby” prompt, press <YES>.

<u>Display Reads</u>	<u>Action</u>
1: Chan1 2: Chan2	Press 3
3: No Cal	
1: Methods	Press 1
2: Sequences	
1: Different Methods	Press 2
2: Same Method	
Use Method 1?	Enter Method 1 and press yes
2 beaker wash?	Press yes
10 sec wash?	Press yes
After analysis, keep electrode In beaker?	Press yes
Samples = 13?	Enter # of samples Press yes
Sample ID # = ?	Enter sample # and Press yes
Begin analysis?	Press yes

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4. In order to lower the initial pH of the blank, standard, or sample below a pH of 4.0 or less, repeat the steps above (starting with..."at the autosample standby press <YES>") using standardized H₂SO₄. When prompted to enter a method number, instead of entering method 1 enter method 8.
5. When the cycle is complete remove blank, standard, or sample from carousel and add three drops of hydrogen peroxide. Boil for 2 to 4 minutes. After cooling, bring the pH of the blank, standard or sample to 8.3 using the standardized NaOH and the autotitrator system. Repeat the steps in #3 under Option #2, beginning with pressing <YES> at the autosample standby. When prompted for a method number, enter method 9 instead of method 8.


M. Option #3 – Analysis #13414 Prep (for use with ManTech analysis #4530)

1. Calibrate the pH electrode by following the directions under 1-P-QM-PRO-9015421.
2. Pour 100 mL of the sample into a 150-mL beaker. Read the initial pH of the sample and record the result in the laboratory data notebook.
3. If the pH is above 4.0, add standard sulfuric acid in 5.0-mL increments to lower the pH to 4.0 or less. If initial pH is less than 4.0, addition of sulfuric acid is not required.
4. Add 5 drops of H₂O₂.
5. Heat the sample to boiling and boil for 2 to 4 minutes.
6. Cool the sample to room temperature. Proceed to ManTech Procedure.

N. Option #1, Analysis #0475, 0476 – Acidity to pH 3.7 and pH 8.3

1. Calibrate the pH electrode by following the directions under 1-P-QM-PRO-9015421.

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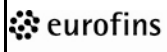
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2. Pour 50 mL of sample into a 100-mL beaker. Read the initial pH of the sample and record the result in the Laboratory Data Notebook.
 3. Titrate to pH 3.7 with 0.02 N NaOH. As endpoint is approached, use smaller additions of titrant and allow electrode to equilibrate between each addition. Record amount of titrant. Titrate to pH 8.3 with 0.02 N NaOH. As endpoint is approached, use smaller additions of titrant and allow electrode to equilibrate between each addition.
 4. Record total amount of titrant. If more than 50 mL of titrant is used, repeat using less sample or a dilution.
- O. Option #2: Autotitrator Procedure – Analysis #0475, 0476 – Acidity to pH 3.7 and pH 8.3

This method utilizes the Orion 960 autotitrator system.

1. Calibrate the pH electrode by following the directions under 1-P-QM-PRO-9015421.
2. Place 50 mL of each standard or sample in a 150-mL beaker and place in sample carousel.
3. At the “Autosample Standby” prompt, press <YES>.

<u>Display Reads</u>	<u>Action</u>
1: Chan 1 2: Chan2 3: No Cal	Press 3
1: Methods 2: Sequences	Press 2
Use Sequence 1?	Enter Sequence 3 and press YES
2 beaker wash?	Press YES
10 sec wash?	Press YES
After analysis, keep electrode in beaker?	Press YES
Samples = 13?	Enter number of samples and press YES
Sample ID # = ?	Enter sample # and press YES
Begin analysis?	Press YES

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4. If more than 50 mL of titrant is used, repeat using less sample.

II. ManTech Procedure (automated method):

- A. Introduction to the procedure for the operation of the ManTech Multi-purpose instrument.

The instrument is equipped with systems to analyze for pH, temperature of pH, alkalinity, conductivity, turbidity, fluoride, ammonia and total hardness. The methods for each procedure is pre programmed and the analyst will not need to make any adjustments.

Each test can be performed individually or in tandem with others. The analyst will determine the combination of analyses for each run. Before operating the instruments, the analyst must ensure that all required reagents needed for each test is in adequate supply and are not expired.


To operate the instrument, open the PC-titrate software menu from the computer desktop.

Each day before any analysis is performed; the daily calibration associated with each analysis must be completed and evaluated to ensure that the acceptance criteria are met. (See the calibration section for the required concentrations and acceptance criteria for each calibration). Daily calibration schedules are created and saved. If a specific analysis is not being performed that day, the calibration can be removed from the schedule for that day.

- B. Performing daily calibration:

Open the daily start up tab and load the standards according to the schedule for each calibration. Click on the start button and the instrument will proceed with the calibration. Once the calibration is complete the calibration data is automatically sent to the assign printer and is printed. Ensure the calibration data meets requirements before proceeding. See the calibration section for the required concentrations and acceptance criteria for each calibration.

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C. Analyzing samples:

NOTE: Prior to starting the ManTech system, make sure all required reagent containers and reagent water containers have sufficient sample volume.

NOTE: Before analyzing for analysis 2200, add 1 mL of 15% of Sodium Acetate to all standards (including the curve), samples, and Blank.


NOTE: Before analyzing for analysis 4530, samples need to be prepared following steps outlined under Manual Procedure M; analysis #13414.

To analyze samples, select “Run titration” from the PC-titrate menu. A blank schedule will appear.

1. Click on the add row buttons to add the required number of rows for that run.
2. Double click on the blank space under the schedule header. The menu of analyses will appear. Select the analyses to be preformed and click ok.
3. When completing the schedule, each analysis must be bracketed by its own CCV of alternating concentrations and a CCB (see QA section). The CCV's and CCB's ID's are pre-programmed and are to be scanned in from the charts provided at each instrument. Barcodes are provided for each CCV and CCB. See Table I.
4. The LCS for each analysis is pre-programmed and is to be scanned in from the charts provided at each instrument. See Table I.
5. Sample numbers can be typed in; however each instrument is equipped with a scanner which is used to scan the sample numbers directly from the label of the container (scan barcodes on label).

The batch information for each Method Blank, LCS, CCV, CCB and samples must be completed using the example below:

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Sample/ bottle code is scanned in and then a ";" followed by the batch designation "1a" followed by a ";" and then "u","d","r", or "m" for the QC Type (u-background, d-duplicate, r-matrix spike, m-matrix spike duplicate). .

For example, for a background QC sample having a sample number of 6515514 and a bottle code of 005A the correct batch information would be:
6515514005A;1a;u


If a sample is analyzed at a dilution the dilution factor is then entered at the very end of the batch information with a ";" placed before it.

For example: If the same sample as used above was analyzed at a 10X dilution then the batch information for that sample would be entered as:
6515514005A;1a;u;10

6. Fill the sample tube with Method Blank, LCS, each CCV, CCB and samples. Ensure the sample tubes are loaded according to the order on the schedule.
7. Click on the auto-generate order number to add the order number to the schedule.
8. Once the schedule is completed, click start and the instrument will proceed with the analysis until the entire schedule of samples is complete.
9. The data is saved automatically and sent to the PC –Titrate export file before it is imported to the LIMS system.

D. Routine Maintenance of ManTech multi-parameter system

1. Calibration of TitrasiPumps: Flow Rate Check:
 - a. Manual Control of Autosampler

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- (1) From the PC-Titrate main menu, click on Titrator, then on Manual Control (autosampler tab)
- (2) Next, click on Load Tray From Folder button and then double click on Automax 197 Tube Sampler file
- (3) Then, under Zone select tubes. Under Tubes select tube position and place a tube in that position on the autosampler tray.
- (4) Click on Home Sampler
- (5) Click on Go To This Location XYZ button. The autosampler will then move to the tube position.
- (6) Click OK button in order to get back to the PC-Titrate main menu

b. Flow Rate Check:

- (1) From the PC-Titrate menu select the pump to be calibrated (Click on Pump Cal button) and follow the prompts.
- (2) Calibration must be performed monthly and documented in the maintenance logbook.


NOTE: When completed, Home sampler (follow instructions under II. ManTech Procedure D1a. steps 1-4)

2. Calibration of Zero and Span for the Hardness detector:

NOTE: Turn on Hardness Detector in order for the detector to warm up before calibration.

NOTE: Ensure reagent water is in titration vessel cup containing the photo cell

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a. Accessing Zero and Span Check screen and set-up:


- (1) From the PC-Titrate main menu, click on Titrator, then on Manual Control
- (2) Click on Analog
- (3) Click on Scan Analog, making sure the continuous button is checked
- (4) The Hardness Detector is on Monitor Electrode # 4

b. Zero Check/Calibration:

- (1) Unscrew the Zero (careful not to look directly into the bright light). The Zero must be as close as possible to 0 mV.
- (2) If not, adjust the screw for Zero on the hardness detector until reading is as close as possible to 0 mV.
- (3) Check/Calibration must be performed monthly and documented in the maintenance logbook.

c. Span Check/Calibration:

- (1) The Span reading must be $-400 \text{ mV} \pm 25 \text{ mV}$.
- (2) If not, adjust the screw for Span on the hardness detector until reading is within range.
- (3) Check/Calibration must be performed monthly and documented in the maintenance logbook.

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3. Changing and Entering Acid Normalities on ManTech :


a. Changing Titrant –Purging titrant:

NOTE: Disconnect acid titrant bottle from dispenser line

- (1) Click on PC-Titrate, Titrator, Manual Control, Serial Devices
- (2) Click on Burivar II TIS1 tab; Titrasiip pump#1/Burette #1
- (3) Purge Buret one time (empty cup-use manual button on side of pump #1 at the top of cup)
- (4) Fill titrant bottle with new standardized 0.02N H₂SO₄ titrant and connect dispenser line to bottle
- (5) Purge system two more times
- (6) Click OK

b. Entering Acid Normalities:

- (1) Click on PC-Titrate, Set-up, Titration Method, Load
- (2) Click Alkalinity
- (3) Under Titrant Information-Concentration, change Normality to current value.
- (4) Click Save
- (5) Click Alkalinity-Low and follow steps above

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E. Maintenance of all other systems:

1. Maintenance of the Ammonia Ion-Selective Electrode – See manufactures instruction manual for maintenance and operation of electrode
2. Maintenance of pH electrodes- refer to 1-P-QM-PRO-9015421 for maintenance of pH electrodes
3. Perform Maintenance on all other systems as needed.

F. Retrieving Historical Raw Data on ManTech :

1. Find run number of sample in question- Go into sample number in Parallax; copy and paste run number
2. Open PC-titrate software menu from computer desktop
3. Click on Titrator, Replay Titration, Load, Sort by order and sample name
4. Click on sample (go by time), Select, Print, Equation Result Report (rplyeqn.srw), Print.

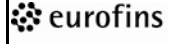
Calculations:

- A. Fluoride, pH, Temperature of pH, Conductivity, Turbidity and Ammonia are measured directly and therefore no calculations are needed.
- B. Alkalinity:

To pH of 8.3:

$$\text{Alkalinity, mg/L CaCO}_3 = (\text{mL of titrant (pH 8.3)} \times \text{Normality} \times 50,000) / \text{mL of sample}$$

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To pH of 4.5:

Alkalinity, mg/L CaCO₃ = (Total mL of titrant x Normality x 50,000)/ mL of sample

- C. Carbonate, Bicarbonate, and Hydroxide Alkalinity are direct calculations from the total alkalinity result.

The computer chooses the appropriate calculation from the # 12707 and # 12150 alkalinity data:

Analysis #12149:

If 12707 result is < MDL	Bicarbonate = 12150 result
If 12707 result is < 1/2 of 12150 result	Bicarbonate = 12150 result - (2 x 12707 result)
If 12707 result is = 1/2 of 12150 result	Bicarbonate = < MDL
If 12707 result is > 1/2 of 12150 result	Bicarbonate = < MDL
If 12707 result is = 12150 result	Bicarbonate = < MDL

Analysis #12148:


If 12707 result is < MDL	Carbonate = < MDL
If 12707 result is < % of 12150 result	Carbonate = 2 x 12707 result
If 12707 result is = % of 12150 result	Carbonate = 2 x 12707 result
If 12707 result is > % of 12150 result	Carbonate = 2 x (12150 result - 12707 result)
If 12707 result is = 12150 result	Carbonate = < MDL

Analysis #1456:

If 12707 result is < MDL	Hydroxide = < MDL
If 12707 result is < % of 12150 result	Hydroxide = < MDL
If 12707 result is = % of 12150 result	Hydroxide = < MDL
If 12707 result is > % of 12150 result	Hydroxide = (2 x 12707 result) - 12150 result
If 12707 result is = 12150 result	Hydroxide = 12150 result

- D. Free Carbon Dioxide Calculation (analysis #238)

The calculation assumes that the total alkalinity of the sample is due almost entirely to hydroxides, carbonates or bicarbonates.

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The total dissolved solids of the sample may not be greater than 500 mg/L for this calculation.

$$mg/L CO_2 = 2.0 \times B \times 10^{(6-pH)}$$

Where:

B = bicarbonate alkalinity (from analysis #12149)

NOTE: Total carbon dioxide can be calculated, if requested, according to the calculations found in Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 4500 CO₂ D-1997.

E. Total Hardness:

$$Hardness (mg/L as CaCO_3) = [(mL EDTA used \times 1000) / mL of sample] \times EDTA Constant$$

F. Analysis #2593 Un-ionized Ammonia Calculation:

$$mg \text{ un-ionized ammonia/L} = (ammonia \text{ nitrogen } (6914) \text{ raw result mg/L}) \times (\% \text{ un-ionized ammonia at a given pH and temperature})$$

Refer to table below for % un-ionized ammonia:

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Table 8010: VI.
Percentage of Ammonia Un-ionized in Distilled Water*

Temp °C	<u>Percentage Un-ionized at a given pH*</u>								
	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
5	0.01	0.04	0.11	0.40	1.1	3.6	10	27	54
10	0.02	0.06	0.18	0.57	1.8	5.4	15	36	64
15	0.03	0.08	0.26	0.83	2.6	7.7	21	45	72
20	0.04	0.12	0.37	1.2	3.7	11	28	55	80
25	0.05	0.17	0.51	1.7	5.1	14	35	63	84
30	0.07	0.23	0.70	2.3	7.0	19	43	70	88

*Prepared from data given in Sillen and Martell.

G. Analysis #4530 - Total Acidity

$$\text{Acidity as mg / mL CaCO}_3 = \frac{[(A \times B) - (C \times D)] \times 50,000}{\text{mL of sample}}$$

Where:

A = Vol. of std. NaOH used in titration


B = Normality of std. NaOH

C = Vol. of std. H₂SO₄ used to reduce pH to less than 4

D = Normality of std. H₂SO₄

H. Analysis #0475, 0476 – Acidity to pH 3.7 and pH 8.3

$$\text{mg/L as CaCO}_3 = \frac{\text{Normality} \times 50,000 \times \text{mL of titrant}}{\text{sample volume, mL}}$$

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Statistical Information/Method Performance:

The method detection limit (MDL) is determined annually by following the procedure outlined in 1-P-QM-QMA-9017309.

The quality control acceptance windows are generated annually by following the procedure outlined in 1-P-QM-QMA-9017313.

Quality Assurance/Quality Control:

The batch size is limited to 20 samples or less. For analyses with more than 10 samples on a batch, two duplicates are needed (excluding ammonia and fluoride – only one duplicate is needed per batch 20 samples –unless a batch contains an NPDES sample(s) from South Carolina and the batch contains more than 10 samples, then two duplicates are needed.).

A Laboratory Control Standard (LCS) must be analyzed for each analysis. See Table I for each analysis LCS concentration.


For alkalinity, Total Acidity and total hardness one matrix spike (MS) must be analyzed per batch of 20 samples or less.

For ammonia, fluoride and Acidity to pH 3.7 and 8.3 (total acidity spikes only), a matrix spike (MS) and a matrix spike duplicate (MSD) must be analyzed per batch of 20 samples or less.

When sample volume does not permit the analysis of either a sample matrix duplicate or an MS and MSD, then a LCSD must be analyzed to demonstrate method precision.

Samples from West Virginia require a usable precision measurement for each batch. Analyzing one of the following on a batch containing a West Virginia sample fulfills this requirement: an MS/MSD, a non-program deleted duplicate, or an LCSD.

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For Specific Conductance, if the batch contains samples from the state of North Carolina a low-level check standard of 5 umhos/cm NaCl must be analyzed.

For Total Hardness, samples that are designated NPDES require digestion. Confirm whether this analysis is appropriate for samples designated NPDES.

For each analysis, a continuing calibration verification (CCV) standard must be analyzed at the beginning of each batch, after every 10 samples and at the end of each batch. The concentration of the CCV must alternate in a repeating wave pattern. All CCVs have an acceptance criteria of 90% to 110%. If any CCV's are outside this range, then the samples bracketed by the out of specification CCV must be repeated. Refer to Table I for CCV concentrations for each analysis.

A continuing calibration verification blank (CCB – a reagent water blank) must be analyzed after each CCV standard on the batch. The CCB must be less than the LOQ for the analysis.

See LIMS for current quality control (QC) acceptance windows. Follow guidelines in 1-P-QM-PRO-9015535 for outlier QC data.

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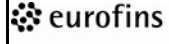
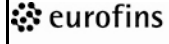
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Table I

Analysis Name and Number	CCV Barcodes/Concentrations
Total Alkalinity (12150) Carbonate (12148) Bicarbonate (12149)	CCVPH2 = 7.00 pH buffer LCSAK = 188 mg/L LCSPH = 7.00 pH buffer PBW = Method Blank CCB = reagent water blank
Total Acidity (4530)	CCVPH8 = 8.00 pH buffer LCSTACD = 500 mg/L PBW = Method Blank CCB = reagent water blank
Acidity to pH 3.7 and pH 8.3 (0475, 0476)	CCVPH8 = 8.00 pH buffer LCSACD = 250 mg/L PBW = Method Blank CCB = reagent water blank
pH (12152) Temperature of pH (12151)	CCVPH2 = 7.00 pH buffer LCSPH = 7.00 pH buffer CCB = reagent water blank
Specific Conductance (12146)	CCVSC1 = 147 uhoms/cm CCVSC2 = 1413 umhos/cm CCVSC3 = 12,900 umhos/cm LCSSC = 147 umhos/cm PBW = Method Blank CCB = reagent water blank
Fluoride (12678)	CCVFL1 = 0.5 mg/L CCVFL2 = 1.0 mg/L CCVFL3 = 1.5 mg/L LCSFL = 1.0 mg/L PBW = Method Blank CCB = reagent water blank
Turbidity (12145)	CCVTB1 = 10 NTU CCVTB2 = 20 NTU CCVTB3 = 30 NTU LCSTB = 10 NTU PBW = Method Blank CCB = reagent water blank
Ammonia (12677) Distilled Ammonia (12679)	CCVNH1 = 1.0 mg/L CCVNH2 = 2.5 mg/L CCVNH3 = 7.5 mg/L LCSNH = 5 mg/L PBWNH = Method Blank (12679-distilled) PBW = Method Blank (12677) CCB = reagent water blank
Total Hardness (12147)	CCVTH1 = 20 mg/L CCVTH2 = 40 mg/L CCVTH3 = 60 mg/L LCSTH = 40 mg/L PBWTH = Method Blank CCB = reagent water blank

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Effective Date	Jun 12, 2015	Status	Effective
Historical/Local Document Number	Analysis 12145, 12146, 12147, 12148, 12149, 12150, 12151, 12152, 12677, 12678, 12679		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

Prepared by	Michele Graham
Reviewed and Approved by	Erik Frederiksen;Review;Wednesday, June 10, 2015 12:31:41 PM EDT Barbara Reedy;Approval;Wednesday, June 10, 2015 2:05:08 PM EDT




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Revision Log:

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Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Reagents and Standards	Clarify and reflect current procedure	Added 10 mg/L fluoride working standard Added 4000 NTU for value of Turbidity Standard Added different source needed for Turbidity standard for curve and LCS/CCVs	
Calibration A.1 and A.2	Clarify and reflect current procedure	Added to refer to 1-P-QM-PRO-9015423 for preparation instructions for turbidity curve standards. Added different source needed for Turbidity standard for curve and LCS/CCVs	

Revision: 7		Effective Date:	Nov 17, 2014
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Throughout entire document	Updated procedure to include additional analyses	Added analyses 4530/13414 and 0475,0476 to SOP	

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Reference:

1. Analysis 12145-Turbidity


- a. Method 180.1 (1993), Methods for Chemical Analysis of Water and Wastes USEPA 600.
- b. Method 180.1, Methods for Chemical Analysis of Water and Wastes USEPA 600.
- c. Standard Methods for the Examination of Water and Wastewater, 21st Edition, 2005, Method 2130 B-2001.

2. Analysis 12146-Specific Conductance

- a. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 2510 B-1997
- b. Method 120.1, Methods for Chemical Analysis of Water and Wastes USEPA 600.
- c. Test Methods for Evaluating Solid Wastes, SW-846 Method 9050A, December 1996.

3. Analysis 12147-Total Hardness

- a. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 2340 C-1997
- b. Method 130.2 (modified), Methods for Chemical Analysis of Water and Wastes USEPA 600.

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4. Analysis 12148-Carbonate Alkalinity

Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 2320 B-1997

5. Analysis 12149-Bicarbonate Alkalinity

Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 2320 B-1997

6. Analysis 12150-Alkalinity

- a. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 2320 B-1997
- b. Method 310.1, Methods for Chemical Analysis of Water and Wastes USEPA 600.


7. Analysis 12151-Temperature of pH

Temperature EPA 170.1 Methods for Chemical Analysis of Water and Wastes USEPA 600.

8. Analysis 12152-pH

- a. Standard Methods for the Examination of Water and Wastewater, 21st Edition, 2005, Method 4500 H/B-2000
- b. Method 150.1, Methods for Chemical Analysis of Water and Wastes USEPA 600.
- c. Test Methods for Evaluating Solid Wastes, SW-846 Method 9040B.
- d. Test Methods for Evaluating Solid Wastes, SW-846 Method 9040C.

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9. Analysis 12677-Ammonia-Nitrogen

- a. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 4500 NH₃ D-1997
- b. Method 350.3, Methods for Chemical Analysis of Water and Wastes USEPA 600.

10. Analysis 12678-Fluoride


- a. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 4500-F C-1997
- b. Method 340.2, Methods for Chemical Analysis of Water and Wastes USEPA 600.

11. Analysis 12679-Ammonia-Nitrogen Distilled

- a. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 4500 NH₃ D-1997
- b. Method 350.3, Methods for Chemical Analysis of Water and Wastes USEPA 600.

12. Analysis 12707-Phenolphthalein Alkalinity

- a. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 2320 B-1997
- b. Method 310.1, Methods for Chemical Analysis of Water and Wastes USEPA 600.

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13. Analysis 4219-Ammonia Distillation

Standard Methods for the Examination of Water and Wastewater, 20th
Edition, 1998, Method 4500 NH₃ B-1997

14. Analysis 2593-Unionized Ammonia

Standard Methods for the Examination of Water and Wastewater, 20th
Editions, 8010 F-1997

15. Analysis 238-Free Carbon Dioxide


Standard Methods for the Examination of Water and Wastewater, 20th
Edition, 1998, Method 4500-CO₂ D-1997

16. Analysis 1456-Hydroxide Alkalinity

Standard Methods for the Examination of Water and Wastewater, 20th
Edition, 1998, Method 2320 B-1997

17. Analysis 2200-Fluoride (Distilled)

- a. Standard Methods for the Examination of Water and Wastewater, 20th
Edition, 1998, Method 4500-F C
- b. Method 340.2, Methods for Chemical Analysis of Water and Wastes
USEPA 600.
- c. Test Methods for Evaluating Solid Wastes, SW-846 Method 9214,
December 1996.

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18. Analysis 4530-Total Acidity

- a. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 2310 B-1997.
- b. Method 305.1, Methods for Chemical Analysis of Water and Wastes USEPA 600.

19. Analysis #0475, 0476 – Acidity to pH 3.7 and pH 8.3 (Titrimetric)

- a. Method 305.2, Methods for Chemical Analysis of Water and Wastes USEPA 600.
- b. Orion 960 Autochemistry System Instruction Manual, Orion Research, 1991.


20. ManTech Associates, Inc. PC-Titration Plus Instruction and Operation manual, January 25 2000.

21. *Chemical Hygiene Plan*, current version.

Cross Reference:

Document	Document Title
Analysis #1448	Bellack Distillation for Fluoride in Waters and Solids by SM 4500 F B–1997 or EPA 340.1 Procedure 6.1
1-P-QM-PRO-9015419	Accumet Model AB30 pH/Ion/Conductivity Meters
1-P-QM-PRO-9015421	pH Probes and Meters
1-P-QM-PRO-9015423	Calibration of Hach 2100AN Turbidimeter
1-P-QM-PRO-9015425	Fixed Volume Hand-Held Pipettes
1-P-QM-PRO-9015426	Adjustable Volume Handheld Pipettes
1-P-QM-PRO-9015428	Orion 960 Autotitration System
1-P-QM-PRO-9015530	Standardization of 0.02 and 0.1 Normal Sulfuric Acid
1-P-QM-PRO-9015535	Quality Control Data for Wet Chemistry
1-P-QM-QMA-9015389	Balance, Syringe, Pipette Verification
1-P-QM-QMA-9017309	Determining Method Detection Limits and Limits of Quantitation
1-P-QM-QMA-9017313	Establishing Control Limits
1-P-QM-QMA-9017328	Reagents and Standards
1-P-QM-QMA-9021767	Laboratory Notebooks, Logbooks, and Documentation for Environmental Testing

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Scope:

This SOP covers two options for analyzing samples for certain analytes (see table below for complete list). Option one is listed as a manual method and option two is listed as an automated method.


The automated method uses an instrument called the ManTech multi-parameter system. The manual method and the ManTech multi-parameter system (automated) method are used for the determination of the following analytes (see table below) in drinking waters, surface waters, and wastewater samples.

The table below lists the name and number of the analyses that are included in this SOP and the method references associated with each.

Table of Analyses and Reference Methods

Analysis Name and Number	Analysis Method
Turbidity, 12145	EPA 180.1 (1993) EPA 180.1
Specific Conductance, 12146	SM 2510B-1997, EPA 120.1, SW-846 9050A
Total Hardness, 12147	SM 2340C-1997, EPA 130.2 modified
Carbonate Alkalinity, 12148	SM 2320B-1997
Bicarbonate Alkalinity, 12149	SM 2320B-1997
Total Alkalinity, 12150	SM 2320B-1997, EPA 310.1
Temperature of pH, 12151	EPA 170.1
pH, 12152	SM 4500-H+B-2000, EPA 150.1, SW-846 9040B, SW-846 9040C
Ammonia-Nitrogen, 12677	SM 4500-NH3D-1997, EPA 350.3
Fluoride, 12678	SM 4500-F C-1997, EPA 340.2
Ammonia-Nitrogen Distilled, 12679	SM 4500-NH3D-1997, EPA 350.3
Phenolphthalein Alkalinity 12707	SM 2320B-1997, EPA 310.1

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Analysis Name and Number	Analysis Method
Ammonia Distillation, 04219	SM 4500-NH3 B-1997
Unionized Ammonia, 02593	SM 8010 F-1997
Free Carbon Dioxide, 00238	SM 4500-CO2 D-1997
Hydroxide Alkalinity, 01456	SM 2320 B-1997
Fluoride (distilled), 02200	SM 4500-F C-1997, EPA 340.2, SW-846 9214
Total Acidity, 04530	SM 2310-B-1997, EPA 305.1
Acidity to pH 3.7 and pH 8.3 (titrimetric)	EPA 305.2

Basic Principles:


If necessary, samples can be analyzed using a manual method.

Samples are analyzed using the ManTech multi-parameter system, which has been designed to test for specific analytes. The system is able to be configured in different ways to optimize sample volumes required, and analysis times. The ManTech system is able to analyze for one parameter or multi-parameters at the same time.

Reference Modifications:

The following analyses have reference modifications:

1. Analysis #12147-Total Hardness:
 - a. The procedures listed in SM 2340C and Method 130.2 are modified by using potassium cyanide (KCN) as the inhibitor instead of sodium cyanide (NaCN).
 - b. SM2340C and EPA 130.2 state to dilute 25 mL of sample to 50 mL with reagent water prior to titration. This procedure uses 50 mL sample.

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2. Analysis #12152 –pH

EPA 150.1 states to repeat measurement on successive volumes of sample until values differ by less than 0.1 pH units. However, SM 4500 H+ B does not require multiple readings.

3. Analysis #12678, 2200 – Fluoride and Distilled Fluoride

- a. The differences between SM 4500-F- C and EPA 340.2 are that SM 4500-F-C states that the electrodes are inserted before stirring the sample. For EPA 340.2 begin stirring the sample before the electrodes are inserted.
- b. This method uses less buffer than suggested by the manufacturer. The concentration ratio of sample to total ionic strength adjustment buffer (TISAB) is the same as EPA Method 340.2.

4. Analysis #12677, 12679– Ammonia-Nitrogen and Distilled Ammonia-Nitrogen


Instead of using NaOH in order to pH adjust the samples during the 12677 and 12679 ammonia analysis, this procedure uses alkaline reagent. Alkaline reagent is a purchased reagent containing NaOH that is currently recommended by the manufacturer of the ammonia electrode.

Interferences:

Sample matrix is likely to be the largest cause of interference for each analysis.

Samples containing oily layers, soaps, suspended solids, or precipitates may impede the electrode response. The electrode must be cleaned according to the manufacturer's instructions.

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Total Hardness – excessive amounts of heavy metals can interfere, causing a faded or indistinct endpoint by the stoichiometric consumption of EDTA. If this interference is not resolved after multiple dilutions on the ManTech automated procedure, then the sample must be analyzed using the manual procedure. See SM 2340C for more discussion on interferences and how to treat them.

Turbidity – the presence of floating debris and coarse sediments, which settle out rapidly, will give low turbidity readings. Finely divided air bubbles will affect the results in a positive manner.

Ammonia Nitrogen – volatile amines are a positive interference. Mercury and Silver also interfere with this procedure. Electrode responds slowly at levels <1 mg NH₃-N/L; use longer electrode immersion times.

Fluoride – several polyvalent cations, notably aluminum, iron and silicon interfere by forming complexes with fluoride. Adding TISABIII provides a uniform ionic strength background, adjusts pH and breaks up complexes so that the fluoride ion activity can be measured. Fluoborates are widely used in industrial processes. At concentrated levels, as in electroplating wastes, fluoborates do not hydrolyze to release fluoride without using the Bellack distillation (Analysis #1448) prior to analyzing the sample distillate by ISE.

Safety Precautions and Waste Handling:


All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability.

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Analysts are considered proficient when they have successfully completed a documented Demonstration of Capability. This consists of four laboratory control samples that are carried through all steps of the analysis and that meet the acceptance criteria for the LCS. Demonstration of Capability is performed annually and documentation is in each individual's training records.

Sample Collection, Preservation, and Handling:

Samples for pH, Temperature of pH, Specific Conductance, Turbidity, Fluoride, Total Alkalinity, Total Acidity, and Acidity to pH 3.7 and pH 8.3 are to be collected in unpreserved glass or plastic containers. Analyze Total Alkalinity, Total Acidity, and Acidity to pH 3.7 and pH 8.3 within 14 days of collection. Analyze Fluoride within 28 days of collection. All other analyses mentioned above are to be analyzed as soon as possible upon receipt at the laboratory.

Samples for Ammonia must be collected in a glass container, preserved with concentrated sulfuric acid to a pH < 2. Analyze within 28 days of collection.


Samples for Total Hardness must be collected in a glass or plastic container, preserved with nitric acid to a pH < 2. Analyze within 6 months of collection.

All samples must be stored at 0° to 6°C, not frozen. Prior to analysis, samples must be brought to room temperature.

Apparatus and Equipment:

1. pH Electrode
2. Fluoride ion selective electrode
3. Interface
4. Burivar I/2 (25 mL burette)

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5. TitraRinse pump
6. TitraRinse slow speed reagent addition pump
7. Turbidity meter – white light turbidity meter option
8. Reversible Peri-Max pump
9. Man-Tech photometric detector with a 620nm filter
10. Conductivity/TDS Meter, Model 4510
11. Ammonia electrode
12. Autosampler - MEGA, 197 sample locations
13. Analytical balance or equivalent. Refer to 1-P-QM-QMA-9015389

For Manual Methods:


A. Analysis #4219 Distillation Apparatus and Equipment

1. Kjeldahl distillation rack
2. Refrigerated recirculator (Coolflow) with a recirculating pressure set at 20 psi and the temperature adjustment set at 10°C, or equivalent.

*Each distillation setup requires the following

3. Glass distillation apparatus with connector and 800 mL Kjeldahl flask
4. pH indicator strips, purchased
5. Porous boiling chips, purchased

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B. Analysis #12677, 12679 ISE Apparatus and Equipment:

1. Analytical balance, or equivalent. Refer to 1-P-QM-QMA-9015389
2. pH meter with expanded millivolt scale, or equivalent
3. Ammonia selective electrode (Thermo Orion 95-12) or equivalent
4. Stir plate with magnetic stirrer with Teflon-coated stirring bar, or equivalent
5. 100-mL class A graduated cylinder, or equivalent
6. Automatic pipette capable of dispensing 1 mL of liquid, or equivalent. Refer to 1-P-QM-PRO-9015425 and 1-P-QM-PRO-9015426


C. Analysis #12147-Total Hardness

1. Class A buret with buret stand, or equivalent
2. 125-mL Erlenmeyer flasks, or equivalent
3. Analytical balance or pan balance, or equivalent. Refer to 1-P-QM-QMA-9015389.
4. Adjustable hand-held automatic pipette, or equivalent. Refer to 1-P-QM-PRO-9015426

D. Analysis #12146-Specific Conductance

Conductivity meter (Accumet Model AB30)

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E. Analysis #12150, 12707 - Alkalinity

1. pH meter that reads to 0.05 pH units, with automatic temperature compensation and a glass electrode or equivalent. Refer to 1-P-QM-PRO-9015421.
2. Orion 960 Autotitration System or equivalent. Refer to 1-P-QM-PRO-9015428. (Automated Procedure only).
3. Microburet with reservoir or equivalent (Manual Procedure only).
4. Analytical balance, or pan balance, or equivalent.


F. Analysis #12678, #2200 –Fluoride and Distilled Fluoride

1. pH meter with expanded millivolt scale, or equivalent. Refer to pH meter manufacturer's Instruction Manual.
2. Fluoride electrode (Orion 94-09-00), or equivalent

If the fluoride electrode's performance degrades, consult the manufacturer's *User Guide* for cleaning and maintenance instructions. If performance does not improve after cleaning, then the electrode must be replaced.

The expected lifespan of a fluoride electrode is 3 years. Refer to the electrode's identification tag for in-service date.

3. Reference electrode (Ag/AgCl), or equivalent
4. Stir plate with magnetic stirrer
5. Timer
6. Class A graduated cylinder, or equivalent

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7. Analytical balance, or equivalent.
8. Assorted automatic pipettes, or equivalent. Refer to 1-P-QM-PRO-9015425 and 1-P-QM-PRO-9015426

G. Analysis #12152-pH

1. pH meter with automated temperature compensator (ATC) probe
2. Combination electrodes or equivalent
3. Stir bar and stir plate


H. Analysis #12145-Turbidity

1. Turbidimeter – Hach Model 2100AN or equivalent
2. Silicone oil and oiling cloth
3. Sample tubes, clear colorless glass

I. Analysis #4530/#13414 -Total Acidity/Prep

1. pH meter that uses a glass electrode and reads to .05 pH units
2. Magnetic stir bar and stir plate
3. Hot plate
4. 150-mL glass beakers and plastic cups
5. 10-mL microburet with reservoir
6. Analytical balance capable of weighing to .0001g

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7. Orion 960 Autotitrator system

J. Analysis #0475,0476 – Acidity to pH 3.7 and pH 8.3

1. pH meter that uses a glass electrode and is able to be read to 0.05 pH units. If automatic temperature compensation is not provided, make titration at 25° ±2°C.
2. Magnetic stirrer and stir plate
3. 100, 150 and 250-mL beakers
4. 10-mL microburet
5. Analytical balance capable of weighing to .0001 g. Refer to 1-P-QM-QMA-9017363
6. Orion 960 autotitration system


Reagents and Standards:

Alternative weights and volumes are acceptable as long as final concentrations remain the same. Refer to 1-P-QM-QMA-9017328 for proper labeling and documentation of reagent preparations.

A. Reagents and Standards needed for Manual and ManTech methods

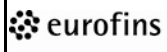
1. Sulfuric acid, 0.02 N
 - a. Dilute 0.6 mL of concentrated sulfuric acid to 1000 mL with reagent water.
 - b. Store at room temperature in glass or plastic container and re-evaluate yearly.

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- c. Standardize according to 1-P-QM-PRO-9015530.
 - d. Re-standardize titrant before use if more than 30 days have passed since the last standardization date.
 2. Total alkalinity standard (9400 mg/L as CaCO₃)
 - a. Dry sodium carbonate (Na₂CO₃) for at least 4 hours at approximately 250°C.
 - b. Desiccate approximately 2 hours.
 - c. Dissolve 9.954g ± 0.002g Na₂CO₃ in reagent water and dilute to 1000 mL in a volumetric flask.
 - d. Stable 3 months.
 - e. Store in a glass container at 0° to 6°C, not frozen.
 - f. Dilute for other concentrations.
 3. pH 4, 7, and 10 buffer solutions- purchased; see container for shelf life information.
- NOTE: A second source 7.00 pH buffer solution that is from ISO 17025 approved vendor must be purchased; see container for shelf life information. This is to be used for analysis 12152 LCS. It is also to be used for analysis 12152 and 12150 CCV's.**
4. Turbidity standard; 4000 NTU – purchased; see container for shelf life information.

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NOTE: The Turbidity standard used to prepare the calibration curve must be prepared using a **different source Primary Formazin Standard than that used for LCS/CCVs.**

5. Total Ionic Strength Adjustment Buffer (TISAB) –purchased; see container for shelf life information.
6. 10N Sodium hydroxide (NaOH) - Purchased; see shelf life for information. Or prepare:
 - a. Prepared - Dissolve 400 g NaOH pellets in 1000 mL volumetric flask containing approximately 800 mL reagent water. Solution becomes very warm.
 - b. Cool to room temperature and dilute to 1000 mL with reagent water.
 - c. Store at room temperature in plastic or glass container and re-evaluate yearly.
7. 0.1 M KCl (12,900 $\mu\text{ohms/cm}$)
 - a. In a 1 L glass volumetric flask, dissolve $7.4555 \pm .0001$ g predried KCl (2 hours at $105^\circ \pm 2^\circ\text{C}$) in approximately 500 mL reagent water.
 - b. Dilute to volume with reagent water.
 - c. Stable 3 months.
 - d. Store at room temperature in a glass container.
 - e. Dilute for other concentrations.

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8. 5 umhos/cm low-level check standard

- a. In a 1 L glass volumetric flask, containing approximately 500 mL reagent water, dissolve 0.0025 g of NaCL.
- b. Prepare fresh before use.

9. Fluoride standard stock solution (100 mg/L)

- a. Dissolve $0.2210 \pm .0005$ g of anhydrous sodium fluoride (NaF) in reagent water and dilute to 1000 mL in a volumetric flask.
- b. Stable for 6 months.
- c. Store in a plastic container at room temperature.
- d. Dilute for other concentrations.

10. Fluoride working standard (10 mg/L)


- a. Pipette 10 mL of Fluoride stock solution (100 mg/L) into a 100 mL volumetric flask.
- b. Dilute to volume using reagent water.
- c. Prepare daily each day calibration curve is analyzed.

NOTE: A separate standard fluoride stock solution must be prepared using a **different source of NaF** when preparing a calibration curve.

10. Ammonia nitrogen standard (100 m/L NH₃-N)

- a. Dry ammonium chloride (NH₄Cl) at 103°C to 105°C for approximately 2 hours.

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- b. Desiccate approximately 1 hour.
- c. Dissolve 0.3819 ± 0.0002 g NH_4Cl in approximately 800 mL reagent water.
- d. Once dissolved, preserve the solution with concentrated sulfuric acid to a $\text{pH} < 2$. Dilute to 1000 mL in a volumetric flask.
- e. Stable for 6 months.
- f. Store at $0^\circ - 6^\circ \text{C}$, not frozen in a glass or plastic container.
- g. Dilute as needed for other concentrations.

NOTE: The Ammonia nitrogen standard used to prepare the calibration curve must be prepared using a **different source** of NH_4Cl .


11. Ammonia electrode storage solutions

- a. Storage between runs – mix 1ppm ammonium chloride solution with pH 4 buffer 1:1.
- b. Overnight storage – mix 10 ppm ammonium chloride solution with pH 4 buffer 1:1.


12. Standard EDTA titrant (0.02N) - Purchased; see container for shelf life information. Or prepare:

- a. Dissolve $3.723 \text{ g} \pm 0.005 \text{ g}$ of disodium EDTA in reagent water and dilute to 1000 mL with reagent water in a volumetric flask.
- b. Stable for 3 months.
- c. Store at room temperature in plastic bottle.


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- d. Standardize daily before use. Refer to Analysis #12147 for instructions for standardizing.
13. pH 10 hardness buffer solution – purchased; see container for shelf life information. Or prepare:
 - a. Dissolve 16.9 g ammonia chloride (NH₄Cl) in 143 mL of concentrated ammonium hydroxide (NH₄OH).
 - b. Separately, dissolve 1.179 ± 0.0005 g of disodium EDTA and 0.78 ± 0.005 g of (MgSO₄ · 7 H₂O) in 50 mL of reagent water (this solution becomes turbid).
 - c. Combine the above two solutions and dilute to 250 mL with reagent water in a volumetric flask.
 - d. Solution is stable 30 days.
 - e. Store at room temperature in plastic container.
 14. Calmagite indicator solution (0.1 % w/v) – Purchased; Store at room temperature. See manufacturer's label for expiration date.
 15. Calcium reference standard (1000 mg/L Ca = 2497 mg/L CaCO₃) – Purchased; store at room temperature. See manufacturer's label for expiration date.
 16. 1000 mg/L CaCO₃ intermediate calcium standard
 - a. Pipette 20.0 mL of purchased reference standard into 50 mL volumetric flask and dilute to volume with reagent water.
 - b. Stable for 6 months.

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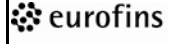
- c. Store at room temperature in glass or plastic container.
17. 15% Sodium Acetate Solution – dissolve 15.0 g of sodium acetate anhydrous in 85 mL of reagent water in a 150 mL beaker. Prepare fresh before use.
 18. Total acidity standard (5000 mg/L as CaCO₃)
 - a. In a 1-L glass volumetric flask containing approximately 500 mL of reagent water; add 20.4000 ± .0005 g potassium hydrogen phthalate.
 - b. Allow to dissolve and dilute solution to volume.
 - c. Store at 0° to 6°C, not frozen, in a glass container.
 - d. Solution expires 6 months from the date of preparation.
 19. Sodium hydroxide, 1 N
 - a. In a 1-L glass volumetric flask containing approximately 500 mL reagent water, dissolve 40.00 ± .05 g NaOH.
 - b. Cool and dilute to volume.
 - c. Store in a plastic bottle at room temperature.
 - d. Solution expires 1 year from date of preparation.
 20. Standardized sodium hydroxide, 0.02 N
 - a. In a 1-L glass volumetric flask, add approximately 500 mL reagent water.
 - b. Add 20 mL of 1 N NaOH to the flask and dilute to volume with reagent water.

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- c. Re-standardize titrant before use if more than 30 days have passed since the last standardization date. Standardize using instructions as per 1-P-QM-PRO-9015531.
 - d. Store at room temperature in a plastic or glass container.
 - e. Solution expires 1 year from the date of preparation.
21. Hydrogen peroxide (H₂O₂, 30% solution) – purchased. Store at room temperature. See label for expiration date.
 22. pH 8.00 buffer Solution; purchased. Store at room temperature. See container for shelf life information.

B. Reagents needed for 4219 analysis:

1. Borate buffer solution – Dissolve 19.0 ± 0.1 g sodium borate, 10-hydrate (Na₂B₄O₇·10 H₂O) in approximately 1000 mL of reagent water. Add 176 mL of 0.1N NaOH to the solution and dilute to 2000 mL with reagent water in a volumetric flask. Store at room temperature in a glass container. Solution stable for 6 months.
2. 0.1N H₂SO₄ – Dilute 3.0 mL of concentrated sulfuric acid to 1000 mL with reagent water in a volumetric flask. Store at room temperature in a glass or plastic container and re-evaluate yearly.
3. 4% H₂SO₄ Solution – Dilute 380 mL of 0.1N H₂SO₄ to 1000 mL with reagent water in a volumetric flask. Store at room temperature in a plastic container and re-evaluate yearly.
4. Antifoam B (purchased). Store at room temperature. See manufacturer's label for expiration date.

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5. Sodium hydroxide, 5N – Dissolve 200 ± 0.5 g sodium hydroxide (NaOH) pellets in approximately 800 mL of reagent water. Solution becomes very warm. Cool to room temperature and dilute to 1000 mL with reagent water in a volumetric flask. Store at room temperature in plastic container and re-evaluate yearly. (This is used to pH adjust samples.)
6. Sodium hydroxide, 0.1N – Dilute 40 mL of 5N NaOH solution to 2000 mL with reagent water in a volumetric flask. Store at room temperature in a plastic container and re-evaluate yearly. (This is used in borate buffer solution.)
7. Dilute Hydrochloric (HCl) acid – To prepare, add 50 mL of concentrated HCl to approximately 3.5 liters of reagent water. Slowly invert. Store at room temperature in a plastic container. (This is used to rinse tubing prior to steam cleaning the distillation apparatus.)
8. Ammonia-nitrogen standard, 500 mg/L NH₃-N – In a 1 L volumetric flask containing approximately 500 mL reagent water, dissolve $1.9095 \pm .0002$ g NH₄Cl (which has been dried at $105^\circ \pm 2^\circ\text{C}$ for at least 2 hours). Dilute to 1 L using reagent water. Preserve the solution with concentrated sulfuric acid to a pH <2. Store the standard at 0° to 6°C , not frozen in a glass or plastic container. Standard expires 6 months from the date of preparation.


Calibration:

Calibration is preformed daily. It is only necessary to calibrate for analyses that will be performed on that day.

A manual calibration and automated calibration section is given for each analysis.

Balances must be calibrated each day before use. Refer to 1-P-QM-QMA-9015389.

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NOTE: When Calibrating using ManTech : For all calibrations, 50 mL of standard is poured into a sample tube. For each analysis, a predetermined and programmed sample volume is used (to be taken from the 50 mL in the sample tube).

NOTE: Recalibration is necessary for each analysis if acceptance criteria is not met.

A. Analysis #12145 Turbidity Calibration

1. Manual Calibration:

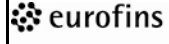
- a. Quarterly Calibration of turbidimeter – Every 90 days prepare a series of calibration standards covering the range 0 to 4000 NTU. Prepare the calibration standards as per instructions in 1-P-QM-PRO-9015423. If the standards are purchased no preparation is necessary. The Turbidity standard used to prepare the calibration curve must be prepared using a different source Formazin Primary standard than that used for the LCS/CCVs. Calibrate the instrument as per the instructions in 1-P-QM-PRO-9015423.
- b. Daily Calibration of turbidimeter- Read the Gelex secondary turbidity standards including a stray light standard, as per the instructions in 1-P-QM-PRO-9015423 each day the analysis is performed. Record the values in the maintenance logbook for the Hach 2100AN Turbidimeter.

2. Automated Calibration:

NOTE: The Turbidity standard used to prepare the calibration curve must be prepared using a different source Formazin Primary standard than that used for the LCS/CCVs.

- a. Dilute the 4000 NTU stock standard to obtain the following concentrations (1.0, 2.5, 5.0, 10.0, 20.0 NTU) and place calibration standards in ascending order in autosampler rack.

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- b. Sampler moves to rinse station and reagent water is pumped through flow cell to rinse tubing and cell.
- c. Sampler moves into first standard and 25 mL of standard is pumped through flow cell.
- d. Turbidity meter stabilizes for 60 seconds and turbidity reading recorded.
- e. Sample is pumped back into tube and sampler moves to rinse station to rinse flow cell and tubing.
- f. Steps b. – e. are repeated for remaining calibration standards.
- g. Acceptance criteria: Correlation coefficient of curve must be ≥ 0.995 .

B. Analysis #12146 Conductivity Calibration – determining cell constant; daily.

1. Manual Calibration:

- a. Determine cell constant daily, according to 1-P-QM-PRO-9015419.
- b. Conductivity Meter Linearity Check:
 - (1) Linearity check of the conductivity meter must be performed on the instrument at least once per year using the following concentrations below. Refer to 1-P-QM-PRO-9015419 for preparation instructions.

.0001M, .0005M, .001M, .005M, .01M, .02M, .05M, .1M
 - (2) Correlation Coefficient must be $\geq .995$. If this acceptance criteria is not met, the linearity check must be repeated.

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2 Automated Calibration:

a. Determine cell constant daily:

- (1) Place 1413 μ homs/cm calibration standard into autosampler rack.
- (2) The conductivity cell is rinsed with reagent water in the rinse station.
- (3) The cell moves to the 1413 μ homs/cm standard and is dipped 3 times in the solution, remaining fully immersed on the third dip.
- (4) Solution stabilizes for 25 seconds. The meter prompts to press calibration key twice.
- (5) The cell constant is displayed. Record cell constant in maintenance logbook.

b. Conductivity Meter Linearity Check:

- (1) Linearity check of the conductivity meter must be performed on the instrument at least once per year using the following concentrations below. Refer to 1-P-QM-PRO-9015419 for preparation instructions.


.0001M, .0005M, .001M, .005M, .01M, .02M, .05M, .1M

- (2) Correlation Coefficient must be $\geq .995$. If this acceptance criteria is not met, the linearity check must be repeated.

C. Analysis #12147, Total Hardness Calibration:

1. Manual Calibration:

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*Standardization of EDTA Titrant:

- a. Weigh 1.000 ± 0.0005 g CaCO_3 and transfer to a 500-mL Erlenmeyer flask.
- b. Add 1 + 1 HCl gradually until the CaCO_3 dissolves.
- c. Add 200 mL reagent water and boil for a few minutes to expel CO_2 .
- d. Allow the flask to cool.
- e. Add a few drops of methyl red indicator and adjust to an intermediate orange color with 3 N NH_4OH or 1 + 1 HCl, as needed.
- f. Dilute to 1000 mL with reagent water in a volumetric flask. (This solution is 1000 mg/L CaCO_3 .)
- g. Dilute 5.0 mL (pipette) of this solution to 50 mL and titrate to a blue endpoint following the steps in the Procedure Section of this analysis.
- h. Perform duplicate trials. Use the average of two trials to calculate the constant.

$$\text{EDTA constant} = \frac{5\text{mL CaCO}_3}{\text{mL of EDTA titrant}}$$


2. Automated Calibration: Not Applicable to this analysis

D. Analysis #12707, 12150: Alkalinity Calibration:

1. Manual Calibration:

The pH meter must be calibrated each day before use. Refer to 1-P-QM-PRO-9015421 for manual calibration instructions.

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2. Automated Calibration:

The pH meter must be calibrated each day before use. See Section E2.
under Calibration section

E. Analysis # 12152: pH Calibration:


1. Manual Calibration:

The pH meter must be calibrated each day before use. Refer to
1-P-QM-PRO-9015421 for manual calibration instructions.

2. Automated Calibration:

- a. Place pH 4, 7, and 10 buffers into autosampler rack and run a schedule to calibrate pH probe.
- b. Sampler moves to rinse station where the sample transfer line and Titrasis vessel are rinsed with reagent water.
- c. Sampler moves to pH 4 buffer position and sample transfer line is primed with pH 4 buffer solution.
- d. 10 mL of buffer solution is pumped into Titrasis cell and stirrer is turned on.
- e. pH of buffer solution is measured and recorded.
- f. Steps b. to e. are repeated for pH buffers 7 and 10.
- g. Acceptance criteria: Slope of pH calibration must be within the range of -65 to -53.

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F. Analysis #12678, 2200 Fluoride Calibration:

1. Manual Calibration:

a. Meter Calibration


Each day that samples are analyzed for fluoride, the meter must be zeroed prior to use with a 2.0-mg/L calibration standard.

Record data in a raw data logbook following instructions in 1-P-QM-QMA-9021767.


- (1) Connect fluoride electrode and reference electrode to the pH meter.

NOTE: The current pH meter in use with an expanded millivolt scale is a VWR pH meter (SB301). The following meter instructions are for it.

- (2) Turn on the power. Press the mode key until "RmV" is displayed
- (3) Place 20 mL of a 2-mg/L calibration standard into a 50-mL plastic beaker.
- (4) Add 2 mL of TISAB III and place electrodes under the surface of the sample.
- (5) Begin stirring at a slow, steady rate.
- (6) Wait while the standard stirs for 3 minutes.
- (7) **After at least 3 minutes**, press the "cal" key. When the reading is stable the display will flash "ready."

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- (8) Press the “OK” key to set the meter to zero.
 - (9) Withdraw the electrodes and rinse with reagent water.
 - (10) **Gently** blot electrodes with clean, dry tissues between readings.
 - (11) Place 20 mL of the 0.5 mg/L CCV into a 50-mL plastic beaker.
 - (12) Add 2 mL of TISAB III buffer and place electrodes under the surface of the sample.
 - (13) Begin stirring at a slow, steady rate.
 - (14) Stir solution for at least 3 minutes.
 - (15) When the mV reading is stable, record the mV reading.
 - (16) On each batch, at least one 0.5-mg/L CCV must be analyzed to validate the curve.
- b. Curve:
- (1) Using the fluoride concentrations listed below, analyze a new calibration curve every 3 months **or** when a bottle having a new lot number of TISAB III is opened.
 - (2) After analyzing, plot calibration curve of F^- concentration vs. Rel mV under log plot using statistics program in LIMS.
 - (3) The calibration curve must have a correlation coefficient of ≥ 0.995 .

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- (4) When analyzing samples from the state of North Carolina, each analyst performing the analytical procedure must produce a standard curve (Ref 15A NCAC 2H .0805 (a) (7) (I)).

Concentration (mg/L)	mL Working Standard (10 mg/L)	Final Volume (mL)
2.00	20	100
1.50	15	100
1.00	10	100
0.50	5	100
0.10	1	100

2. Automated Calibration:

NOTE: Before analyzing for analysis 2200, add 1 mL of 15% of Sodium Acetate to all curve standards.

- a. Dilute Stock standard to obtain the following concentrations: concentrations of 2.0, 1.5, 1.0, 0.5, 0.1 mg/L and place calibration standards into autosampler rack in ascending order and run a schedule to calibrate fluoride probe.
- b. Sampler moves to rinse station where sample transfer line and Titrasiip vessel are rinsed with reagent water.
- c. Sampler moves to first standard position.
- d. Sample transfer line is primed with standard solution.
- e. 30 mL of standard and 3 mL of TISAB is pumped into the Titrasiip vessel, and stirrer is turned on.
- f. Fluoride concentration is measured and recorded.
- g. Steps b. – f. are repeated for remaining standards.

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h. Acceptance criteria: Correlation coefficient of curve must be ≥ 0.995 .

G. Analysis #12677, 12679 Ammonia Calibration

1. Manual Calibration:

Curve:


Prepare a calibration curve daily using the concentrations listed below. (Dilute 100 mg NH₃-N /L stock solution with reagent water in 100-mL volumetric flasks.) After analyzing, plot calibration curve of mg NH₃-N /L vs. Rel mV using the log plot program in LIMS. The correlation coefficient of the curve must be $\geq .995$ and the slope of the curve must range from 54 to 60 mV. The curve must be analyst specific.

<u>Conc. (mg/L NH₃-N)</u>	<u>mL 100 mg/L → 100 mL</u>
0.1	0.1
0.5	0.5
2.5	2.5
5.0	5.0
10.0	10.0

Refer to Procedure I or J for instructions on analyzing curve.

2. Automated Calibration:

- a. Ensure electrode is filled to line with appropriate fill solution (NH₄Cl).
- b. Dilute stock standard to obtain the following concentrations: 0.1, 0.5, 2.5, 5.0, 10.0 mg/L and place calibration standards into the sampler rack in ascending order, and pH 4 buffer into dip rinse (second rinse) position.
- c. Sampler moves to flowing rinse station where electrode is rinsed with reagent water.

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- d. Sampler moves to dip station and electrode remains immersed in pH 4 buffer for 15 seconds.
- e. Sampler moves to flowing rinse station where electrode is rinsed again with reagent water.
- f. Sampler moves to first calibration standard position and stirrer is turned on.
- g. 0.45 mL of ISA (10 N NaOH) is added to sample to adjust pH to 11 or greater, ensuring all NH_4 is converted to NH_3 .
- h. Ammonia electrode is allowed to stabilize and reading is recorded.
- i. Steps c. - h. are repeated for remaining calibration standards.
- j. Acceptance criteria: The slope of the curve must range from -55 to -63 mV and the correlation coefficient of the curve must be ≥ 0.995 .

H. Analysis #4530/#13414 - Total Acidity/Prep


1. Manual Calibration:

The pH meter must be calibrated each day before use. Refer to 1-P-QM-PRO-9015421 for manual calibration instructions.

2. Automated Calibration:

The pH meter must be calibrated each day before use. See Section E2. under Calibration section.

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I. Analysis #0475, 0476 - Acidity to pH 3.7 and pH 8.3

1. Manual Calibration:

The pH meter must be calibrated each day before use. Refer to 1-P-QM-PRO-9015421 for manual calibration instructions.

2. Automated Calibration:

The pH meter must be calibrated each day before use. See Section E2. under Calibration section.


Procedure:

I. Manual Procedures:

A. Analysis #12145, Turbidity

1. Turn on the instrument and allow at least ½ hour for warm up.
2. Install the USEPA filter module.
3. Select NTU units by pressing the Units key.
4. Read the Gelex secondary turbidity standards including a stray light standard, as per the instructions in 1-P-QM-PRO-9015423 each day the analysis is performed. Record the values in the maintenance logbook for the Hach 2100AN Turbidimeter.
5. Analyze blank, standard, or sample by filling the sample cell to the line, wipe to remove any water or fingerprints, and apply a thin layer of silicone oil to the sample cell.
6. Place the sample cell in the instrument compartment and close the lid.


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7. Select automatic ranging by pressing the Range key.
8. Enable ratio on by pressing the RATIO key until a green light appears next to the Ratio key.
9. Read and record the results.
10. Dilute the sample with deionized water if the NTU reading is greater than 40 NTU.

B. Analysis #12146, Specific Conductance

1. Turn meter on.
2. Determine cell constant daily, according to 1-P-QM-PRO-9015419.
3. Rinse probe with reagent water and place probe in a reagent water blank sample.
4. Read and record the conductivity value when the meter stabilizes.
5. Repeat steps 3 and 4 with a LCS, check standards, samples and CCV recording the final value for each.
6. If the sample exceeds 12.9 mS/cm, then the appropriate dilution must be made so that the reading falls within the verifiable range of the electrode.

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C. Analysis #12147, Total Hardness

Record data in a raw data logbook following instructions in 1-P-QM-QMA-9021767.

1. Place 50 mL of sample into a 125-mL Erlenmeyer flask, or equivalent (low hardness samples).

NOTE: If greater than 10 mL of EDTA titrant is needed, re-analyze the sample using a smaller aliquot of sample diluted to 50 mL with reagent water.

2. Add **2 mL** of buffer solution to achieve a pH of 10.0 ± 0.1 .
3. Add **1 mL** of Calmagite indicator solution. The solution color changes to wine red indicating the pH is in the range of 10.0 ± 0.1 .
4. Titrate slowly with continuous stirring with standardized EDTA titrant until the last reddish tint disappears. The solution is normally blue at the endpoint. Complete the titration within 5 minutes of adding the buffer.
5. If the endpoint is not sharp, re-analyze the sample. Add approximately 0.66 ± 0.05 g KCN inhibitor per 50 mL of sample **after adding the buffer solution** and follow steps 3 and 4 in the procedure section.


NOTE: Add additional buffer if needed to achieve the pH 10.0 ± 0.1 .

D. Option #1 - Analysis #12707, Alkalinity to pH 8.3 (titrimetric) and Analysis #12150, Alkalinity to pH 4.5 (titrimetric)

Record data in a raw data logbook following instructions in 1-P-QM-QMA-9021767.

1. Calibrate the pH meter each day before use.
2. Analyze a CCV to confirm meter calibration.

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3. Measure 50 mL of well-mixed sample or a smaller portion diluted to 50 mL if the sample matrix dictates. Pour into a beaker containing a stir bar.


The blank is prepared by measuring 140 mL of reagent water. Analyze using the low alkalinity method (Procedure D.11.)

The LCS is prepared by pipetting 1 mL of the 9400 mg/L stock into a 150 mL beaker and diluting to 50 mL with reagent water.

The MS is prepared by adding an appropriate volume of the 9400 mg/L stock to an aliquot of field sample.

NOTE: Although this method is suitable for all concentration ranges of alkalinity, use appropriate aliquots to avoid a titration volume >50 mL.

4. Rinse electrodes with reagent water and gently blot dry with clean tissues between each use.
5. Place beaker on stir plate. Immerse electrode in liquid and gently stir at a constant rate. Do not let the stir bar bump the electrode.
6. **Record pH of sample.** If pH is >8.3, titrate with 0.02 N or 0.1 N sulfuric acid to a pH of 8.30 ± 0.02 . Record the volume of titrant used (analysis 12707).
7. After 8.30 ± 0.02 endpoint is reached, continue titrating to a pH of 4.50 ± 0.02 . Record the total volume of titrant used to reach second endpoint (analysis 12150).
8. When initial pH is ≤ 8.3 , titrate with 0.02 N or 0.1 N sulfuric acid to a pH of 4.50 ± 0.02 . Record the volume of titrant used (analysis 12150).
9. As each endpoint is approached, add smaller amounts of titrant and confirm that pH equilibrium is reached before adding more titrant.

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10. For 50 mL of sample, if the need for a large volume of 0.02 N sulfuric acid titrant is anticipated, analyze the sample using 0.1 N sulfuric acid titrant. Avoid using >50 mL of titrant to reach the pH 4.5 endpoint.

11. For 50 mL of sample, if the total volume of 0.02 N sulfuric acid titrant used to reach the pH 4.5 endpoint is <1 mL (i.e., <20 mg/L total alkalinity), repeat titration using the following steps. **(Low Alkalinity Method)**.
 - a. Measure 140 mL of well-mixed sample.
 - b. Titrate with 0.02 N sulfuric acid to a pH of 4.50 ± 0.02 .
 - c. Record the volume of titrant used in the comment section of the raw data logbook as "A".
 - d. Carefully continue titrating to a pH of 4.20 ± 0.02 .
 - e. Record the total volume of titrant used to reach second endpoint in the comment section as "B".
 - f. Calculate the total alkalinity titrant volume as (2A-B), record this calculated value as the titrant volume in the appropriate column in the raw data logbook and use this same calculated value as the "Total mL of titrant" in the pH to 4.5 alkalinity calculation on page 11.

12. Analyze a CCV after every 10 samples and at the end of a batch to confirm meter calibration.

- E. Option #2: Autotitrator Procedure - Analysis #12707, Alkalinity to pH 8.3 (titrimetric) and Analysis #12150, Alkalinity to pH 4.5 (titrimetric)
 1. The pH meter must be calibrated each day before use.

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2. Before beginning the analysis, flush the dispenser with the appropriate titrant, following the cleaning instructions in 1-P-QM-PRO-9015428.
3. Under “Analyze,” at the “Autosample Standby” prompt, press <YES>.

Display Reads

1: Chan 1 2: Chan 2
3: No Cal

1: Methods
2: Sequences

1: Different
2: Same method

Use method 1?

2 beaker wash?

10 sec wash?

After analysis, keep electrode
in beaker?

Samples = 13?

Start with Beaker 1?

Use Sequence 1 for Beaker 1?

Sample ID # = ?

Begin analysis?

Action

Press < 3 >

Press < 1 or 2>

Press < 1 or 2 >

Enter Method #,
and then press <YES>

Press <YES>

Press <YES>

Press <YES>

Enter number of samples,
and then press <YES>

Press <YES>

Press <YES>


Enter Sample ID #,
and press <YES>

Press <YES>

4. Analyze a CCV to confirm meter calibration using stored *Method #1*.
5. Measure 50 mL of well-mixed sample. Initially, analyze all samples at 50 mL volume on Sequence #2.


The LCS is prepared by pipetting 1 mL of the 9400 mg/L stock to into a 150 mL beaker and diluting to 50 mL with reagent water.

The MS is prepared by adding an appropriate volume of the 9400 mg/L stock to an aliquot of field sample.

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6. Pour into a 150-mL beaker and place in the sample carousel.
7. Using stored Method #1, analyze a CCV after every 10 samples and at the end of a batch to confirm meter calibration.
8. Determine if the sample must be reanalyzed.
 - a. For 50 mL of sample, if the total volume of 0.02 N sulfuric acid titrant used to reach the pH 4.5 endpoint is <1 mL (i.e., <20 mg/L total alkalinity), repeat titration using 140 mL of sample and stored Sequence #1. See Step E.9.
 - b. Any sample using more than 50 mL of 0.02N titrant must be reanalyzed using 0.1N titrant. See Step E.10.
9. Low Alkalinity Sequence
 - a. Measure 140 mL of well-mixed sample.

The blank is analyzed using this sequence. Prepare by measuring 140 ml of reagent water.
 - b. Follow Steps E.3. – E.7. using stored Sequence #1 instead of stored Method #1.
10. 0.1 N Titrant Sequence
 - a. Reprogram the auto titrator Sequence #1. See 1-P-QM-PRO-9015428.
 - b. Analyze a CCV and a check LCS
 - c. Measure 50 mL of well-mixed sample and pour into a 150-mL beaker placed in the sample carousel.

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- d. Analyze samples using Sequence #1.
 - e. Using stored Method #1, analyze a CCV after every 10 samples and at the end of a batch to confirm meter calibration.
11. After completing the analysis, flush the dispenser with reagent water following the cleaning instructions in 1-P-QM-PRO-9015428.

NOTE: The Orion 960 autotitrator system presently has three stored methods for alkalinity and one stored method for pH.

Method #1 – This method is programmed to take the pH of the sample.

Method #2 – This method is programmed for 0.02 N acid titrant and 50 mL of sample and the programmed endpoints are pH 8.3 and 4.5

Method #3 – This method is programmed for 0.1 N acid titrant and 50 mL of sample and the programmed endpoints are 8.3 and 4.5


Method #4 – This method is programmed for 0.02 N acid titrant and 140 mL of sample and the programmed endpoints are pH 4.5 and 4.2

The Orion 960 autotitrator system presently has two stored sequences for alkalinity.

Sequence #1 – This sequence is programmed to run *Method #1* followed by *Method #4*.

Sequence #2 – This sequence is programmed to run *Method #1* followed by *Method #2*.

Sequence #1 can be re-programmed to run *Method #1* followed by *Method #3*, as needed using steps in the manufacturer's instruction manual.

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F. Analysis #12148, 12149, and 1456 Carbonate, Bicarbonate and Hydroxide Alkalinity

Refer to Calculations section

G. Analysis #12151 and 12152, Temperature of pH and pH

1. 40 CFR Part 136 states that water pH is to be analyzed within 15 minutes or less of collection. Samples are analyzed as soon as possible after the sample is received in the laboratory.
2. Place enough sample in a clean beaker to immerse the sensing elements of the electrodes (approximately 30 mL).
3. Rinse and shake off any water on the electrode. Immerse the calibrated electrode in the sample and stir at a constant rate, being careful not to let the stir bar bump the electrode.
4. When the meter has stabilized, obtain the pH reading and temperature of the sample. Record each reading and temperature in the Laboratory Data Notebook.

NOTE: If pH reading is < 4.00 or >10.00, then the pH result will be reported with a qualifying flag.

5. Analyze a CCV after every 10 samples and at the end of the batch.


H. Analysis #12678 and 2200 Fluoride and Distilled Fluoride

NOTE: Analysis 2200 is applicable for the determination of fluoride in liquid and solid samples that have been previously distilled using Analysis #1448.

Analysis #1448 is required for NPDES monitoring prior to analyzing by ISE.

1. Allow samples to equilibrate to room temperature prior to analysis.

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2. Calibrate the meter. See Meter Calibration in Calibration section
3. Pipette sample volumes or measure using a Class A graduated cylinder.
4. Place 20 mL or a suitable portion diluted to 20 mL in a 50-mL plastic beaker.
5. Add 2 mL of TISAB III buffer and place electrodes under the surface of the sample.
6. Begin stirring at a slow, steady rate.


For samples referencing EPA Method 340.2, analyze as in procedural step 5, except begin stirring the sample before the electrodes are inserted.

7. Stir the solution for at least 3 minutes.
8. When the mV reading is stable, record the mV reading.

NOTE: The 3-minute guide is a minimum time limit — record the mV reading when a stable reading is observed. This statement is applicable to mV readings above the limit of quantitation (LOQ) because samples with fluoride concentrations less than the LOQ may have continued slight fluctuation.

9. Withdraw the electrodes and rinse with reagent water.

Gently blot electrodes with clean, dry tissues between readings.

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NOTE: If the mV reading drops below 0.0 (a negative Rel mV reading), immediately withdraw the electrodes from the sample, rinse with reagent water and store electrodes in a reagent blank while a sample dilution is made. Prior to re-analyzing the sample at a higher dilution, analyze a continuing calibration verification (CCV) standard to insure calibration was not lost. If necessary, recalibrate and begin again by analyzing another CCV prior to the sample.


I. Analysis #12677, Ammonia - Nitrogen in Water by Ion-Selective Electrode Method (ISE)

Record data in raw data logbook following instructions in LOM-SOP-LAB-220.

1. Connect ammonia electrode to pH/ISE meter.
2. Place 100 mL aliquot of sample (or a suitable portion diluted to 100-mL with reagent water) into a 150-mL glass beaker.
3. Rinse electrode with reagent water. Immerse electrode into liquid and mix gently with a magnetic stirrer. Stir at a slow, steady rate so air bubbles do not become trapped on the electrode membrane surface. Continue stirring during analysis.
4. Add **1 mL** alkaline reagent to raise pH to above 11. Add the alkaline reagent down the side of the glass beaker (into the sample) very slowly in order to minimize the formation of air bubbles. Document that the pH of the sample is greater than 11 in the raw data logbook.
5. Keep electrode in solution until a stable millivolt reading is obtained.

NOTE: Do not add alkaline reagent before immersing the electrode; it is possible to lose ammonia from a basic solution.

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NOTE: If necessary, allow standards and samples containing ≤ 1 mg $\text{NH}_3\text{-N/L}$ additional time for stabilization.


NOTE: Dilute samples with reagent water if they are more concentrated than the highest standard on the curve.

6. Record the stabilized mV reading of each sample in a raw data logbook and convert the reading to the ammonia concentration using the standard curve.
 7. Dip the electrode into the pH 4.0 buffer solution and then rinse the electrode with reagent water.
- J. Analysis #12679, Ammonia – Nitrogen by Ion-Selective Electrode Method (ISE), Analysis #4219, Ammonia Distillation and Analysis #2593, Un-ionized Ammonia

1. Analysis 4219 Distillation Procedure:

Record data in raw data logbook following instructions in 1-P-QM-QMA-9021767.

- a. Before each distillation, rinse tubes with dilute HCl. Add approximately 500 mL of reagent water to an 800-mL Kjeldahl flask to steam clean the distillation apparatus.
- b. Connect Kjeldahl flask to glass adapter and hose. Turn on the Coolflow. Turn on the temperature control and distill until approximately 150 mL of water is collected in the beaker at the bottom of the setup. Remove distillate from delivery tube immediately after turning off heat source to avoid back wash during the cool-down phase.
- c. Measure 500 mL of sample (or an aliquot diluted to 500 mL with reagent water) using a Class A graduated cylinder. Pour into a beaker and adjust the pH of the sample to 9.5 to 12 with 5N NaOH. Check pH with purchased pH strips, and then add 25 mL of borate buffer solution.


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- d. Transfer the solution to an 800-mL Kjeldahl flask. Add a pinch of boiling chips and approximately 5 mL of antifoam B to the solution. Connect flask to glass adapter and hose. Turn on the Coolflow.
- e. Measure 50 mL of 4% H₂SO₄ solution into a 400-mL beaker. Make sure the delivery tube is below the level of the 4% H₂SO₄ solution (receiving solution).
- f. Begin heating. Collect approximately 220 mL of distillate. Turn off heat and immediately remove the distillate beakers from the delivery tube. Turn off the Coolflow.
- g. Pour the distillate into a 500-mL Class A graduated cylinder and dilute to final volume of 500 mL with reagent water. Store distillate at 0°C - 6°C; not frozen, prior to analyzing
- h. Analyze distillate for NH₃-N according to Analysis #12679 procedure.

2. Analysis 12679 ISE Procedure:

Record data in raw data logbook following instructions in 1-P-QM-QMA-9021767.

- a. Connect ammonia electrode to pH/ISE meter.
- b. Place 100 mL aliquot of sample (or a suitable portion diluted to 100-mL with reagent water) into a 150-mL glass beaker.
- c. Rinse electrode with reagent water. Immerse electrode into liquid and mix gently with a magnetic stirrer. Stir at a slow, steady rate so air bubbles do not become trapped on the electrode membrane surface. Continue stirring during analysis.

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d. Add **1 mL** alkaline reagent to raise pH above 11. Add the alkaline reagent down the side of the glass beaker (into the sample) very slowly in order to minimize the formation of air bubbles. Document that the pH of the sample is above 11 in the raw data logbook.

e. Keep electrode in solution until a stable millivolt reading is obtained.

NOTE: Do not add alkaline reagent before immersing the electrode; ammonia is lost from a basic solution.

NOTE: Standards and samples containing ≤ 1 mg $\text{NH}_3\text{-N/L}$ require extra time for stabilization.

NOTE: Dilute samples with reagent water if they are more concentrated than the highest standard on the curve.


f. Record the stabilized mV reading of each sample in a raw data logbook and convert the reading to the ammonia concentration using the standard curve.

g. Dip the electrode into the pH 4.0 buffer solution and then rinse the electrode with reagent water.

K. Option #1 – Analysis #4530 - Total Acidity

1. Calibrate the pH electrode by following the directions under 1-P-QM-PRO-9015421.
2. Pour 50 mL of the sample into a 150-mL beaker. Read the initial pH of the sample and record the result in the laboratory data notebook.
3. If the pH is above 4.0, add standard sulfuric acid in 5.0-mL increments to lower the pH to 4.0 or less. If initial pH is less than 4.0, addition of sulfuric acid is not required.

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4. Add 5 drops of H₂O₂ (in hood).
5. Heat the sample to boiling and boil for 2 to 4 minutes.
6. Cool the sample to room temperature and titrate with standardized sodium hydroxide to pH 8.3. If more than 50 mL of titrant is used, repeat procedure using less sample.

L. Option #2: Autotitrator Procedure – Analysis #4530 - Total Acidity

This method utilizes the Orion 960 autotitrator system.

1. Calibrate the pH electrode by following the directions under 1-P-QM-PRO-9015421.
2. Place 50 mL of each standard or sample in a 150-mL beaker and place in sample carousel.
3. In order to record the initial pH of the blank, standard, or sample, at the “Autosample Standby” prompt, press <YES>.

<u>Display Reads</u>	<u>Action</u>
1: Chan1 2: Chan2	Press 3
3: No Cal	
1: Methods	Press 1
2: Sequences	
1: Different Methods	Press 2
2: Same Method	
Use Method 1?	Enter Method 1 and press yes
2 beaker wash?	Press yes
10 sec wash?	Press yes
After analysis, keep electrode In beaker?	Press yes
Samples = 13?	Enter # of samples Press yes
Sample ID # = ?	Enter sample # and Press yes
Begin analysis?	Press yes

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4. In order to lower the initial pH of the blank, standard, or sample below a pH of 4.0 or less, repeat the steps above (starting with..."at the autosample standby press <YES>") using standardized H₂SO₄. When prompted to enter a method number, instead of entering method 1 enter method 8.
5. When the cycle is complete remove blank, standard, or sample from carousel and add three drops of hydrogen peroxide. Boil for 2 to 4 minutes. After cooling, bring the pH of the blank, standard or sample to 8.3 using the standardized NaOH and the autotitrator system. Repeat the steps in #3 under Option #2, beginning with pressing <YES> at the autosample standby. When prompted for a method number, enter method 9 instead of method 8.

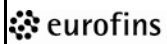
M. Option #3 – Analysis #13414 Prep (for use with ManTech analysis #4530)

1. Calibrate the pH electrode by following the directions under 1-P-QM-PRO-9015421.
2. Pour 100 mL of the sample into a 150-mL beaker. Read the initial pH of the sample and record the result in the laboratory data notebook.
3. If the pH is above 4.0, add standard sulfuric acid in 5.0-mL increments to lower the pH to 4.0 or less. If initial pH is less than 4.0, addition of sulfuric acid is not required.
4. Add 5 drops of H₂O₂.
5. Heat the sample to boiling and boil for 2 to 4 minutes.
6. Cool the sample to room temperature. Proceed to ManTech Procedure.

N. Option #1, Analysis #0475, 0476 – Acidity to pH 3.7 and pH 8.3

1. Calibrate the pH electrode by following the directions under 1-P-QM-PRO-9015421.

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2. Pour 50 mL of sample into a 100-mL beaker. Read the initial pH of the sample and record the result in the Laboratory Data Notebook.
 3. Titrate to pH 3.7 with 0.02 N NaOH. As endpoint is approached, use smaller additions of titrant and allow electrode to equilibrate between each addition. Record amount of titrant. Titrate to pH 8.3 with 0.02 N NaOH. As endpoint is approached, use smaller additions of titrant and allow electrode to equilibrate between each addition.
 4. Record total amount of titrant. If more than 50 mL of titrant is used, repeat using less sample or a dilution.
- O. Option #2: Autotitrator Procedure – Analysis #0475, 0476 – Acidity to pH 3.7 and pH 8.3

This method utilizes the Orion 960 autotitrator system.

1. Calibrate the pH electrode by following the directions under 1-P-QM-PRO-9015421.
2. Place 50 mL of each standard or sample in a 150-mL beaker and place in sample carousel.
3. At the “Autosample Standby” prompt, press <YES>.

<u>Display Reads</u>	<u>Action</u>
1: Chan 1 2: Chan2 3: No Cal	Press 3
1: Methods 2: Sequences	Press 2
Use Sequence 1?	Enter Sequence 3 and press YES
2 beaker wash?	Press YES
10 sec wash?	Press YES
After analysis, keep electrode in beaker?	Press YES
Samples = 13?	Enter number of samples and press YES
Sample ID # = ?	Enter sample # and press YES
Begin analysis?	Press YES

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4. If more than 50 mL of titrant is used, repeat using less sample.

II. ManTech Procedure (automated method):

- A. Introduction to the procedure for the operation of the ManTech Multi-purpose instrument.

The instrument is equipped with systems to analyze for pH, temperature of pH, alkalinity, conductivity, turbidity, fluoride, ammonia and total hardness. The methods for each procedure is pre programmed and the analyst will not need to make any adjustments.

Each test can be performed individually or in tandem with others. The analyst will determine the combination of analyses for each run. Before operating the instruments, the analyst must ensure that all required reagents needed for each test is in adequate supply and are not expired.


To operate the instrument, open the PC-titrate software menu from the computer desktop.

Each day before any analysis is performed; the daily calibration associated with each analysis must be completed and evaluated to ensure that the acceptance criteria are met. (See the calibration section for the required concentrations and acceptance criteria for each calibration). Daily calibration schedules are created and saved. If a specific analysis is not being performed that day, the calibration can be removed from the schedule for that day.

- B. Performing daily calibration:

Open the daily start up tab and load the standards according to the schedule for each calibration. Click on the start button and the instrument will proceed with the calibration. Once the calibration is complete the calibration data is automatically sent to the assign printer and is printed. Ensure the calibration data meets requirements before proceeding. See the calibration section for the required concentrations and acceptance criteria for each calibration.

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C. Analyzing samples:

NOTE: Prior to starting the ManTech system, make sure all required reagent containers and reagent water containers have sufficient sample volume.

NOTE: Before analyzing for analysis 2200, add 1 mL of 15% of Sodium Acetate to all standards (including the curve), samples, and Blank.


NOTE: Before analyzing for analysis 4530, samples need to be prepared following steps outlined under Manual Procedure M; analysis #13414.

To analyze samples, select “Run titration” from the PC-titrate menu. A blank schedule will appear.

1. Click on the add row buttons to add the required number of rows for that run.
2. Double click on the blank space under the schedule header. The menu of analyses will appear. Select the analyses to be preformed and click ok.
3. When completing the schedule, each analysis must be bracketed by its own CCV of alternating concentrations and a CCB (see QA section). The CCV's and CCB's ID's are pre-programmed and are to be scanned in from the charts provided at each instrument. Barcodes are provided for each CCV and CCB. See Table I.
4. The LCS for each analysis is pre-programmed and is to be scanned in from the charts provided at each instrument. See Table I.
5. Sample numbers can be typed in; however each instrument is equipped with a scanner which is used to scan the sample numbers directly from the label of the container (scan barcodes on label).

The batch information for each Method Blank, LCS, CCV, CCB and samples must be completed using the example below:

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Sample/ bottle code is scanned in and then a ";" followed by the batch designation "1a" followed by a ";" and then "u","d","r", or "m" for the QC Type (u-background, d-duplicate, r-matrix spike, m-matrix spike duplicate). .

For example, for a background QC sample having a sample number of 6515514 and a bottle code of 005A the correct batch information would be:
6515514005A;1a;u


If a sample is analyzed at a dilution the dilution factor is then entered at the very end of the batch information with a ";" placed before it.

For example: If the same sample as used above was analyzed at a 10X dilution then the batch information for that sample would be entered as:
6515514005A;1a;u;10

6. Fill the sample tube with Method Blank, LCS, each CCV, CCB and samples. Ensure the sample tubes are loaded according to the order on the schedule.
7. Click on the auto-generate order number to add the order number to the schedule.
8. Once the schedule is completed, click start and the instrument will proceed with the analysis until the entire schedule of samples is complete.
9. The data is saved automatically and sent to the PC –Titrate export file before it is imported to the LIMS system.

D. Routine Maintenance of ManTech multi-parameter system

1. Calibration of TitrasiPumps: Flow Rate Check:
 - a. Manual Control of Autosampler

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- (1) From the PC-Titrate main menu, click on Titrator, then on Manual Control (autosampler tab)
- (2) Next, click on Load Tray From Folder button and then double click on Automax 197 Tube Sampler file
- (3) Then, under Zone select tubes. Under Tubes select tube position and place a tube in that position on the autosampler tray.
- (4) Click on Home Sampler
- (5) Click on Go To This Location XYZ button. The autosampler will then move to the tube position.
- (6) Click OK button in order to get back to the PC-Titrate main menu

b. Flow Rate Check:

- (1) From the PC-Titrate menu select the pump to be calibrated (Click on Pump Cal button) and follow the prompts.
- (2) Calibration must be performed monthly and documented in the maintenance logbook.

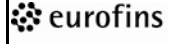
NOTE: When completed, Home sampler (follow instructions under II. ManTech Procedure D1a. steps 1-4)

2. Calibration of Zero and Span for the Hardness detector:

NOTE: Turn on Hardness Detector in order for the detector to warm up before calibration.

NOTE: Ensure reagent water is in titration vessel cup containing the photo cell

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a. Accessing Zero and Span Check screen and set-up:


- (1) From the PC-Titrate main menu, click on Titrator, then on Manual Control
- (2) Click on Analog
- (3) Click on Scan Analog, making sure the continuous button is checked
- (4) The Hardness Detector is on Monitor Electrode # 4

b. Zero Check/Calibration:

- (1) Unscrew the Zero (careful not to look directly into the bright light). The Zero must be as close as possible to 0 mV.
- (2) If not, adjust the screw for Zero on the hardness detector until reading is as close as possible to 0 mV.
- (3) Check/Calibration must be performed monthly and documented in the maintenance logbook.

c. Span Check/Calibration:

- (1) The Span reading must be $-400 \text{ mV} \pm 25 \text{ mV}$.
- (2) If not, adjust the screw for Span on the hardness detector until reading is within range.
- (3) Check/Calibration must be performed monthly and documented in the maintenance logbook.

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3. Changing and Entering Acid Normalities on ManTech :


a. Changing Titrant –Purging titrant:

NOTE: Disconnect acid titrant bottle from dispenser line

- (1) Click on PC-Titrate, Titrator, Manual Control, Serial Devices
- (2) Click on Burivar II TIS1 tab; Titrasisp pump#1/Burette #1
- (3) Purge Buret one time (empty cup-use manual button on side of pump #1 at the top of cup)
- (4) Fill titrant bottle with new standardized 0.02N H₂SO₄ titrant and connect dispenser line to bottle
- (5) Purge system two more times
- (6) Click OK

b. Entering Acid Normalities:

- (1) Click on PC-Titrate, Set-up, Titration Method, Load
- (2) Click Alkalinity
- (3) Under Titrant Information-Concentration, change Normality to current value.
- (4) Click Save
- (5) Click Alkalinity-Low and follow steps above

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E. Maintenance of all other systems:

1. Maintenance of the Ammonia Ion-Selective Electrode – See manufactures instruction manual for maintenance and operation of electrode
2. Maintenance of pH electrodes- refer to 1-P-QM-PRO-9015421 for maintenance of pH electrodes
3. Perform Maintenance on all other systems as needed.

F. Retrieving Historical Raw Data on ManTech :

1. Find run number of sample in question- Go into sample number in Parallax; copy and paste run number
2. Open PC-titrate software menu from computer desktop
3. Click on Titrator, Replay Titration, Load, Sort by order and sample name
4. Click on sample (go by time), Select, Print, Equation Result Report (rplyeqn.srw), Print.


Calculations:

- A. Fluoride, pH, Temperature of pH, Conductivity, Turbidity and Ammonia are measured directly and therefore no calculations are needed.
- B. Alkalinity:

To pH of 8.3:

$$\text{Alkalinity, mg/L CaCO}_3 = (\text{mL of titrant (pH 8.3)} \times \text{Normality} \times 50,000) / \text{mL of sample}$$

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To pH of 4.5:

Alkalinity, mg/L CaCO₃ = (Total mL of titrant x Normality x 50,000)/ mL of sample

- C. Carbonate, Bicarbonate, and Hydroxide Alkalinity are direct calculations from the total alkalinity result.

The computer chooses the appropriate calculation from the # 12707 and # 12150 alkalinity data:

Analysis #12149:

If 12707 result is < MDL	Bicarbonate = 12150 result
If 12707 result is < 1/2 of 12150 result	Bicarbonate = 12150 result - (2 x 12707 result)
If 12707 result is = 1/2 of 12150 result	Bicarbonate = < MDL
If 12707 result is > 1/2 of 12150 result	Bicarbonate = < MDL
If 12707 result is = 12150 result	Bicarbonate = < MDL

Analysis #12148:


If 12707 result is < MDL	Carbonate = < MDL
If 12707 result is < % of 12150 result	Carbonate = 2 x 12707 result
If 12707 result is = % of 12150 result	Carbonate = 2 x 12707 result
If 12707 result is > % of 12150 result	Carbonate = 2 x (12150 result - 12707 result)
If 12707 result is = 12150 result	Carbonate = < MDL

Analysis #1456:

If 12707 result is < MDL	Hydroxide = < MDL
If 12707 result is < % of 12150 result	Hydroxide = < MDL
If 12707 result is = % of 12150 result	Hydroxide = < MDL
If 12707 result is > % of 12150 result	Hydroxide = (2 x 12707 result) - 12150 result
If 12707 result is = 12150 result	Hydroxide = 12150 result

- D. Free Carbon Dioxide Calculation (analysis #238)

The calculation assumes that the total alkalinity of the sample is due almost entirely to hydroxides, carbonates or bicarbonates.

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The total dissolved solids of the sample may not be greater than 500 mg/L for this calculation.

$$mg/L CO_2 = 2.0 \times B \times 10^{(6-pH)}$$

Where:

B = bicarbonate alkalinity (from analysis #12149)

NOTE: Total carbon dioxide can be calculated, if requested, according to the calculations found in Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 4500 CO₂ D-1997.

E. Total Hardness:

$$Hardness (mg/L as CaCO_3) = [(mL EDTA used \times 1000) / mL of sample] \times EDTA Constant$$

F. Analysis #2593 Un-ionized Ammonia Calculation:

$$mg \text{ un-ionized ammonia/L} = (ammonia \text{ nitrogen } (6914) \text{ raw result mg/L}) \times (\% \text{ un-ionized ammonia at a given pH and temperature})$$

Refer to table below for % un-ionized ammonia:

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Table 8010: VI.
Percentage of Ammonia Un-ionized in Distilled Water*

Temp °C	<u>Percentage Un-ionized at a given pH*</u>								
	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
5	0.01	0.04	0.11	0.40	1.1	3.6	10	27	54
10	0.02	0.06	0.18	0.57	1.8	5.4	15	36	64
15	0.03	0.08	0.26	0.83	2.6	7.7	21	45	72
20	0.04	0.12	0.37	1.2	3.7	11	28	55	80
25	0.05	0.17	0.51	1.7	5.1	14	35	63	84
30	0.07	0.23	0.70	2.3	7.0	19	43	70	88

*Prepared from data given in Sillen and Martell.

G. Analysis #4530 - Total Acidity

$$\text{Acidity as mg / mL CaCO}_3 = \frac{[(A \times B) - (C \times D)] \times 50,000}{\text{mL of sample}}$$

Where:

A = Vol. of std. NaOH used in titration


B = Normality of std. NaOH

C = Vol. of std. H₂SO₄ used to reduce pH to less than 4

D = Normality of std. H₂SO₄

H. Analysis #0475, 0476 – Acidity to pH 3.7 and pH 8.3

$$\text{mg/L as CaCO}_3 = \frac{\text{Normality} \times 50,000 \times \text{mL of titrant}}{\text{sample volume, mL}}$$

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Statistical Information/Method Performance:

The method detection limit (MDL) is determined annually by following the procedure outlined in 1-P-QM-QMA-9017309.

The quality control acceptance windows are generated annually by following the procedure outlined in 1-P-QM-QMA-9017313.

Quality Assurance/Quality Control:

The batch size is limited to 20 samples or less. For analyses with more than 10 samples on a batch, two duplicates are needed (excluding ammonia and fluoride – only one duplicate is needed per batch 20 samples –unless a batch contains an NPDES sample(s) from South Carolina and the batch contains more than 10 samples, then two duplicates are needed.).

A Laboratory Control Standard (LCS) must be analyzed for each analysis. See Table I for each analysis LCS concentration.


For alkalinity, Total Acidity and total hardness one matrix spike (MS) must be analyzed per batch of 20 samples or less.

For ammonia, fluoride and Acidity to pH 3.7 and 8.3 (total acidity spikes only), a matrix spike (MS) and a matrix spike duplicate (MSD) must be analyzed per batch of 20 samples or less.

When sample volume does not permit the analysis of either a sample matrix duplicate or an MS and MSD, then a LCSD must be analyzed to demonstrate method precision.

Samples from West Virginia require a usable precision measurement for each batch. Analyzing one of the following on a batch containing a West Virginia sample fulfills this requirement: an MS/MSD, a non-program deleted duplicate, or an LCSD.

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For Specific Conductance, if the batch contains samples from the state of North Carolina a low-level check standard of 5 umhos/cm NaCl must be analyzed.

For Total Hardness, samples that are designated NPDES require digestion. Confirm whether this analysis is appropriate for samples designated NPDES.

For each analysis, a continuing calibration verification (CCV) standard must be analyzed at the beginning of each batch, after every 10 samples and at the end of each batch. The concentration of the CCV must alternate in a repeating wave pattern. All CCVs have an acceptance criteria of 90% to 110%. If any CCV's are outside this range, then the samples bracketed by the out of specification CCV must be repeated. Refer to Table I for CCV concentrations for each analysis.

A continuing calibration verification blank (CCB – a reagent water blank) must be analyzed after each CCV standard on the batch. The CCB must be less than the LOQ for the analysis.

See LIMS for current quality control (QC) acceptance windows. Follow guidelines in 1-P-QM-PRO-9015535 for outlier QC data.

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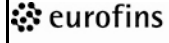
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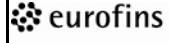
Table I

Analysis Name and Number	CCV Barcodes/Concentrations
Total Alkalinity (12150) Carbonate (12148) Bicarbonate (12149)	CCVPH2 = 7.00 pH buffer LCSAK = 188 mg/L LCSPH = 7.00 pH buffer PBW = Method Blank CCB = reagent water blank
Total Acidity (4530)	CCVPH8 = 8.00 pH buffer LCSTACD = 500 mg/L PBW = Method Blank CCB = reagent water blank
Acidity to pH 3.7 and pH 8.3 (0475, 0476)	CCVPH8 = 8.00 pH buffer LCSACD = 250 mg/L PBW = Method Blank CCB = reagent water blank
pH (12152) Temperature of pH (12151)	CCVPH2 = 7.00 pH buffer LCSPH = 7.00 pH buffer CCB = reagent water blank
Specific Conductance (12146)	CCVSC1 = 147 uhoms/cm CCVSC2 = 1413 umhos/cm CCVSC3 = 12,900 umhos/cm LCSSC = 147 umhos/cm PBW = Method Blank CCB = reagent water blank
Fluoride (12678)	CCVFL1 = 0.5 mg/L CCVFL2 = 1.0 mg/L CCVFL3 = 1.5 mg/L LCSFL = 1.0 mg/L PBW = Method Blank CCB = reagent water blank
Turbidity (12145)	CCVTB1 = 10 NTU CCVTB2 = 20 NTU CCVTB3 = 30 NTU LCSTB = 10 NTU PBW = Method Blank CCB = reagent water blank
Ammonia (12677) Distilled Ammonia (12679)	CCVNH1 = 1.0 mg/L CCVNH2 = 2.5 mg/L CCVNH3 = 7.5 mg/L LCSNH = 5 mg/L PBWNH = Method Blank (12679-distilled) PBW = Method Blank (12677) CCB = reagent water blank
Total Hardness (12147)	CCVTH1 = 20 mg/L CCVTH2 = 40 mg/L CCVTH3 = 60 mg/L LCSTH = 40 mg/L PBWTH = Method Blank CCB = reagent water blank

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Eurofins Document Reference	1-P-QM-WI -9013078	Revision	3
Effective Date	Nov 25, 2013	Status	Effective
Historical/Local Document Number	Analysis 11996, 11997, 13130		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		


Prepared by	Marla Lord
Reviewed and Approved by	Kenneth Boley;Review;Monday, November 18, 2013 12:57:46 PM EST Barbara Reedy;Approval;Monday, November 25, 2013 7:51:43 AM EST

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Revision Log:

Revision: 3		Effective Date:	This version
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Reference	Required reference	Added 5030C	
Sample Collection, Preservation and Handling	Current requirement	Updated temperature range to 0° to 6°C, not frozen	
Reagents and Standards A.2	Current practice	Added "or equivalent" to methanol description	

Revision: 2		Effective Date:	Mar 15, 2013
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Throughout Document	Reflect re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers	
Sample Collection, Preservation and Handling	Current requirement	Changed pH requirement from ≤2 to <2	


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Reference:

1. Volatile Organic Compounds by Gas Chromatography/ Mass Spectrometry (GC/MS), SW-846 Method 8260C, August 2006.
2. Determinative Chromatographic Separations, SW-846 Method 8000B, December 1996.
3. Purge and Trap for Aqueous Samples, SW-846 Method 5030B, December 1996.
4. Purge and Trap for Aqueous Samples. SW-846 Method 5030C, Rev 3, May 2003.
5. *Total Petroleum Hydrocarbons Analysis-Gasoline Method*, California Department of Health Services, LUFT Task Force.
6. *Chemical Hygiene Plan*, current version.

Cross Reference:

Document	Document Title
1-P-QM-PRO-9015465	Glassware Cleaning
1-P-QM-PRO-9015467	GC/MS Instrumentation Maintenance
1-P-QM-PRO-9015469	GC/MS Volatile Standards Traceability
1-P-QM-PRO-9015470	Preparation and Analysis of Cleaning Blanks for GC and GC/MS Volatiles
1-P-QM-PRO-9015471	GC/MS Volatiles Audit Process
1-P-QM-PRO-9017810	Level II Review of GS/MS Volatiles
1-P-QM-QMA-9015390	Demonstrations of Capability
1-P-QM-QMA-9017309	Determining Method Detection Limits and Limits of Quantitation

 <div>Lancaster Laboratories Environmental</div>	<p>Document Title: Determination of Volatile Target Compounds and Gasoline Range Organics (GRO) by Capillary Column Gas Chromatography/Mass Spectrometry (GC/MS) in Waters and Wastewaters by Method 8260C</p>	<p>Eurofins Document Reference: 1-P-QM-WI -9013078</p>
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Scope:


This method is suitable for the determination of the target compounds listed and maintained in the LIMS (Laboratory Information Management System) for aqueous matrices. Non-target volatile compounds in the sample can be tentatively identified (TIC) using a mass spectral reference library comparison. This analysis must be performed by or under the direct supervision of an operator experienced in the analysis of volatile organics by purge and trap GC/MS methodologies and skilled in mass spectral interpretation. Using this method, the TICs are quantitated with an estimated concentration. Compounds other than those listed in the LIMS for this group of master scans are analyzed using USEPA SW-846 Method 8260C. Attachment I describes the proper analysis procedure for Gasoline Range Organics in Water. Due to poor purging efficiency or poor gas chromatographic performance, some analytes require calibration at higher levels and higher practical quantitation limits (PQLs). Any additional compounds must be added to the theoretical standard concentrations (TSC) sheet. Standards containing additional analytes must be prepared as described in the Standards section of this document. Both secondary stock solutions and matrix spike solutions must be prepared for use in analyzing additional compounds.

Basic Principles:

A 5-mL or 25-mL sample or a dilution of a sample is placed in a specially designed purge vessel. The sample is purged with an inert gas and the effluent gas passed through a sorbent tube where the volatile organics are trapped. After purging, the sorbent trap is rapidly heated and backflushed on to the head of a gas chromatographic (GC) capillary column. The GC column is temperature programmed to separate the volatile compounds, which are subsequently detected and identified using mass spectrometric techniques.

When a compound reaches the Mass Spectrometer, it is bombarded by high-energy electrons (70 eV). This causes the compound to fragment and form ions. The positive ions are focused into a quadrupole mass analyzer, where the ions are separated according to their mass/charge ratios during rapid repetitive scans. These ions are then amplified and detected with an electron multiplier.

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The resulting time/intensity/mass spectra data are stored and processed by a computer. Target compounds are identified on the basis of relative retention times and mass spectral matches to standards, which are injected every 12 hours on the same system. The internal standard method is used for quantitation.

Interferences:


Contaminant sources are volatile compounds in the laboratory environment, impurities in the inert purging gas, carryover from samples containing high concentrations of volatile organic compounds and dirty glassware. The analyst must demonstrate that the system is free from interferences (by producing acceptable method blank data) before analyzing a batch of samples. Matrix effects from heavily contaminated waters can interfere with the internal standard responses, target analytes and surrogate recoveries, thereby hindering accurate quantitation. See Section 4.0 of SW-846 Method 8260C for further discussion.

Safety Precautions and Waste Handling:

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined; therefore, each chemical compound must be treated as a potential health hazard. Exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as the use of fume hoods, safety glasses, lab coats, and gloves. Neat compound sources and stock solutions must be collected into a lab pack upon expiration. The lab pack is delivered to Safety personnel for

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appropriate disposal. Expired secondary standard solutions in methanol must be disposed of as solvent waste. Pour expired secondary standard solutions into the appropriate solvent waste collection container. Aqueous calibration standard mixes are disposed of as nonhazardous aqueous waste due to the low concentration. Samples with a pH ≤ 2 are taken to storage until disposal in an acid waste container.

Personnel Training and Qualifications:

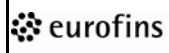
All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability.

Education Requirement: A 4-year Baccalaureate Degree from an accredited College or University in one of the physical sciences and/or one to three years of relevant gas chromatography experience.

Analysts must be trained in the proper method of volatile organic sample preparation and analysis as determined by the supervisor(s). All training and education relating to volatile organic sample preparation and analysis must be documented by each analyst in his/her training record. All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP.

Specifically, each new chemist trains with an experienced chemist for the first 12 weeks depending on the individual and his/her previous experience. The first 12 weeks are spent working one-on-one with the trainer. This time is less if the new chemist has prior relevant experience in GC/MS and/or analytical chemistry background.

During the training period, the new chemist learns daily maintenance, calibration techniques, data and library search review, and forms generation. He/she is also required to read all relevant SOPs and EPA methods.

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To evaluate the proficiency of each chemist, several checks have been established. The first is the ability to successfully calibrate. The chemist analyzes a series of at least five calibration standards and performs the calibration routine. Secondly, each analyst must perform a Demonstration of Capability (DOC). Refer to 1-P-QM-QMA-9015390 for specific requirements. Demonstration of Capability is performed annually and is maintained in the analyst's training records.

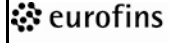
Sample Collection, Preservation, and Handling:

The samples to be analyzed with this method must be stored in a refrigerator at 0°C to 6°C, not frozen. Samples are collected in 40-mL vials with no headspace. Preserve samples to a pH of <2 in order to prevent degradation of aromatic compounds that are present in the sample. 1:1 HCL is the recommended preservative. Preserved samples must be analyzed within 14 days of collection; those that are not preserved must be analyzed within 7 days of collection.


Apparatus and Equipment:

1. Gastight micro-syringes – 1 to 1000 µL (various sizes)
2. 5-mL gastight syringes
3. Analytical balance, capable of accurately weighing ± 0.0001 g
4. Glassware
 - a. Class-A Volumetric flasks with ground-glass stopper
 - b. Vials, 1.5-mL, 15-mL, and 40-mL screw cap, with Teflon™/silicone septa
 - c. Mininert vials, 1 mL, 2 mL, and 5 mL

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5. Purge and trap device – Consisting of the sample purger, the trap, and desorber; the OI Analytical 4560, OI Analytical 4660, or equivalent meets the requirements of this method. The purging chamber must have the purge gas passing through the sample as finely divided bubbles and minimize the headspace between the sample and the trap to <15 mL.
6. Autosampler – OI Analytical 4551, OI Analytical 4552, Archon, or equivalent meets the requirements of this method.
7. Spiker unit – OI analytical Model 4551/4552 SAM/Spiker or equivalent. One or two automated syringe spikers can be added to the OI Analytical Model 4551/4552 autosampler to automatically introduce 1 µL of internal standard (ISTD), surrogate standard, and/or matrix spiking solutions to the sample as it is being transferred to the sparge vessel. The Archon has a groove that can deliver 1 µL of appropriate standards.
8. GC/MS system – The Agilent 5890GC/5972 MSD, Agilent 6890GC/5973MSD, Agilent 6890GC/5975MSD and Shimadzu GC/MS QP5000 meet the requirements for this method.
9. Data System/Computer/Software – this is interfaced to the GC/MS system that continuously acquires and stores data during the analysis, and can process/reduce data to generate the appropriate forms and supporting data. The software used for acquisition is HP Chemstation®, and data reduction is accomplished using Target® software.
10. GC Columns
 - a. Column 1 – 30M × 0.25 mm ID DB624 capillary column with a 1.4-µm film thickness from Agilent, or equivalent (to be used with the Shimadzu QP5000 or the Agilent 5972, 5973 and 5975 MSDs)

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- b. Column 2 – 20M × 0.18 mm ID DB624 capillary column with a 1.0-µm film thickness from Agilent, or equivalent (to be used with the Shimadzu QP5000 or the Agilent 5972, 5973 and 5975 MSDs)
- c. Column 3 – 20M × 0.18 mm ID DB-VRX capillary column with a 1.0-µm film thickness from Agilent, or equivalent (to be used with the Shimadzu QP5000 or the Agilent 5972, 5973 and 5975 MSDs)

NOTE: Refer to 1-P-QM-PRO-9015467 for instrumentation maintenance and troubleshooting.

Reagents and Standards:

A. Reagents

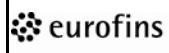
1. Reagent water is defined as water in which an interferent is not observed at or above the reporting limit for parameters of interest. In general, the deionized water supplied at the taps in the laboratory meets these criteria. If the reagent water does not meet the requirements, see your supervisor for further instructions.
2. Methanol, Purge and Trap Grade or equivalent.

B. Standards

See 1-P-QM-PRO-9015469 for standards traceability.

1. Stock standard solutions – Stock solutions must be prepared in methanol. Standards are prepared from ampulated and neat compounds obtained from suppliers that indicate the purity of the compound. No correction for purity is made if the purity is listed as ≥96%. Pre-made solutions can be used if the supplier documents the concentrations of the solutions. All ampulated standards are stored at -10° to -15°C until the expiration date indicated by the vendor or for 1 year if no expiration date is provided.


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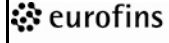
- a. For most of the target compounds, the stock standard solutions are purchased from a vendor as custom mixes (V for calibration and Q for separate source quality control). The internal and surrogate standards are purchased from a vendor, as well as the target compounds that are gases at room temperature. These gaseous standards have a 1-week expiration date, starting from the date they are opened.
- b. 8260A Surrogate standard spiking solution (8260SS) – a 2500 µg/mL stock standard solution of dibromofluoromethane, toluene-d₈, 4-bromofluorobenzene, and 1,2-dichloroethane-d₄ is prepared in methanol by a commercial supplier.
- c. 8260A Internal standard spiking solution (8260IS) – a 2500 µg/mL stock standard solution of fluorobenzene, chlorobenzene-d₅, 1,4-dichlorobenzene-d₄, and 12500 µg/mL deuterated tertiary butyl alcohol (tBA-d₁₀) is prepared in methanol by a commercial supplier. Deuterated tertiary butyl alcohol (tBA-d₁₀) is used sometimes as an auxiliary ISTD.

To prepare stock standards from neat compounds:

- (1) Place about 9.8 mL methanol or an equivalent solvent into a tared 10.0-mL glass-stoppered volumetric flask. Weigh the flask to the nearest 0.1 mg.
- (2) Add the liquids using a syringe or pipette by adding 2 or more drops of the assayed material to the flask, being careful that no drop hits the side of the flask. Reweigh the flask, record/note the amount, dilute to volume, stopper, and mix by inverting the flask at least 3 times. Calculate the concentration of the standard.

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- (3) The stock standard solutions are stored in Teflon™-sealed screw-capped vials at -10° to -15°C. The compound name, concentration, date prepared, and expiration date must appear on the bottle.
 - (4) Replace in-house prepared stock standard solutions every 6 months.
2. Secondary dilution standards - Using the stock standard solutions, prepare secondary stock solutions in methanol containing the desired compounds. These standards are prepared by calculating the volume of each stock standard required to produce a given volume of a mixed working standard with a known concentration of each analyte. When custom mixes are used, these are diluted down individually or combined together with other mixes. The working standard is tested according to 1-P-QM-PRO-9015469. The verified working standard is poured into Teflon-lined screw-capped GC vials or mininert vials and stored at -10° to -15°C. A designator indicating the standard, month, and day of preparation must be on the standard vials. The designator and the calculations for the working standard preparation are to be recorded in the standards logbook. Replace secondary dilution standards every 6 months unless otherwise indicated.
 - a. 1,4-Bromofluorobenzene (BFB) standard – Prepare a 50-µg/mL solution of BFB in methanol by diluting the stock standard (prepared from neat material) with methanol to a final volume of 100 mL. The volume of stock standard used varies depending on the actual stock concentration.
 - b. IS/SS spiking solution – Dilute 1 mL of 8260IS and 1 mL of 8260SS with methanol to 10-mL final volume (resulting in a concentration of 250 µg/mL, 1250 µg/mL for tBA-d10). This is assuming a 1-µL groove in the autosampler. If the groove is determined to be other than 1 µL, the standard preparation must be adjusted so that appropriate final concentration is obtained.

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- c. Calibration spiking solution – Prepare solutions in methanol that contain the compounds of interest at known concentrations. Suggested calibration levels are 4, 10, 20, 50, 100, and 300 ppb for 5-mL purge analysis. Suggested calibration levels are 0.5, 1, 2, 5, 10, and 25 ppb for 25-mL purge analysis. To help prevent confusion, a Theoretical Standard Concentration (TSC) sheet is filled out for all initial calibrations (see Figures 1 and 2). Replace calibration spiking solution every month.
- d. Matrix spiking solution – Prepare second source solutions in methanol that contain the compounds of interest at known concentrations. To help prevent confusion, a TSC sheet is filled out for all quality control samples (see Figures 4 and 5). These solutions serve as both the matrix spiking solution and the laboratory control sample solutions. Matrix spikes also serve as duplicates. Therefore, two aliquots of the same sample need to be spiked for analysis with these solutions. Replace matrix spiking solution every month.

Store all standard solutions at -10° to -15°C.

Preparation of Glassware:

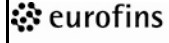
All glassware is cleaned according to 1-P-QM-PRO-9015465.

Calibration:

A. Instrument conditions

1. The purge and trap device must have the trap conditioned for at least 10 minutes at 180° to 220°C at a flow rate of 20 to 60 mL/min prior to initial use.

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2. An example of purge and trap conditions are listed below:

Purge Gas	Helium
Purge Flow	35 - 45 mL/min
Purge Temperature	40°C for 8260C waters
Purge Time	11 minutes
Desorb Temperature	190° - 220°C
Desorb Time	0.5 to 4 minutes **
Bake Temperature	180°-220°C
Bake Time	5 – 16 min

**Range as suggested by the purge and trap instrument manufacturer


NOTE: Purge and trap conditions are changed to optimize instrument operations. A record of actual purge and trap conditions for each instrument is found in the appropriate instrument maintenance log.

3. The suggested gas chromatographic operating conditions are listed in the table below, depending on the column used:

	<u>Column 1</u>	<u>Column 2</u>	<u>Column 3</u>
Column liquid phase	DB-624	DB-624	DB-VRX
Carrier gas	Helium	Helium	Helium
Carrier gas flow	0.8 mL/min	0.6 mL/min	0.6 mL/min
Make-up gas flow	None	None	None
Initial temperature	45°C	45°C	45°C
Initial hold time	4.5 min	2.5 min	4 min
Temperature ramp	12°/min until 100°C then 25°/min until 240°C	12°/min until 100°C then 25°/min until 235°C	25°/min until 60°C then 36°/min until 240°C
Final temperature	240°C	235°C	240°C
Final hold time	None	.02 min	1 min

4. The recommended mass spectrometer operating conditions are listed below:

Mass range:	35 – 300 amu
Scan time:	One scan cycle per second or less and resulting in at least five scans per chromatographic peak

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NOTE: It is not necessary to use the exact parameters listed above. Equivalent columns and conditions that give the performance required by the method are acceptable.

B. Tuning

Tune the GC/MS system to meet the criteria in Table 1 following a 50-ng injection of BFB. The chromatographic conditions must be the same as those under which the samples are analyzed except that the temperature ramp is increased and the initial temperature and flow rate is different. The BFB tune must be verified every 12 hours.

The tune must be evaluated by taking the average of the three scans across the BFB peak apex with a background subtraction of a scan within 20 scans prior to the start of the BFB peak.

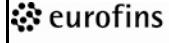
NOTE: All standards, samples, and associated quality control samples must be analyzed with the same MS parameters as those used to obtain a successful tune.

C. Initial calibration

1. The initial internal standard calibration consists of analyzing six distinct levels of analyte concentrations and producing response factors for each compound (six levels are required if second order regression fits are used). Refer to Figure 1 or 2 for the preparation of the calibration standards.

The relative standard deviation of the response factors determines the suitability of the average relative response factor for calculation of the analyte concentration.

NOTE: 5 levels of standard are required by the method.

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2. A method detection limit (MDL) standard must be analyzed with each initial calibration. This standard is prepared at or near the departmental MDL and is not to be included in the calibration curve. All compounds must be detected in the MDL standard. (See Figure 1 or 2 for the preparation information).

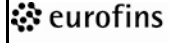
a. When using an OI 4552 or OI 4551 autosampler, the standards (including target and surrogate compounds) are prepared and poured into 40-mL vials with Teflon™-lined septa. A 5-mL or 25-mL aliquot is withdrawn from the vial by the autosampler. The aliquot is transferred through the spiker unit to add the IS/SS spiking solution and then transferred to the sparge vessel.

b. Purge and desorb according to Calibration A.

c. Collect GC/MS data until the end of the GC run.

d. Empty and rinse the purging chamber at least twice with reagent water prior to loading another sample into the vessel, to minimize the possibility of carryover contamination.

e. Each level is analyzed as described above. Next, tabulate the area response of the characteristic ions (Table 2) against concentration for each analyte, surrogate standard, and internal standard and calculate relative response factors (RRF) for each compound (see Calculation section). The calibration is valid for 12 hours from the injection of the BFB tune standard, at which time a new tune check and a continuing calibration check standard are evaluated prior to the analysis of additional samples. The following table describes the guidelines for an acceptable initial calibration:

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Frequency	Acceptance Criteria	Corrective Action
Initially and then when analytes in the daily calibration standard fail criteria.	<ol style="list-style-type: none"> 1. % RSD of $\leq 20\%$ is required for all analytes. 10% of the analytes may fail this criteria. 2. All compounds of interest must be detected in the MDL standard. 3. The relative retention times of the target compounds must agree within 0.06 relative retention time (RRT) units. The exception would be in the case of system maintenance. 4. Minimum response factors must be met for select compounds. See Table 3. 	<ol style="list-style-type: none"> 1. Any target analyte with a %RSD of $\leq 20\%$ must use the average RRF for quantitation. For any analyte in which the %RSD $> 20\%$, a first-degree linear regression can be used (providing that the correlation coefficient [CC] is ≥ 0.99). A quadratic fit ** (using 6 stds) can also be used (provided the coefficient of determination [CD] is ≥ 0.99). If the linear fit and quadratic fit pass the criteria for any given analyte, then use the line/curve with the smallest positive y-intercept. If the y-intercept quantifies to be greater than the LOQ, consult your supervisor immediately or recalibrate. If CC or CD is < 0.99, recalibrate. Supervisory approval is required for exceptions to these guidelines. If $> 10\%$ target analytes fail, recalibration is required. 2. If a compound is not detected in the MDL standard, then report to the level of the lowest standard detected. 3.-4. Perform system maintenance and recalibrate.

**Consult USEPA method 8000B for non-linear curve fitting techniques/guidelines

NOTE: If a linear fit is used for a compound, the lowest calibration standard point must be recalculated against the curve. The recalculated concentration must be within $\pm 30\%$ of the standard's true concentration. If this criteria is not met, notify a supervisor so that an alternate LOQ can be evaluated.

D. Following the calibration, an Initial Calibration Verification (ICV) standard must be run. The ICV is prepared according to the TSC sheet in Figures 3 and 5. The ICV acts as a second source standard to check against the initial calibration. All analytes must meet ICV acceptance windows of 70%-130%. If the ICV does not meet the aforementioned criteria, a second ICV is analyzed before invalidating the initial calibration. Upon failure of the second ICV, the system must be recalibrated after proper corrective action is taken.

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- E. Continuing calibration verification (CCV) – The CCV is performed by analyzing a CCV standard in subsequent tune periods after an initial calibration. The CCV is analyzed at 50 ppb for 5-mL purge waters and 5 ppb for 25-mL purge waters. The CCV is considered valid when the criteria listed below are met:

Frequency	Acceptance Criteria	Corrective Action
Every 12 hours.	<ol style="list-style-type: none"> 1. % Drift of $\leq 20\%$ is required for all analytes. 20% of analytes may fail this criteria if not detected in proceeding samples. 2. The relative retention times (RRT) of the target compounds must agree within 0.06 RRT units. The exception would be in the case of system maintenance. 3. The extracted ion current profile (EICP) area for each internal standard must fall within the window of -50% to $+100\%$ from the mid-level standard area produced during the last initial calibration. 4. Minimum response factors must be met for select compounds. See Table 3. 	1.-4. In the event that the continuing calibration verification (CCV) standard fails <u>any</u> of these criteria, sample analysis must be suspended and the CCV must be re-analyzed. If the re-analysis fails any of the criteria then adjustments are to be made to the analytical system to return it to its original condition, followed by the analyses of 2 consecutive CCVs at the same level that failed. If both CCVs pass the criteria, then sample analysis can continue. Otherwise, the system must be recalibrated and the samples reanalyzed, or the data can be qualified.

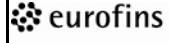
Procedure:

A. Method Blank:

Analyze the method blank as described above for the initial calibration standards. The method blank is examined for interfering peaks. Any target compound peaks are calculated as described under the Calculations section of this procedure. All

compounds must be less than the reporting limit for the associated samples. If the blank values exceed these values, corrective action must be taken and the method blank reanalyzed until the criteria are met.

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B. Laboratory Control Sample/ Duplicate and Matrix Spike/Duplicate: Refer to table in QA/QC section for specific requirements.

C. Qualitative analysis

A compound is identified by comparison of the following parameters with those of a standard of this suspected compound (standard reference spectra). In order to verify identification, the following criteria must be met:

1. The intensities of the characteristic ions of the compound must maximize in the same scan or within one scan of each other.
2. The compound relative retention time must compare within ± 0.06 RRT units of the RRT of the standard.
3. The characteristic ions from the reference mass spectrum are defined to be the three ions of greatest relative intensity, or any ions over 30% relative intensity if less than three such ions occur in the reference spectrum.
4. The relative intensities of the characteristic ions must agree within 30% of the relative intensities of these ions in the reference spectrum. Analyst discretion is used to determine compound identification. (Example: for an ion with an abundance of 50% in the reference spectrum, the corresponding abundance in a sample spectrum can range between 20% and 80%).
5. The above criteria apply to hits greater than or equal to the LOQ. For hits between the MDL and the LOQ, both the criteria listed above and the analyst's discretion is used to determine compound identification.

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6. The analyst must account for peaks that are greater than 10% relative intensity in the sample mass spectrum, but not present in the standard mass spectrum. Also, if a compound fails any of the criteria listed above but in the judgment of the mass spectral interpretation specialist is a correct identification, the identification is used and the quantitation of the peak is performed.

The primary and secondary ions for the target compounds can be found in Table 2.

D. Quantitative analysis

Once a compound has been identified, quantitation is based on the internal standard technique and the integrated area from the extracted ion current profile (EICP) of the primary characteristic ion. The list of primary characteristic ions is listed in Table 2.


E. Sample Analysis

A 5-mL or 25-mL aliquot of the sample is analyzed using the same instrumental conditions as the standard (whether ICAL or CCV), tune and method blank. If the QA criteria are satisfied and no target compounds are detected at concentrations above the calibration range, the results can be reported. To avoid possible matrix effects, sample carryover and re-analyses, an initial dilution is performed if:

1. Prescreening indicates a high volatile organic content in the sample
2. Historical data (or lack thereof) and/or sample appearance indicate a need for dilution

If target compounds are detected in the sample at concentrations above the calibration range, a dilution must be performed (See 1-P-QM-PRO-9015470 for information on when cleaning blanks must be run). See Section 11.5.6 in method SW-846 8260C for recommended dilution procedures.

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Calculations:

A. Calibration calculations

1. Calculation of the relative response factor (RRF):

$$RRF = \frac{[A(x) \times C(is)]}{[A(is) \times C(x)]}$$

Where:

A(x) = Characteristic ion area for the compound being measured

A(is) = Characteristic ion area for the specific internal standard

C(x) = Concentration of the compound being measured

C(is) = Concentration of specific internal standard

2. Regression equations:

1st Order (linear) regression: $Y = Mx + B$

2nd order (quadratic) regression: $Y = Cx^2 + Mx + B$

Where:

x = Area(Std) / Area(Istd)

Y = Conc.(Std)/Conc.(Istd)


M = 1st degree slope

C = 2nd degree slope

B = Y-intercept

3. Percent relative standard deviation (%RSD):

$$\%RSD = \frac{\text{Standard Deviation}}{\text{Mean}} \times 100$$

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4. Calculation of the percent drift:

$$\% \text{ Drift} = \frac{C(i) - C(c)}{C(i)} \times 100$$

Where:

C(i) = Calibration check compound standard concentration

C(c) = Measured concentration using selected quantification method

B. QA Calculations:

1. Calculation of percent recovery

$$\% \text{ Recovery} = \frac{SSR - SR}{SA} \times 100$$

Where:

SSR = Spiked sample result

SR = Sample result

SA = Spike added

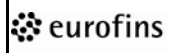
2. Relative percent difference (RPD)

$$RPD = \frac{MSR - MSDR}{(1/2)(MSR + MSDR)} \times 100$$

Where:

MSR = Matrix spike measured concentration

MSDR = Matrix spike duplicate measured concentration

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C. Analyte concentration

$$Concentration (\mu g/L) = \frac{(A_x)(I_s)}{(A_{is})(RRF)}$$

Where:

A_x = Area of the quantitation ion peak for the compound to be measured

A_{is} = Area of the quantitation ion peak for the appropriate internal standard

I_s = Concentration of internal standard added in µg/L

RRF = Relative response factor from the initial calibration

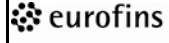
Statistical Information/Method Performance:

The LCS must contain 80% to 100% of the compounds in the calibration mix. LCS, MS, and surrogate recoveries and RPD are compared to the limits stored on the LIMS. These limits are statistically derived but must fall within 70% to 130% recovery for South Carolina compliance samples. Historical data for MS/Ds, LCS/Ds, measurement of uncertainty, is reviewed at least annually. Reporting limits including method detection limits (MDLs) and limits of quantitation (LOQs) are set according to EPA method requirements and are evaluated annually. Refer to 1-P-QM-QMA-9017309 for specific guidelines and procedures. Updates to the LIMS are made as needed by the QA Department and only as directed by the supervisor. The department database is updated via a download from the LIMS.

Quality Assurance/Quality Control:


Each analysis batch (consisting of no more than 20 samples) must contain a method blank, a laboratory control sample (LCS), and either an unspiked background sample (US), a matrix spike (MS), a matrix spike duplicate (MSD), a laboratory control sample/laboratory control sample duplicate (LCS/LCSD) or a duplicate (DUP). The LCS serves as a 2nd source standard verification of the initial calibration (ICAL). Additional

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QC samples are required to meet project or state certification requirements. Every sample or QC analysis must contain internal standards and surrogate compounds at a concentration of 50 µg/L for a 5-mL purge or 10 µg/L for a 25-mL purge.

Quality Control Item	Acceptance Criteria	Corrective Action
Internal Standards Added to every sample, standard, method blank and QC sample	1. <i>Peak areas within -50% to +100% of the area in the associated reference standard.</i> 2. Retention time (RT) within 30 seconds of RT for associated reference standard.	1. Check instrument for possible problems and then reanalyze samples. 2. If re-injecting meets the criteria, report this analysis. 3. If this reanalysis still shows the same problem, report results from first analysis and qualify data with a comment.
Surrogates Added to every sample, standard, method blank and QC sample	All % recoveries must fall within statistically derived QC limits, which are evaluated on a semi-annual basis.	If non-compliant, check for calculation or preparation errors. If no errors are found, check system for problems and reanalyze. If this reanalysis still shows the same problem, report first analysis and qualify data with a comment. If recoveries are outside of specification high and no target compounds are detected, then a reanalysis or comment is not required.
Method Blank (MB) Performed during each tune period after the initial calibration or CCV (minimum of 1 MB per 20 samples)	1. Must meet internal standard criteria. 2. Must meet surrogate criteria. 3. Quantitative results for all target compounds must be less than the reporting limit for the associated samples.	1.-2. Inspect system for possible problems and reanalyze. 3. If the MB contains target analytes and the associated samples do not, then no corrective action is required. If the target compounds in the MB are also in the associated samples, then they must be reanalyzed after a clean MB is obtained (certain projects may allow some exceptions for common laboratory contaminants like methylene chloride and acetone up to 5X the LOQ)
Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) LCS analyzed with each batch of ≤ 20 samples LCSD analyzed if MS/MSD unavailable See Figures 4 and 5 for preparation info.	1. Must meet internal standard criteria. 2. Must meet surrogate criteria. 3. All % recoveries must fall within statistically derived QC limits, which are evaluated on a semi-annual basis.	1.-2. If non-compliant, check for calculation or preparation errors. If no errors found, check system for problems and reanalyze. 3. If LCS/LCSD re-analysis still fails, perform appropriate system maintenance and restart the tune period. Only with a LCS % recovery failing high (for the requested target compounds) with targets non-detected in the sample, can the results be <u>reported</u> . Otherwise, the sample must be analyzed with a compliant LCS.

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Quality Control Item	Acceptance Criteria	Corrective Action
Matrix Spike/Matrix Spike Duplicate (MS/MSD) MS/MSD analyzed with each batch of ≤ 20 samples (if sufficient sample volume available) See Figures 4 and 5 for preparation info.	1. % Recoveries must fall within statistically derived QC limits, which are evaluated on a semi-annual basis 2. RPDs within QC limits.	1. If LCS within QC limits, proceed with sample analysis. 2. If most recoveries and/or RPDs outside of QC limits, consult the supervisor.

NOTE: Prior to release from the analytical laboratory, all data is reviewed in accordance with 1-P-QM-PRO-9015471 or 1-P-QM-PRO-9017810 (dual purge and trap).

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Attachment I

Gasoline Range Organics (GRO) by Gas Chromatography/Mass Spectroscopy (GC/MS)

This section is specific to the steps required for GRO analysis. See the main body of the SOP for general information/ processes.

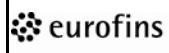
Basic Principles:

The GRO analysis is typically performed in conjunction with the analysis of other volatile target compounds by SW-846 Method 8260C. The GRO quantitation range is 0.1 minutes before the peak apex of C6 (hexane) to 0.2 minutes after the peak apex of C12 (dodecane); however, other ranges can be established. By establishing a (C12) GRO window to 0.2 minutes following the elution of dodecane, the areas from a trio of unresolved peaks eluting near to the upper limit of the range must consistently be included in the total GRO area. In addition, the range remains tight enough to ensure that no C13 or greater compounds can be included in the total GRO area. The C4 range retention time is determined by selecting the first peak after the air and/or artifact peak minus 0.1 minutes in the first standard analyzed in the ICAL. This analysis must be performed by or under the direct supervision of an operator experienced in the analysis of volatile organics by GC/MS purge and trap methodologies. The area of the total ion chromatogram for the GRO range is determined. The area of the internal standards and surrogate standards are found and subtracted from the total area of the chromatogram within the desired time range. The resulting area is then quantitated versus the internal standard, fluorobenzene.

Interferences:

See main body of SOP.

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Safety Precautions and Waste Handling:

See main body of SOP.

Personnel Training and Qualifications:

See main body of SOP.

NOTE: A separate Demonstration of Capability for GRO is required.

Sample Collection, Preservation, and Handling:

See main body of SOP.

Apparatus and Equipment:

See main body of SOP.

Reagents and Standards:


A. Reagents- See main body of SOP.

B. Standards- See main body of SOP for general standards.

1. GRO calibration standard – a 5500-µg/mL stock unleaded gasoline composite prepared in methanol by a commercial supplier.
2. GRO QC standard – a 20,000-µg/mL stock unleaded gasoline composite prepared in methanol by a commercial supplier

Store all standard solutions at -10° to -15°C

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Calibration:

A. Initial calibration:

Prior to the analysis of any calibration level, retention time markers must be run for the GRO range of interest. The retention time markers are hexane (C6) and Dodecane (C12). Other markers can be used if different ranges are required by a project.

Internal standard calibration for GRO consists of analyzing six distinct levels of GRO area in order to produce a response factor for the GRO quantitation range of interest using the internal standard, fluorobenzene. The relative standard deviation of the response factor determines the suitability of the average relative response factor for calculation of the GRO concentration.

NOTE: 5 levels of standard are required by the method.

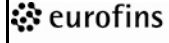
1. Prepare the calibration standards at appropriate levels. Suggested calibration levels are 44, 110, 550, 1100, 2200, and 4400 ppb.

To prevent confusion and assure proper calibration, a Theoretical Standard Concentration (TSC) sheet is completed for each calibration (Figure 6). The TSC sheet contains the theoretical concentration for each certified analyte in the calibration at the various levels.

2. Each level is analyzed as described in the procedure under data analysis. Next, tabulate the area response for the GRO quantitation range minus the peak areas for the internal and surrogate standards that elute within the GRO range. Calculate the relative response factor (RRF) for GRO (see Calculation section) using the internal standard peak area for fluorobenzene.

NOTE: Although four internal standard compounds are spiked for the 8260B analysis, only one, fluorobenzene, is used for the quantitation of the GRO result.

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3. Calculate the average relative response factors for the GRO quantitation range of interest. The calibration levels are evaluated on the basis of the relative standard deviation of the RRF values (%RSD). The %RSD for the GRO range of interest must be $\leq 20\%$. If the calibration meets this requirement then the average RRF is used to calculate sample concentrations. If the %RSD is $> 20\%$ then re-analysis of one or more levels can be necessary before the calibration is valid.

B. Initial Calibration Verification (ICV):

Following the calibration, an Initial Calibration Verification (ICV) standard must be run. The ICV is prepared according to the TSC sheet in Figure 6 (QC prep). The ICV acts as a second source standard to check against the initial calibration. Results must quantitate within the 70-130% window. If the ICV does not meet the aforementioned criteria, a second ICV can be run before invalidating the initial calibration. Upon failure of the second ICV, the system must be recalibrated after proper corrective action is taken.

C. Continuing calibration verification (CCV):

The CCV involves an analysis for the 1100-ppb standard. The calibration is considered valid if the percent drift is $\leq 20\%$. Also, the internal standard peak area of fluorobenzene for the CCV is monitored against the mid-point standard of the initial calibration and must be -50% to $+100\%$ of the area counts. If any criteria listed above fails, the CCV is considered invalid. In the case where two consecutive CCVs fail, corrective action must be taken which can include re-analysis of the calibration check, instrument maintenance, and/or recalibration. If the criteria are met, the selected quantitation method from the initial calibration is used for blank and sample calculations until the end of the 12-hour period.

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Procedure:

Samples must be analyzed in accordance with the analyses listed in the main body of this SOP. However, additional requirements are required for the GRO data analysis.

- A. The Total Ion Chromatogram (TIC) is reviewed to insure proper integration around the 8260 surrogates and internal standards. Also the TIC is checked to make sure all major peaks are integrated.
- B. The quantitation of the GRO range is performed using the equations listed in the Calculations section of this procedure. All calculations must report concentrations in values of µg/L. In the case where the total GRO concentration exceeds the calibration range, the sample is re-analyzed at a dilution that brings the GRO concentration within the calibration range of the GC/MS system.

Calculations:

See main body of SOP.

Statistical Information/Method Performance:

See main body of SOP.

Quality Assurance/Quality Control:

See main body of SOP.


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Table 1

BFB Key Ion Abundance Criteria

<u>Mass</u>	<u>Ion Abundance Criteria</u>
50	15% to 40% of mass 95
75	30% to 60% of mass 95
95	base peak, 100% relative abundance
96	5% to 9% of mass 95
173	less than 2% of mass 174
174	greater than 50% of mass 95
175	5% to 9% of mass 174
176	greater than 95% but less than 101% of mass 174
177	5% to 9% of mass 176

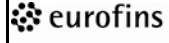
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Table 2
Primary and Secondary Ions

Compound Name	Primary Ion	Secondary Ion
Chloromethane	50	52
Vinyl Chloride	62	64
Bromomethane	94	96
Chloroethane	64	66
1,1-Dichloroethene	96	61, 63
Acetone	43	58
Carbon Disulfide	76	78
Methylene Chloride	84	49, 86
1,1-Dichloroethane	63	65, 83
<i>trans</i> -1,2-Dichloroethene	96	61, 63
<i>cis</i> -1,2-Dichloroethene	96	61, 63
2-Butanone	43	72
Chloroform	83	85
1,2-Dichloroethane	62	98
1,1,1-Trichloroethane	97	61, 99
Carbon Tetrachloride	117	119
Benzene	78	
Trichloroethene	95	130, 132
1,2-Dichloropropane	63	76
Bromodichloromethane	83	85
<i>cis</i> -1,3-Dichloropropene	75	77, 110
<i>trans</i> -1,3-Dichloropropene	75	77, 110
1,1,2-Trichloroethane	97	83, 85
Dibromochloromethane	129	127
Bromoform	173	175
4-Methyl-2-pentanone	43	58
Toluene	92	91
Tetrachloroethene	166	131, 164
2-Hexanone	43	58
Chlorobenzene	112	77
Ethylbenzene	91	106
Xylene (total)	106	91
Styrene	104	78
1,1,2,2-Tetrachloroethane	83	85, 131
Dibromofluoromethane	113	111
1,2-Dichloroethane-d4	102	104
Fluorobenzene	96	70
Toluene-d8	98	100
Chlorobenzene-d5	117	82
4-Bromofluorobenzene	95	174
1,4-Dichlorobenzen-d4	152	115

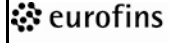
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Table 3
Minimum Relative Response Factors For ICAL and CCV

Volatile Compounds	Minimum Response Factor
Dichlorodifluoromethane	0.100
Chloromethane	0.100
Vinyl Chloride	0.100
Bromomethane	0.100
Chloroethane	0.100
Trichlorofluoromethane	0.100
1,1-Dichloroethene	0.100
1,1,2-Trichloro-1,2,2-trifluoroethane	0.100
Acetone	0.100
Carbon Disulfide	0.100
Methyl Acetate	0.100
Methylene Chloride	0.100
trans-1,2-Dichloroethene	0.100
cis-1,2-Dichloroethene	0.100
Methyl tert-Butyl Ether	0.100
1,1-Dichloroethane	0.200
2-Butanone	0.100
Chloroform	0.200
1,1,1-Trichloroethane	0.100
Cyclohexane	0.100
Carbon Tetrachloride	0.100
Benzene	0.500
1,2-Dichloroethane	0.100
Trichloroethene	0.200
Methylcyclohexane	0.100
1,2-Dichloropropane	0.100
Bromodichloromethane	0.200
cis-1,3-Dichloropropene	0.200
trans-1,3-Dichloropropene	0.100
4-Methyl-2-pentanone	0.100
Toluene	0.400
1,1,2-Trichloroethane	0.100
Tetrachloroethene	0.200
2-Hexanone	0.100
Dibromochloromethane	0.100
1,2-Dibromoethane	0.100
Chlorobenzene	0.500
Ethylbenzene	0.100

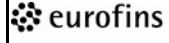
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Table 3 Continued

Volatile Compounds	Minimum Response Factor
m&p-Xylene	0.100
o-Xylene	0.300
Styrene	0.300
Bromoform	0.100
Isopropylbenzene	0.100
1,1,2,2-Tetrachloroethane	0.300
1,3-Dichlorobenzene	0.600
1,4-Dichlorobenzene	0.500
1,2-Dichlorobenzene	0.400
1,2-Dibromo-3-chloropropane	0.050
1,2,4-Trichlorobenzene	0.200

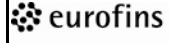
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Figure 1

Theoretical Standard Concentrations
Initial Calibration for Large Curve
Purchased Standards
EPA SW846 Method 8260C

Date: _____
Instrument: _____

VOA1= 1:5 dilution of VCS#1B, VCS#2B, and VCS#4C

VOA2= 1:5 dilution of VCS#2B

VOA6= 1:5 dilution of VCS#6

VOA3= 1:5 dilution of VCS#3B and Vacrolein

2CEVE= 1:5 dilution of VCS#1B-2CEVE

Stock mix name	VOA1 2CEVE 1,3-BUT	VOA3	VOA2	VOA6 EE Custom Freon V	n-PEN	CYC	EOH	Restek Gases (2000 ppm) Lt#		Flask mL
300 ppb std	15 µL	6 µL		15µL	15 µL	30 µL	30 µL	7.5 µL		50
100 ppb std	5 µL	2 µL		5 µL	5 µL	10 µL	10 µL	2.5 µL		50
50 ppb std	5 µL	2 µL		5 µL	5 µL	10 µL	10 µL	2.5 µL		100
20 ppb std	4 µL	1.6 µL	4 µL	4 µL	4 µL	16 µL	16 µL	2.0 µL		200
10 ppb std	2 µL	0.8 µL	2 µL	2 µL	2 µL	8 µL	8 µL	1.0 µL		200
4 ppb std	4 µL	1.6 µL	12 µL	4 µL	4 µL	32 µL	20 µL	2.0 µL		1000 *
1 ppb std	* Aliquot 12.5 mL of 1000 mL flask into 50 mL flask									
							EOH	Custom UST V MIX w/OXY Lt#		
4 ppb std for 0.5ppb MDL							32 µL	2.0 µL		1000 +
0.5 ppb std	+ Aliquot 12.5 mL of 1000 mL flask into 100 mL flask									

Compound name	std mix	Stock ppm	300 ppb	100 ppb	50 ppb	20 ppb	10 ppb	4 ppb	1 ppb
Benzene	CS#1B	5000	300	100	50	20	10	4	1
Bromobenzene		5000	300	100	50	20	10	4	1
Bromodichloromethane		5000	300	100	50	20	10	4	1
Bromoform		5000	300	100	50	20	10	4	1
n-Butylbenzene		5000	300	100	50	20	10	4	1
sec-Butylbenzene		5000	300	100	50	20	10	4	1
tert-Butylbenzene		5000	300	100	50	20	10	4	1
Carbon Tetrachloride		5000	300	100	50	20	10	4	1
Chlorobenzene		5000	300	100	50	20	10	4	1
Chloroform		5000	300	100	50	20	10	4	1
2-Chlorotoluene		5000	300	100	50	20	10	4	1
4-Chlorotoluene		5000	300	100	50	20	10	4	1
Dibromochloromethane		5000	300	100	50	20	10	4	1
1,2-Dibromo-3-chloropropane		5000	300	100	50	20	10	4	1
1,2-Dibromoethane (EDB)		5000	300	100	50	20	10	4	1
Dibromomethane		5000	300	100	50	20	10	4	1
1,2-Dichlorobenzene		5000	300	100	50	20	10	4	1
1,3-Dichlorobenzene		5000	300	100	50	20	10	4	1
1,4-Dichlorobenzene		5000	300	100	50	20	10	4	1

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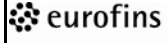
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Figure 1 Continued

Theoretical Standard Concentrations
Initial Calibration for Large Curve
Purchased Standards
EPA SW846 Method 8260C

Compound name	std mix	Stock ppm	300 ppb	100 ppb	50 ppb	20 ppb	10 ppb	4 ppb	1 ppb
1,1-Dichloroethane	CS#1B	5000	300	100	50	20	10	4	1
1,2-Dichloroethane		5000	300	100	50	20	10	4	1
1,1-Dichloroethene		5000	300	100	50	20	10	4	1
cis-1,2-Dichloroethene		5000	300	100	50	20	10	4	1
trans-1,2-Dichloroethene		5000	300	100	50	20	10	4	1
1,2-Dichloropropane		5000	300	100	50	20	10	4	1
1,3-Dichloropropane		5000	300	100	50	20	10	4	1
2,2-Dichloropropane		5000	300	100	50	20	10	4	1
1,1-Dichloropropene		5000	300	100	50	20	10	4	1
cis-1,3-Dichloropropene		5000	300	100	50	20	10	4	1
trans-1,3-Dichloropropene		5000	300	100	50	20	10	4	1
Ethylbenzene		5000	300	100	50	20	10	4	1
Hexachlorobutadiene		5000	300	100	50	20	10	4	1
Isopropylbenzene (Cumene)		5000	300	100	50	20	10	4	1
p-Isopropyltoluene		5000	300	100	50	20	10	4	1
Methylene Chloride		5000	300	100	50	20	10	4	1
Naphthalene		5000	300	100	50	20	10	4	1
n-Propylbenzene		5000	300	100	50	20	10	4	1
Styrene		5000	300	100	50	20	10	4	1
1,1,1,2-Tetrachloroethane		5000	300	100	50	20	10	4	1
1,1,2,2-Tetrachloroethane		5000	300	100	50	20	10	4	1
Tetrachloroethene		5000	300	100	50	20	10	4	1
Toluene		5000	300	100	50	20	10	4	1
1,2,3-Trichlorobenzene		5000	300	100	50	20	10	4	1
1,2,4-Trichlorobenzene		5000	300	100	50	20	10	4	1
1,3,5-Trichlorobenzene		5000	300	100	50	20	10	4	1
1,1,1-Trichloroethane		5000	300	100	50	20	10	4	1
1,1,2-Trichloroethane		5000	300	100	50	20	10	4	1
Trichloroethene		5000	300	100	50	20	10	4	1
1,2,3-Trichloropropane		5000	300	100	50	20	10	4	1
1,2,4-Trimethylbenzene		5000	300	100	50	20	10	4	1
1,3,5-Trimethylbenzene		5000	300	100	50	20	10	4	1
m-Xylene		5000	300	100	50	20	10	4	1
o-Xylene		5000	300	100	50	20	10	4	1
p-Xylene		5000	300	100	50	20	10	4	1
Pentachloroethane	CS#6	5000	300	100	50	20	10	4	1
Allyl Chloride		5000	300	100	50	20	10	4	1
Bromochloromethane		5000	300	100	50	20	10	4	1
Methyl Acetate		5000	300	100	50	20	10	4	1
Methylcyclohexane		5000	300	100	50	20	10	4	1
2-Methylnaphthalene		5000	300	100	50	20	10	4	1
1,2,3-Trimethylbenzene		5000	300	100	50	20	10	4	1
1,2-Diethylbenzene		5000	300	100	50	20	10	4	1
1,3-Diethylbenzene		5000	300	100	50	20	10	4	1
1,4-Diethylbenzene		5000	300	100	50	20	10	4	1

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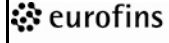
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Figure 1 Continued

Theoretical Standard Concentrations
Initial Calibration for Large Curve
Purchased Standards
EPA SW846 Method 8260C

Compound name	Std mix	Stock ppm	300 ppb	100 ppb	50 ppb	20 ppb	10 ppb	4 ppb	1 ppb
Methacrylonitrile	CS#2B	12500	750	250	125	100	50	40	10
Propionitrile		25000	1500	500	250	200	100	80	20
trans-1,4-Dichloro-2-Butene		12500	750	250	125	100	50	40	10
t-Butyl Alcohol		25000	1500	500	250	200	100	80	20
2-Propanol		25000	1500	500	250	200	100	80	20
Isobutyl Alcohol		62500	3750	1250	625	500	250	200	50
n-Butanol		125000	7500	2500	1250	1000	500	400	100
1,4-Dioxane		62500	3750	1250	625	500	250	200	50
2-Butanone	CS#3B	25000	600	200	100	40	20	8	2
2-Hexanone		25000	600	200	100	40	20	8	2
4-Methyl-2-Pentanone		25000	600	200	100	40	20	8	2
Acetone		25000	600	200	100	40	20	8	2
Acrylonitrile		12500	300	100	50	20	10	4	1
2-Nitropropane		25000	600	200	100	40	20	8	2
Tetrahydrofuran		25000	600	200	100	40	20	8	2
Methyl-t-butyl Ether	CS#4C	5000	300	100	50	20	10	4	1
Ethyl Methacrylate		5000	300	100	50	20	10	4	1
Methyl Methacrylate		5000	300	100	50	20	10	4	1
Freon 113		5000	300	100	50	20	10	4	1
Hexane		5000	300	100	50	20	10	4	1
Heptane		5000	300	100	50	20	10	4	1
Cyclohexane		5000	300	100	50	20	10	4	1
Benzyl Chloride		5000	300	100	50	20	10	4	1
Methyl Iodide		5000	300	100	50	20	10	4	1
Carbon Disulfide		5000	300	100	50	20	10	4	1
2-Chloro-1,3-Butadiene		5000	300	100	50	20	10	4	1
di-Isopropyl Ether		5000	300	100	50	20	10	4	1
tert-Amyl Methyl Ether		5000	300	100	50	20	10	4	1
Ethyl-t-butyl Ether		5000	300	100	50	20	10	4	1
Bromomethane	Gas mix	2000	300	100	50	20	10	4	1
Chloroethane		2000	300	100	50	20	10	4	1
Chloromethane		2000	300	100	50	20	10	4	1
Dichlorodifluoromethane		2000	300	100	50	20	10	4	1
Trichlorofluoromethane		2000	300	100	50	20	10	4	1
Vinyl Chloride		2000	300	100	50	20	10	4	1
Cyclohexanone	CYC	6250	3750	1250	625	500	250	200	50
2-Chloroethyl Vinyl Ether	2CEVE	5000	300	100	50	20	10	4	1
1,3-Butadiene	1,3-BUT	1000	300	100	50	20	10	4	1

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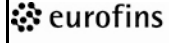
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Figure 1 Continued

Theoretical Standard Concentrations
Initial Calibration for Large Curve
Purchased Standards
EPA SW846 Method 8260C

Compound name	std mix	Stock ppm	300 ppb	100 ppb	50 ppb	20 ppb	10 ppb	4 ppb	1 ppb	0.5 ppb
Acrolein	VACR	125000	3000	1000	500	200	100	40	10	
Ethyl Ether	EE	1000	300	100	50	20	10	4	1	
n-Pentane	n-PEN	1000	300	100	50	20	10	4	1	
Freon 123a	Custom	1000	300	100	50	20	10	4	1	
Dichlorofluoromethane	Freon V	1000	300	100	50	20	10	4	1	
Ethanol	EOH	12500	7500	2500	1250	1000	500	250	62.5	50
Benzene	UST V	2000	--	--	--	--	--	--	--	0.5
Bromoform	Mix w/	2000	--	--	--	--	--	--	--	0.5
Chlorobenzene	Oxy	2000	--	--	--	--	--	--	--	0.5
Chloroform		2000	--	--	--	--	--	--	--	0.5
Chloromethane		2000	--	--	--	--	--	--	--	0.5
1,2-Dibromoethane		2000	--	--	--	--	--	--	--	0.5
1,1-Dichloroethane		2000	--	--	--	--	--	--	--	0.5
1,2-Dichloroethane		2000	--	--	--	--	--	--	--	0.5
1,1-Dichloroethene		2000	--	--	--	--	--	--	--	0.5
1,2-Dichloropropane		2000	--	--	--	--	--	--	--	0.5
Ethylbenzene		2000	--	--	--	--	--	--	--	0.5
Isopropylbenzene		2000	--	--	--	--	--	--	--	0.5
Methyl-t-butyl Ether		2000	--	--	--	--	--	--	--	0.5
Naphthalene		2000	--	--	--	--	--	--	--	0.5
1,1,2,2-Tetrachloroethane		2000	--	--	--	--	--	--	--	0.5
Toluene		2000	--	--	--	--	--	--	--	0.5
Vinyl Chloride		2000	--	--	--	--	--	--	--	0.5
m+p-Xylene		4000	--	--	--	--	--	--	--	1.0
o-Xylene		2000	--	--	--	--	--	--	--	0.5
Isopropyl ether (dIPE)		2000	--	--	--	--	--	--	--	0.5
tert-Amyl methyl ether		2000	--	--	--	--	--	--	--	0.5
Ethyl-tert-butyl ether		2000	--	--	--	--	--	--	--	0.5
Tert-Butanol (tBA)		10000	--	--	--	--	--	--	--	2.5

ppb of analytical standard = (stock ppm)(μ L stock) / flask mL

Analyst: _____

Date: _____

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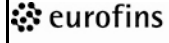
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Figure 2

Theoretical Standard Concentrations
Initial Calibration for Large Curve
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C
25 mL Purge

Date: _____
Instrument: _____

RV4MIX1 = 50 µl VOA1 + 100 µl VOA3 + 150 µl VOA2 + 700 µl MeOH
RV4MIX2 = 50 µl VOA6 + 50 µl EE + 50 µl 13BUT + 850 µl MeOH
RV4GAS = 25 µl Restek 502.2 Mix1 (2000ppm) + 50 µl Restek Custom V Freon Std + 925 µl MeOH
VOA1= 1:5 dilution of VCS#1B, VCS#2B, and VCS#4C
VOA2= 1:5 dilution of VCS#2B
VOA3= 1:5 dilution of VCS#3B and Vaeolein
VOA6= 1:5 dilution of VCS#6
2CEVE= 1:5 dilution of VCS#1B-2CEVE

Stock mix name	RV4MIX1 RV4GAS	RV4MIX2								Flask ml
25 ppb std	25 µl	25 µl								50
10 ppb std	10 µl	10 µl								50
5 ppb std	5 µl	5 µl								50
2 ppb std	2 µl	2 µl								50
1 ppb std	2 µl	2 µl								100
.5 ppb std	2 µl	2 µl								200
.1 ppb std	1 µl	1 µl								500
	Std mix	Stock ppm	25 ppb	10 ppb	5 ppb	2 ppb	1 ppb	.5 ppb	.1 ppb	
Benzene	CS#1B	5000	25	10	5	2	1	.5	.1	
Bromobenzene		5000	25	10	5	2	1	.5	.1	
Bromodichloromethane		5000	25	10	5	2	1	.5	.1	
Bromoform		5000	25	10	5	2	1	.5	.1	
n-Butylbenzene		5000	25	10	5	2	1	.5	.1	
sec-Butylbenzene		5000	25	10	5	2	1	.5	.1	
tert-Butylbenzene		5000	25	10	5	2	1	.5	.1	
Carbon Tetrachloride		5000	25	10	5	2	1	.5	.1	
Chlorobenzene		5000	25	10	5	2	1	.5	.1	
Chloroform		5000	25	10	5	2	1	.5	.1	
2-Chlorotoluene		5000	25	10	5	2	1	.5	.1	
4-Chlorotoluene		5000	25	10	5	2	1	.5	.1	
Dibromochloromethane		5000	25	10	5	2	1	.5	.1	
1,2-Dibromo-3-chloropropane		5000	25	10	5	2	1	.5	.1	
1,2-Dibromoethane (EDB)		5000	25	10	5	2	1	.5	.1	
Dibromomethane		5000	25	10	5	2	1	.5	.1	
1,2-Dichlorobenzene		5000	25	10	5	2	1	.5	.1	
1,3-Dichlorobenzene		5000	25	10	5	2	1	.5	.1	
1,4-Dichlorobenzene		5000	25	10	5	2	1	.5	.1	

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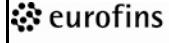
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Figure 2 Continued

Theoretical Standard Concentrations
Initial Calibration for Large Curve
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C

Compound name	std mix	Stock ppm	25 ppb	10 ppb	5 ppb	2 ppb	1 ppb	.5 ppb	.1 ppb
1,1-Dichloroethane	CS#1B	5000	25	10	5	2	1	.5	.1
1,2-Dichloroethane		5000	25	10	5	2	1	.5	.1
1,1-Dichloroethene		5000	25	10	5	2	1	.5	.1
cis-1,2-Dichloroethene		5000	25	10	5	2	1	.5	.1
trans-1,2-Dichloroethene		5000	25	10	5	2	1	.5	.1
1,2-Dichloropropane		5000	25	10	5	2	1	.5	.1
1,3-Dichloropropane		5000	25	10	5	2	1	.5	.1
2,2-Dichloropropane		5000	25	10	5	2	1	.5	.1
1,1-Dichloropropene		5000	25	10	5	2	1	.5	.1
cis-1,3-Dichloropropene		5000	25	10	5	2	1	.5	.1
trans-1,3-Dichloropropene		5000	25	10	5	2	1	.5	.1
Ethylbenzene		5000	25	10	5	2	1	.5	.1
Hexachlorobutadiene		5000	25	10	5	2	1	.5	.1
Isopropylbenzene (Cumene)		5000	25	10	5	2	1	.5	.1
p-Isopropyltoluene		5000	25	10	5	2	1	.5	.1
Methylene Chloride		5000	25	10	5	2	1	.5	.1
Naphthalene		5000	25	10	5	2	1	.5	.1
n-Propylbenzene		5000	25	10	5	2	1	.5	.1
Styrene		5000	25	10	5	2	1	.5	.1
1,1,1,2-Tetrachloroethane		5000	25	10	5	2	1	.5	.1
1,1,2,2-Tetrachloroethane		5000	25	10	5	2	1	.5	.1
Tetrachloroethene		5000	25	10	5	2	1	.5	.1
Toluene		5000	25	10	5	2	1	.5	.1
1,2,3-Trichlorobenzene		5000	25	10	5	2	1	.5	.1
1,2,4-Trichlorobenzene		5000	25	10	5	2	1	.5	.1
1,3,5-Trichlorobenzene		5000	25	10	5	2	1	.5	.1
1,1,1-Trichloroethane		5000	25	10	5	2	1	.5	.1
1,1,2-Trichloroethane		5000	25	10	5	2	1	.5	.1
Trichloroethene		5000	25	10	5	2	1	.5	.1
1,2,3-Trichloropropane		5000	25	10	5	2	1	.5	.1
1,2,4-Trimethylbenzene		5000	25	10	5	2	1	.5	.1
1,3,5-Trimethylbenzene		5000	25	10	5	2	1	.5	.1
m-Xylene		5000	25	10	5	2	1	.5	.1
o-Xylene		5000	25	10	5	2	1	.5	.1
p-Xylene		5000	25	10	5	2	1	.5	.1
2-Chloroethyl Vinyl Ether	2-CEVE	5000	25	10	5	2	1	.5	.1
Bromomethane	Gas mix	2000	25	10	5	2	1	.5	.1
Chloroethane		2000	25	10	5	2	1	.5	.1
Chloromethane		2000	25	10	5	2	1	.5	.1
Dichlorodifluoromethane		2000	25	10	5	2	1	.5	.1
Trichlorofluoromethane		2000	25	10	5	2	1	.5	.1
Vinyl Chloride		2000	25	10	5	2	1	.5	.1

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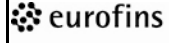
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Figure 2 Continued

Theoretical Standard Concentrations
Initial Calibration for Large Curve
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C

Compound name	std mix	Stock ppm	25 ppb	10 ppb	5 ppb	2 ppb	1 ppb	.5 ppb	.1 ppb
Methacrylonitrile	CS#2B	12500	250	100	50	20	10	5	1
Propionitrile		25000	500	200	100	40	20	10	2
trans-1,4-Dichloro-2-Butene		12500	250	100	50	20	10	5	1
t-Butyl Alcohol		25000	500	200	100	40	20	10	2
2-Propanol		25000	500	200	100	40	20	10	2
Isobutyl Alcohol		62500	1250	500	250	100	50	25	5
n-Butanol		125000	2500	1000	500	200	100	50	10
1,4-Dioxane		62500	1250	500	250	100	50	25	5
2-Butanone	CS#3B	25000	250	100	50	20	10	5	1
2-Hexanone		25000	250	100	50	20	10	5	1
4-Methyl-2-Pentanone		25000	250	100	50	20	10	5	1
Acetone		25000	250	100	50	20	10	5	1
2-Nitropropane		25000	250	100	50	20	10	5	1
Tetrahydrofuran		25000	250	100	50	20	10	5	1
Acrylonitrile		12500	125	50	25	10	5	2.5	.5
Methyl-t-butyl Ether	CS#4C	5000	25	10	5	2	1	.5	.1
Ethyl Methacrylate		5000	25	10	5	2	1	.5	.1
Methyl Methacrylate		5000	25	10	5	2	1	.5	.1
Freon 113		5000	25	10	5	2	1	.5	.1
Hexane		5000	25	10	5	2	1	.5	.1
Heptane		5000	25	10	5	2	1	.5	.1
Cyclohexane		5000	25	10	5	2	1	.5	.1
Benzyl Chloride		5000	25	10	5	2	1	.5	.1
Methyl Iodide		5000	25	10	5	2	1	.5	.1
Carbon Disulfide		5000	25	10	5	2	1	.5	.1
2-Chloro-1,3-Butadiene		5000	25	10	5	2	1	.5	.1
di-Isopropyl Ether		5000	25	10	5	2	1	.5	.1
tert-Amyl Methyl Ether		5000	25	10	5	2	1	.5	.1
Ethyl-t-butyl Ether		5000	25	10	5	2	1	.5	.1
Acrolein	VACR	125000	1250	500	250	100	50	25	5
Ethyl Ether	EE	1000	25	10	5	2	1	.5	.1
1,3-Butadiene	13BUT	1000	25	10	5	2	1	.5	.1
Dichlorofluoromethane	V Freon	1000	25	10	5	2	1	.5	.1
Freon 123a		1000	25	10	5	2	1	.5	.1

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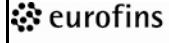
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Figure 2 Continued

Theoretical Standard Concentrations
Initial Calibration for Large Curve
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C

Compound name	std mix	Stock ppm	25 ppb	10 ppb	5 ppb	2 ppb	1 ppb	.5 ppb	.1
Bromochloromethane	CS#6	5000	25	10	5	2	1	.5	.1
Allyl Chloride		5000	25	10	5	2	1	.5	.1
Methyl Acetate		5000	25	10	5	2	1	.5	.1
Methylcyclohexane		5000	25	10	5	2	1	.5	.1
Pentachloroethane		5000	25	10	5	2	1	.5	.1
1,2,3-Trimethylbenzene		5000	25	10	5	2	1	.5	.1
2-Methylnaphthalene		5000	25	10	5	2	1	.5	.1
1,2-Diethylbenzene		5000	25	10	5	2	1	.5	.1
1,3-Diethylbenzene		5000	25	10	5	2	1	.5	.1
1,4-Diethylbenzene		5000	25	10	5	2	1	.5	.1

ppb of analytical standard = (stock ppm)(μ L stock) / flask mL

Analyst: _____
Date: _____

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(saved as 8260B Lg Ical 25 mL purge)

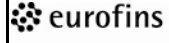
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Figure 3

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C
Water, Low Soil, and NJ MeOH Prep

Date: _____
Instrument: _____

Qn-pentane = 40ul of n-pentane lot# _____ to 960ul MEOH lot# _____
QBUT = 40ul of 1,3-Butadiene lot# _____ to 960ul MEOH lot# _____
Qcustom Freon V = 40uL of Custom Freon Q lot# _____ to 960 uL MeOH lot # _____

Stock mix Name	QCS#1B _____	QCYC _____	QEOH _____	QCS#1B 2CEVE	Restek 502.2 "Q" Gas mix	Final Volume
	QCS#2B _____	QEE _____	Qn-pentane _____	QCS#6 _____	_____	
	QCS#3B _____	QBUT _____	Custom Freon Q	QACR _____		
	QCS#4C _____	_____	_____	_____		
20 ppb	2.0 µL	50.0 µL	50.0 µL	2.0 ul	1.0 µL	100 mL Flask

Compound name	Std mix	Stock ppm	20 ppb
Benzene	QCS#1B	1000	20
Bromobenzene		1000	20
Bromodichloromethane		1000	20
Bromoform		1000	20
n-Butylbenzene		1000	20
sec-Butylbenzene		1000	20
tert-Butylbenzene		1000	20
Carbon Tetrachloride		1000	20
Chlorobenzene		1000	20
Chloroform		1000	20
2-Chlorotoluene		1000	20
4-Chlorotoluene		1000	20
Dibromochloromethane		1000	20
1,2-Dibromo-3-chloropropane		1000	20
1,2-Dibromoethane (EDB)		1000	20
Dibromomethane		1000	20
1,2-Dichlorobenzene		1000	20
1,3-Dichlorobenzene		1000	20
1,4-Dichlorobenzene		1000	20
1,1-Dichloroethane		1000	20
1,2-Dichloroethane		1000	20
1,1-Dichloroethene		1000	20
cis-1,2-Dichloroethene		1000	20
trans-1,2-Dichloroethene		1000	20
1,2-Dichloropropane		1000	20
1,3-Dichloropropane		1000	20
2,2-Dichloropropane		1000	20

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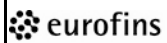
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Figure 3 Continued

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C
Water, Low Soil, and NJ MeOH Prep

Compound name	Std mix	Stock ppm	20 ppb
1,1-Dichloropropene	QCS#1B	1000	20
cis-1,3-Dichloropropene		1000	20
trans-1,3-Dichloropropene		1000	20
Ethylbenzene		1000	20
Hexachlorobutadiene		1000	20
p-Isopropyltoluene		1000	20
Methylene Chloride		1000	20
Isopropylbenzene (Cumene)		1000	20
Naphthalene		1000	20
n-Propylbenzene		1000	20
Styrene		1000	20
1,1,1,2-Tetrachloroethane		1000	20
1,1,2,2-Tetrachloroethane		1000	20
Tetrachloroethene		1000	20
Toluene		1000	20
1,2,3-Trichlorobenzene		1000	20
1,2,4-Trichlorobenzene		1000	20
1,3,5-Trichlorobenzene		1000	20
1,1,1-Trichloroethane		1000	20
1,1,2-Trichloroethane		1000	20
Trichloroethene		1000	20
1,2,3-Trichloropropane		1000	20
1,2,4-Trimethylbenzene		1000	20
1,3,5-Trimethylbenzene		1000	20
m-Xylene		1000	20
o-Xylene		1000	20
p-Xylene		1000	20
Bromomethane	QGas mix	2000	20
Chloroethane		2000	20
Chloromethane		2000	20
Dichlorodifluoromethane		2000	20
Trichlorofluoromethane		2000	20
Vinyl Chloride		2000	20
Methacrylonitrile	QCS#2B	7500	150
Propionitrile		7500	150
trans-1,4-Dichloro-2-Butene		5000	100
t-Butyl Alcohol		10000	200
2-Propanol		7500	150
Isobutyl Alcohol	QCS#3B	25000	500
n-Butanol		50000	1000
1,4-Dioxane		25000	500
2-Butanone		7500	150
2-Hexanone		5000	100

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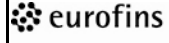
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Figure 3 Continued

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C
Water, Low Soil, and NJ MeOH Prep

Compound name	Std mix	Stock ppm	20 ppb
4-Methyl-2-Pentanone	QCS#3B	5000	100
Acetone		7500	150
Acrylonitrile		5000	100
2-Nitropropane		1000	20
Tetrahydrofuran		5000	100
Methyl-t-butyl Ether	QCS#4C	1000	20
Ethyl Methacrylate		1000	20
Methyl Methacrylate		1000	20
Freon 113		1000	20
Hexane		1000	20
Heptane		1000	20
Cyclohexane		1000	20
Benzyl Chloride		1000	20
Methyl Iodide		1000	20
Carbon Disulfide		1000	20
2-Chloro-1,3-Butadiene		1000	20
di-Isopropyl Ether		1000	20
tert-Amyl Methyl Ether		1000	20
Ethyl-t-butyl Ether		1000	20
Pentachloroethane	QCS#6	1000	20
Allyl Chloride		1000	20
Bromochloromethane		1000	20
Methyl Acetate		1000	20
Methylcyclohexane		1000	20
2-Methylnaphthalene		1000	20
1,2,3-Trimethylbenzene		1000	20
1,2-Diethylbenzene		1000	20
1,3-Diethylbenzene		1000	20
1,4-Diethylbenzene		1000	20
Acrolein	QACR	7500	150
2- Chloroethyl Vinyl Ether	QCS#1B 2CEVE	1000	20
Cyclohexanone	QCYC	1000	500
Ethyl Ether	QEE	40	20
n-Pentane	Qn-PEN	40	20
Dichlorofluoromethane	Custom	40	20
Freon 123a	Freon Q	40	20

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Figure 3 Continued

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C
Water, Low Soil, and NJ MeOH Prep

Compound name	Std mix	Stock	20 ppb
		ppm	
1,3-Butadiene	QBUT	40	20
Ethanol	QEOH	1000	500

ppb of analytical standard = (stock ppm)(μ l stock) / final volume

Analyst: _____
Date: _____

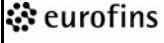
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Figure 4

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C
Water Prep

QVOA6= 1:25 QCS#6
QARC = 1: 25 QCS#1B2CEVE, QACR stock
QVOA1= 1:25 QCS#1B, QCS#2B, QCS3B, QCS#4C
Qn-pentane = 40ul of n-pentane lot# _____ to 960ul MEOH lot# _____
QBUT = 40ul of 1,3-Butadiene lot# _____ to 960ul MEOH lot# _____
Custom Freon Q = 40ul of Custom Freon Q lot# _____ to 960 ul MEOH lot# _____

Date: _____

Instrument: _____

QGASES=1:50 Restek 502.2 "Q" Gas mix

Stock mix Name	QVOA1 QARC Custom Freon Q	QVOA6 QEE QDEM	QEOH QCYC QBUT	8260 SS 2500 ppm Lot# _____	QGASES Qn-pentane	Final Volume	MeOH Lot#	Used
20 ppb	2.5 µL	2.5 µL	2.5 µL	0.1 ul	2.5 µL	5 mL Syringe	.1 mL	
20 ppb	21.5 µL	21.5 µL	21.5 µL	-	21.5 µL	43 mL Vial	-	
20 ppb	25.0 µL	25.0 µL	25.0 µL	1.0 ul	25.0 µL	50 mL Flask	1 mL	

Compound name	std mix	Stock ppm	20 ppb
Benzene	QCS#1B	1000	20
Bromobenzene		1000	20
Bromodichloromethane		1000	20
Bromoform		1000	20
n-Butylbenzene		1000	20
sec-Butylbenzene		1000	20
tert-Butylbenzene		1000	20
Carbon Tetrachloride		1000	20
Chlorobenzene		1000	20
Chloroform		1000	20
2-Chlorotoluene		1000	20
4-Chlorotoluene		1000	20
Dibromochloromethane		1000	20
1,2-Dibromo-3-chloropropane		1000	20
1,2-Dibromoethane (EDB)		1000	20
Dibromomethane		1000	20
1,2-Dichlorobenzene		1000	20
1,3-Dichlorobenzene		1000	20
1,4-Dichlorobenzene		1000	20
1,1-Dichloroethane		1000	20
1,2-Dichloroethane		1000	20
1,1-Dichloroethene		1000	20
cis-1,2-Dichloroethene		1000	20
trans-1,2-Dichloroethene		1000	20
1,2-Dichloropropane		1000	20
1,3-Dichloropropane		1000	20
2,2-Dichloropropane		1000	20
1,1-Dichloropropene		1000	20

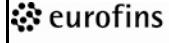
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Figure 4 Continued

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C
Water Prep

Compound name	std mix	Stock ppm	20 ppb
cis-1,3-Dichloropropene	QCS#1B	1000	20
trans-1,3-Dichloropropene		1000	20
Ethylbenzene		1000	20
Hexachlorobutadiene		1000	20
p-Isopropyltoluene		1000	20
Methylene Chloride		1000	20
Isopropylbenzene (Cumene)		1000	20
Naphthalene		1000	20
n-Propylbenzene		1000	20
Styrene		1000	20
1,1,1,2-Tetrachloroethane		1000	20
1,1,2,2-Tetrachloroethane		1000	20
Tetrachloroethene		1000	20
Toluene		1000	20
1,2,3-Trichlorobenzene		1000	20
1,2,4-Trichlorobenzene		1000	20
1,3,5-Trichlorobenzene		1000	20
1,1,1-Trichloroethane		1000	20
1,1,2-Trichloroethane		1000	20
Trichloroethene		1000	20
1,2,3-Trichloropropane		1000	20
1,2,4-Trimethylbenzene		1000	20
1,3,5-Trimethylbenzene		1000	20
m-Xylene		1000	20
o-Xylene		1000	20
p-Xylene		1000	20
Bromomethane	QGas mix	2000	20
Chloroethane		2000	20
Chloromethane		2000	20
Dichlorodifluoromethane		2000	20
Trichlorofluoromethane		2000	20
Vinyl Chloride		2000	20
Methacrylonitrile	QCS#2B	7500	150
Propionitrile		7500	150
trans-1,4-Dichloro-2-Butene		5000	100
t-Butyl Alcohol		10000	200
2-Propanol		7500	150
Isobutyl Alcohol		25000	500
n-Butanol		50000	1000
1,4-Dioxane		25000	500

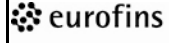
 Lancaster Laboratories Environmental	Document Title: Determination of Volatile Target Compounds and Gasoline Range Organics (GRO) by Capillary Column Gas Chromatography/Mass Spectrometry (GC/MS) in Waters and Wastewaters by Method 8260C	Eurofins Document Reference: 1-P-QM-WI -9013078
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Figure 4 Continued

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C
Water Prep

Compound name	std mix	Stock ppm	20 ppb
2-Butanone	QCS#3B	7500	150
2-Hexanone		5000	100
4-Methyl-2-Pentanone		5000	100
Acetone		7500	150
Acrylonitrile		5000	100
2-Nitropropane		1000	20
Tetrahydrofuran		5000	100
Methyl-t-butyl Ether	QCS#4C	1000	20
Ethyl Methacrylate		1000	20
Methyl Methacrylate		1000	20
Freon 113		1000	20
Hexane		1000	20
Heptane		1000	20
Cyclohexane		1000	20
Benzyl Chloride		1000	20
Methyl Iodide		1000	20
Carbon Disulfide		1000	20
2-Chloro-1,3-Butadiene		1000	20
di-Isopropyl Ether		1000	20
tert-Amyl Methyl Ether		1000	20
Ethyl-t-butyl Ether		1000	20
Pentachloroethane	QCS#6	1000	20
Allyl Chloride		1000	20
Bromochloromethane		1000	20
Methyl Acetate		1000	20
Methylcyclohexane		1000	20
2-Methylnaphthalene		1000	20
1,2,3-Trimethylbenzene		1000	20
1,2-Diethylbenzene		1000	20
1,3-Diethylbenzene		1000	20
1,4-Diethylbenzene		1000	20
Dichlorofluoromethane	Custom Freon Q	1000	20
Freon 123a			
Acrolein	QACR	7500	150
2- Chloroethyl Vinyl Ether	QCS#1B 2CEVE	1000	20
Cyclohexanone	QCYC	1000	500
Ethyl Ether	QEE	40	20

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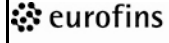
 Lancaster Laboratories Environmental	Document Title: Determination of Volatile Target Compounds and Gasoline Range Organics (GRO) by Capillary Column Gas Chromatography/Mass Spectrometry (GC/MS) in Waters and Wastewaters by Method 8260C	Eurofins Document Reference: 1-P-QM-WI -9013078
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Figure 4 Continued

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C
Water Prep

Compound name	std mix	Stock ppm	20 ppb
n-Pentane	Qn-PEN	40	20
Diethoxymethane	QDEM	40	20
1,3-Butadiene	QBUT	40	20
Ethanol	QEOH	1000	500

ppb of analytical standard = (stock ppm)(μ l stock) / final volume

Analyst: _____

Date: _____

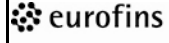
 Lancaster Laboratories Environmental	Document Title: Determination of Volatile Target Compounds and Gasoline Range Organics (GRO) by Capillary Column Gas Chromatography/Mass Spectrometry (GC/MS) in Waters and Wastewaters by Method 8260C	Eurofins Document Reference: 1-P-QM-WI -9013078
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Figure 5

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C
25ml Purge Waters

Date: _____
Instrument: _____

QARC= 1:25 QCS#1B2CEVE, QACR stock
QVOA1= 1:25 QCS#1B, QCS#2B, QCS3B, QCS#4C
QFREON/GAS = 1:25 Custom Q Freon Std + 1:50 Restek 502.2 "Q" Gas Mix + 1:25 Butadiene
QVOA6= 1:25 QCS#6

Stock mix Name	QVOA1 QARC	QVOA6	QEE	QFREON/GAS/BUT	Final Volume	Prep Used
5 ppb	6.25 µL	6.25 µL	6.25 uL	6.25 ul	50 mL	
5 ppb	12.5 µL	12.5 µL	12.5 uL	12.5 ul	100 mL	
5 ppb	5.38 µL	5.38 µL	5.38 uL	5.38 ul	43 mL vial	

Compound name	std mix	Stock ppm	5 ppb
Benzene	QCS#1B	1000	5
Bromobenzene		1000	5
Bromodichloromethane		1000	5
Bromoform		1000	5
n-Butylbenzene		1000	5
sec-Butylbenzene		1000	5
tert-Butylbenzene		1000	5
Carbon Tetrachloride		1000	5
Chlorobenzene		1000	5
Chloroform		1000	5
2-Chlorotoluene		1000	5
4-Chlorotoluene		1000	5
Dibromochloromethane		1000	5
1,2-Dibromo-3-chloropropane		1000	5
1,2-Dibromoethane (EDB)		1000	5
Dibromomethane		1000	5
1,2-Dichlorobenzene		1000	5
1,3-Dichlorobenzene		1000	5
1,4-Dichlorobenzene		1000	5
1,1-Dichloroethane		1000	5
1,2-Dichloroethane		1000	5
1,1-Dichloroethene		1000	5
cis-1,2-Dichloroethene		1000	5
trans-1,2-Dichloroethene		1000	5
1,2-Dichloropropane		1000	5
1,3-Dichloropropane		1000	5
2,2-Dichloropropane		1000	5
1,1-Dichloropropene		1000	5
cis-1,3-Dichloropropene		1000	5
trans-1,3-Dichloropropene		1000	5
Ethylbenzene		1000	5
Hexachlorobutadiene		1000	5

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Figure 5 Continued

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C
25 ml Purge Waters

Compound name	std mix	Stock ppm	5 ppb
Isopropylbenzene (Cumene)	QCS#1B	1000	5
p-Isopropyltoluene		1000	5
Methylene Chloride		1000	5
Naphthalene		1000	5
n-Propylbenzene		1000	5
Styrene		1000	5
1,1,1,2-Tetrachloroethane		1000	5
1,1,2,2-Tetrachloroethane		1000	5
Tetrachloroethene		1000	5
Toluene		1000	5
1,2,3-Trichlorobenzene		1000	5
1,2,4-Trichlorobenzene		1000	5
1,3,5-Trichlorobenzene		1000	5
1,1,1-Trichloroethane		1000	5
1,1,2-Trichloroethane		1000	5
Trichloroethene		1000	5
1,2,3-Trichloropropane		1000	5
1,2,4-Trimethylbenzene		1000	5
1,3,5-Trimethylbenzene		1000	5
m-Xylene		1000	5
o-Xylene		1000	5
p-Xylene		1000	5
2-Chloroethyl Vinyl Ether	QCS#1B 2CLEVE	1000	5
Bromomethane		40	5
Chloroethane	QGas mix	40	5
Chloromethane		40	5
Dichlorodifluoromethane		40	5
Trichlorofluoromethane		40	5
Vinyl Chloride		40	5
Methacrylonitrile	QCS#2B	7500	37.5
Propionitrile		7500	37.5
trans-1,4-Dichloro-2-Butene		5000	25
t-Butyl Alcohol		10000	50
2-Propanol		7500	37.5
Isobutyl Alcohol		25000	125
n-Butanol		50000	250
1,4-Dioxane		25000	125
2-Hexanone	QCS#3B	5000	25
4-Methyl-2-Pentanone		5000	25
Acetone		7500	37.5

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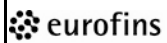
 Lancaster Laboratories Environmental	Document Title: Determination of Volatile Target Compounds and Gasoline Range Organics (GRO) by Capillary Column Gas Chromatography/Mass Spectrometry (GC/MS) in Waters and Wastewaters by Method 8260C	Eurofins Document Reference: 1-P-QM-WI -9013078
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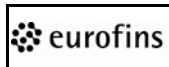
Figure 5 Continued

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C
25 ml Purge Waters

Compound name	std mix	Stock ppm	5 ppb
Acrylonitrile	QCS#3B	5000	25
2-Nitropropane		1000	5
Tetrahydrofuran		5000	25
2-Butanone		7500	37.5
Methyl-t-butyl Ether	QCS#4C	1000	5
Ethyl Methacrylate		1000	5
Methyl Methacrylate		1000	5
Freon 113		1000	5
Hexane		1000	5
Heptane		1000	5
Cyclohexane		1000	5
Benzyl Chloride		1000	5
Methyl Iodide		1000	5
Carbon Disulfide		1000	5
2-Chloro-1,3-Butadiene		1000	5
di-Isopropyl Ether		1000	5
tert-Amyl Methyl Ether		1000	5
Ethyl-t-butyl Ether		1000	5
Pentachloroethane	QVOA6	1000	5
Allyl Chloride		1000	5
Bromochloromethane		1000	5
Methyl Acetate		1000	5
Methylcyclohexane		1000	5
2-Methylnaphthalene		1000	5
1,2,3-Trimethylbenzene		1000	5
1,2-Diethylbenzene		1000	5
1,3-Diethylbenzene		1000	5
1,4-Diethylbenzene		1000	5
1,3-Butadiene	Butadiene	1000	5
Ethyl Ether	QEE	40	5
Dichlorofluoromethane	Q FREON	1000	5
Freon 123a		1000	5
Acrolein	QACR	7500	37.5

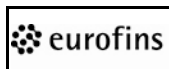
ppb of analytical standard = (stock ppm)(μ l stock) / final volume

Analyst: _____
Date: _____

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Eurofins Document Reference	1-P-QM-WI -9013077	Revision	3
Effective Date	May 19, 2014	Status	Effective
Historical/Local Document Number	Analysis 11995		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

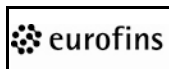
Prepared by	Marla Lord
Reviewed and Approved by	Kenneth Boley;Review;Thursday, May 1, 2014 12:17:34 PM EDT Barbara Reedy;Approval;Monday, May 5, 2014 10:28:01 AM EDT

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Revision Log:

Revision: 3		Effective Date:	This version
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Throughout Document	Reflect re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers	
Title	EtQ requirement	Shortened document title to read as follows " Determination of Volatile Target Compounds and Gasoline Range Organics (GRO) by GC/MS in Soils and Solids by Method 8260C "	
Reference	Current practice	Added Method 5030B	
Sample Collection, Preservation and Handling	Current requirement	Updated temperature range	
Reagents and Standards A.2	Current practice	Added "or equivalent" to methanol description	

Revision: 02		Effective Date:	Jun 14, 2012
Section	Justification	Changes	
Revision Log	Formatting requirements per LOM-SOP-LAB-201	Removed revision logs up to the previous version.	
Reference	Update of method	Added 5035A	

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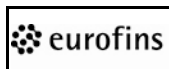
Reference:

1. Volatile Organic Compounds by Gas Chromatography/ Mass Spectrometry (GC/MS), SW-846 Method 8260C, August 2006.
2. Method 8000C, USEPA SW-846, Rev. 3, March 2003.
3. Method 5030B, USEPA SW-846, Rev. 2, December 1996.
4. Method 5035, USEPA SW-846, Rev. 0, December 1996.
5. Method 5035A, USEPA SW-846, Rev. 1, July 2002
6. *Total Petroleum Hydrocarbons Analysis-Gasoline Method*, California Department of Health Services, LUFT Task Force.
7. *Chemical Hygiene Plan*, current version.

Cross Reference:

Document	Document Title
Analysis #0374, 6646, 10445, 11966, 11967	GC/MS - Bulk Solid Matrix Sample Preparation
Analysis #8389, 8390, 6130, 6117, 6174, 7578, 7320	Preparation of Soils for Volatile Analysis by EPA SW-846 Method 5035
1-P-QM-PRO-9015467	GC/MS Instrumentation Maintenance
1-P-QM-PRO-9015469	GC/MS Volatile Standards Traceability
1-P-QM-PRO-9015470	Preparation and Analysis of Cleaning Blanks for GC and GC/MS Volatiles
1-P-QM-PRO-9015471	GC/MS Volatiles Audit Process
1-P-QM-QMA-9015390	Demonstrations of Capability
1-P-QM-QMA-9017309	Determining Method Detection Limits and Limits of Quantitation

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Scope:

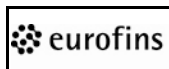
This method is suitable for the determination of compounds listed and maintained in the LIMS for soil and solid matrices. Samples consist of soils/solids collected or submitted in bulk in glass containers with Teflon™-lined screw-caps or in field core sampling/storage containers (i.e., EnCore™ or equivalent). Non-target volatile compounds in the sample can be tentatively identified (TIC) using a mass spectral reference library comparison. This analysis must be performed by or under the direct supervision of an operator experienced in the analysis of volatile organics by purge and trap GC/MS methodologies and skilled in mass spectral interpretation. Using this method, the TICs are quantitated with an estimated concentration.

Compounds other than those listed in the LIMS for this group of master scans may be analyzed using USEPA SW-846 Method 8260C. Selected Ion Monitoring (SIM) parameters can be used to detect, identify and quantitate volatile organic compounds in methanol extracts of soils/solids, if lower quantitation limits are required (project- or client-specified) and/or matrix interferences are anticipated. Attachment I describes the proper analysis procedure for Gasoline Range Organics in soils and solids. Due to poor purging efficiency or poor chromatography, some analytes require calibration at higher levels and/or higher practical quantitation limits (PQLs). Any additional compounds must be added to the theoretical standard concentrations (TSC) sheet. Standards containing additional analytes must be prepared as described in the Standards section of this document. Both secondary stock solutions and matrix spike solutions must be prepared for use in analyzing additional compounds.

Basic Principles:

The soil sample is prepared according to analysis 0374 or 8389 and 8390 for 8260C. The sample is purged with an inert gas and the effluent gas passed through a sorbent trap where the volatile organics are trapped. After purging, the sorbent trap is rapidly heated and backflushed onto the head of a gas chromatographic column held at the appropriate initial temperature for the column in use. The gas chromatographic column is temperature programmed to separate the volatile compounds, which are subsequently detected and identified using mass spectrometric techniques.

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When a compound reaches the MS, it is bombarded by high energy electrons (70 eV). This causes the compound to fragment and form ions. The positive ions are focused into a quadrupole mass analyzer, where the ions are separated according to their mass/charge ratios during rapid repetitive scans. These ions are then amplified and detected with an electron multiplier.

The resulting time/intensity/mass spectra data are stored and processed by a computer. Target compounds are identified on the basis of relative retention times and mass spectral matches to standards, which are injected every 12 hours on the same system. The internal standard method is used for quantitation.

Interferences:

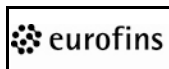
Contaminant sources are volatile compounds in the laboratory environment, impurities in the inert purging gas, carryover from samples containing high concentrations of volatile organic compounds and dirty glassware. The analyst must demonstrate that the system is free from interferences (by producing acceptable method blank data) before analyzing a batch of samples. Matrix effects from heavily contaminated soils and solids can interfere with the internal standard responses, target analytes and surrogate recoveries, thereby hindering accurate quantitation. See Section 4.0 of SW-846 Method 8260C for further discussion.

Safety Precautions and Waste Handling:

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

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The toxicity of each reagent used has not been precisely determined. However, each reagent must be treated as a potential health hazard. Safety measures would include the use of fume hoods, safety glasses, lab coats, and gloves when working directly with reagents. Refer to the *Lancaster Laboratories Chemical Hygiene Plan* for specific details.

Personnel Training and Qualifications:

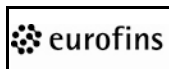
All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability.

Education Requirement: A 4–year Baccalaureate Degree from an accredited College or University in one of the physical sciences and/or 1 – 3 years of relevant gas chromatography experience.

Analysts must be trained in the proper method of volatile organic sample preparation and analysis as determined by the supervisor(s). All training and education relating to volatile organic sample preparation and analysis must be documented by each analyst in their training record. Specifically, each new chemist must train with an experienced chemist for the first 12 weeks depending on the individual and their previous experience. The first 12 weeks are spent working one-on-one with the trainer. This time may be less if the new chemist has prior relevant experience in GC/MS and analytical chemistry background.

During the training period, the new chemist must learn daily maintenance, calibration techniques, data and library search review, and forms generation. They are also required to read all relevant SOPs and EPA methods.

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To measure the proficiency of each chemist, several checks have been established. The first is the ability to successfully calibrate. The chemist analyzes a series of at least five calibration standards and performs the calibration routine. Secondly, each analyst must perform a Demonstration of Capability (DOC). Refer to 1-P-QM-QMA-9015390 for specific requirements. Demonstration of Capability is performed annually and is maintained in the analyst's training records.

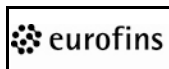
Sample Collection, Preservation, and Handling:

The samples must be stored in a refrigerator at 0°C - 6°C, not frozen. Soils are collected/submitted in bulk in glass containers with Teflon™-lined screw-caps or in field core sampling/storage containers (i.e., EnCore™ or equivalent). Samples are preserved in methanol and either frozen reagent water or Sodium Bisulfate. All samples must be analyzed within 14 days of collection.

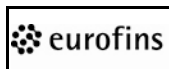
Apparatus and Equipment:

1. Gastight micro syringes – 10-μL and larger
2. 5-mL gastight syringes
3. Analytical balance, capable of accurately weighing ±0.0001 g
4. Top-loading balance capable of weighing ±0.01 g
5. Glassware
 - a. Class A Volumetric flasks with ground-glass stopper
 - b. Vials, 1.5-mL, 15-mL, and 40-mL screw cap, with Teflon/silicone septa
 - c. Mininert vials, 1-mL, 2-mL, and 5-mL

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6. Purge and trap device – Consisting of the sample purger, the trap, and desorber; the OI Analytical 4560, OI Analytical 4660, or equivalent meets the requirements of this method. The purging chamber must have the purge gas passing through the sample as finely divided bubbles and minimize the headspace between the sample and the trap to <15 mL.
7. Autosampler – OI Analytical 4551, Archon, or equivalent meets the requirements of this method. The Archon has the capability to purge solid samples directly in the 40-mL vial (needed for samples prepared by analysis 8389).
8. Spiker units (optional) – OI Analytical Model 4551 SIM/Spiker or equivalent. One or two automated syringe spikers can be added to the OI Analytical Model 4551 autosampler to automatically introduce 10 µL of internal standard (ISTD), surrogate standard, and/or matrix spiking solutions to the sample as it is being transferred to the sparge vessel. The Archon has a groove that can deliver 1 µL of appropriate standards.
9. GC/MS system – The HP 5890GC/5972 MSD, HP 6890GC/5973MSD, HP 6890GC/5975MSD, and Shimadzu GC/MS QP5000 meet the requirements for this method.
10. Data System/Computer/Software– this is interfaced to the GC/MS system, which continuously acquires and stores data during the analysis, and can process/reduce data to generate the appropriate forms and supporting data. The software used for acquisition is HP Chemstation®, and data reduction is accomplished using Target® software.
11. GC Columns
 - a. Column 1 – 30M × 0.25 mm ID DB624 capillary column with a 1.4-µm film thickness from Agilent, or equivalent (to be used with the Shimadzu QP5000 or the Agilent 5972, 5973 and 5975 MSDs)

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- b. Column 2 – 20M × 0.18 mm ID DB624 capillary column with a 1.0-µm film thickness from Agilent, or equivalent (to be used with the Shimadzu QP5000 or the Agilent 5972, 5973 and 5975 MSDs)

Different sampling/analysis combinations are used based on how the sample was collected, expected level of VOCs in the sample, possible matrix interferences, list of target compounds, whether TICs were requested, the required quantitation limits and the type of equipment/instrumentation available.

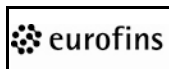
NOTE: Refer to 1-P-QM-PRO-9015467 for instrumentation maintenance and troubleshooting.

Reagents and Standards:

A. Reagents

1. Reagent water is defined as water in which an interferant is not observed at or above the reporting limit for parameters of interest. In general, the deionized water supplied at the taps in the laboratory must meet these criteria. If the reagent water does not meet the requirements, see your supervisor for further instructions.
2. Purge and Trap grade Methanol or equivalent
3. Sodium bisulfate – ACS grade
4. Sand- Ottawa Standard

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B. Standards

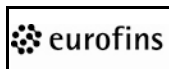
See 1-P-QM-PRO-9015469 for standards traceability.

1. Stock standard solutions – Stock solutions must be prepared in methanol. Standards are prepared from ampulated and neat compounds obtained from suppliers that indicate the purity of the compound. No correction for purity is made if the purity is listed as $\geq 96\%$. Pre-made solutions can be used if the supplier documents the concentrations of the solutions. All ampulated standards are stored at -10 to -15°C until the expiration date indicated by the vendor or for 1 year if no expiration date is provided.

NOTE: For most of the target compounds, the stock standard solutions are purchased from a vendor as custom mixes (V for calibration and Q for separate source quality control). The internal and surrogate standards are purchased from a vendor, as well as the target compounds that are gases at room temperature. These gaseous standards have a 1-week expiration date, starting from the date they are opened.

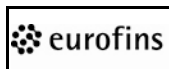
2. Surrogate stock standard solution (for high level soils) – a 2500 µg/mL stock standard solution of dibromofluoromethane, toluene-d8, 4-bromofluorobenzene, and 1,2-dichloroethane-d4 is prepared in methanol by a commercial supplier
3. 8260A Internal standard spiking solution (8260IS) – a 2500 µg/mL stock standard solution of fluorobenzene, chlorobenzene-d5, 1,4-dichlorobenzene-d4, and 12500 µg/mL deuterated tertiary butyl alcohol (tBA-d10) is prepared in methanol by a commercial supplier. Deuterated tertiary butyl alcohol (tBA-d10) is used sometimes as an auxiliary ISTD.. If an Archon autosampler is used, dilute the stock to 250 µg/mL (1250 µg/mL for tBA-d10) in methanol. This is assuming a 1-µL groove in the autosampler. If the groove is determined to be other than 1 µL, the standard preparation must be adjusted so that appropriate final concentration is obtained (50 µg/kg or 1 µg/kg for SIM scan).

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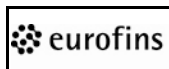
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To prepare stock standards from neat compounds:

- a. Place about 9.8 mL methanol or an equivalent solvent into a tared 10.0-mL glass-stoppered volumetric flask. Weigh the flask to the nearest 0.1 mg.
 - b. Add the liquids using a syringe or pipette by adding 2 or more drops of the assayed material to the flask, being careful that no drop hits the side of the flask. Reweigh the flask, record/note the amount, dilute to volume, stopper, and mix by inverting the flask at least 3 times. Calculate the concentration of the standard.
 - c. The stock standard solutions are stored in Teflon-sealed screw-capped vials at -10 to -15°C. The compound name, concentration, date prepared, and expiration date must appear on the bottle.
 - d. Replace in house prepared stock standard solutions every 6 months.
4. Secondary dilution standards – Using the stock standard solutions, prepare secondary stock solutions in methanol containing the desired compounds. These standards are prepared by calculating the volume of each stock standard required producing a given volume of a mixed working standard with a known concentration of each analyte. When custom mixes are used, these may be diluted down individually, or combined together with other mixes. The working standard is tested according to 1-P-QM-PRO-9015469. The verified working standard is poured into Teflon-lined screw-capped GC vials or mininert vials and stored at -10 to -15°C. A designator indicating the standard, month, and day of preparation must be on the standard vials. The designator and the calculations for the working standard preparation are to be recorded in the standards logbook. Replace secondary dilution standards every 6 months unless otherwise indicated.

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- a. 1,4-Bromofluorobenzene (BFB) standard – Prepare a 50-µg/mL solution of BFB in methanol by diluting the stock standard (prepared from neat material) with methanol to a final volume of 100 mL. The volume of stock standard used varies, depending on the actual stock concentration.
- b. Surrogate standard spiking solution (high level only) – Prepare the surrogate standard spiking solution from the stock standard solutions at a concentration of 25 or 250 µg/mL in methanol.
- c. Internal standard (IS) solution (high level only) – fluorobenzene, chlorobenzene-d5, 1,4-dichlorobenzene-d4, and tert-Butyl Alcohol-d10. One mL of 8260IS is diluted with methanol to a total volume of 10 mL to give a final concentration of 250 µg/mL (1250 µg/mL for tBA-d10). This is assuming a 1-µL groove in the autosampler. If the groove is determined to be other than 1 µL, the standard preparation must be adjusted so that appropriate final concentration is obtained.
- d. IS/SS spiking solution – Dilute 1 mL of 8260IS and 1 mL of 8260SS with methanol to 10-mL final volume (resulting in a concentration of 250 µg/mL, 1250 µg/mL for tBA-d10). This is assuming a 1-µL groove in the autosampler. If the groove is determined to be other than 1 µL, the standard preparation must be adjusted so that appropriate final concentration is obtained.
- e. Calibration spiking solution – Prepare solutions in methanol that contain the compounds of interest at known concentrations. Suggested calibration levels are 4, 10, 20, 50, 100, and 300. Replace the calibration spiking solution every month.

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- f. Matrix spiking solution – Prepare solutions in methanol that contain the compounds of interest at known concentrations. These solutions serve as both the matrix spiking solution and the laboratory control sample solutions. Matrix spikes also serve as duplicates; therefore, two aliquots of the same sample need to be spiked for analysis with these solutions. Replace the matrix spiking solution every month.
- g. Store all standard solutions at -10 to -15°C.

Calibration:

A. Instrument Conditions:

1. The purge and trap device must have the trap conditioned for at least 10 minutes at 180° to 220°C at a flow rate of 20 to 60 mL/min prior to initial use.
2. An example of purge and trap conditions are listed below:

Purge gas	Helium
Purge flow	35 – 40 mL/min
Purge temperature	40°C for low level soils and ambient temp. for medium/high level soils
Purge time	11 min
Desorb temperature	190°-220°C
Desorb time	0.5 to 4 minutes **
Bake temperature	180°-220°C
Bake time	8 min (±3 min)

** - Range as suggested by the purge and trap instrument manufacturer

NOTE: Purge and trap conditions may be changed to optimize instrument operations. A record of actual purge and trap conditions for each instrument may be found in the appropriate instrument maintenance log.

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3. The suggested gas chromatographic operating conditions are listed in the table below, depending on the column used:

	<u>Column 1</u>	<u>Column 2</u>
Column liquid phase	DB-624	DB-624
Carrier gas	Helium	Helium
Carrier gas flow	.8 mL/min	.6 mL/min
Make-up gas flow	None	None
Initial temperature	45°C	45°C
Initial hold time	4.5 min	2.5 min
Temperature ramp	12°/min to 100°C then 25°/min to 240°C	12°/min to 100°C then 25°/min to 235°C
Final temperature	240°C	235°C
Final hold time	None	.02 min

4. Recommended mass spectrometer (MS) operating conditions:

Ions	Positive
Electron energy	70 volts
Mass range	35 – 300 amu

H-P systems Scan time:

Number A/D Samples	2 ² (4)
Integration Time/Sample	50 microsec
Total Scan Time	0.6 sec

5. Recommended MS operating conditions for SIM scan of target compounds:

SIM Parameters

Group	Ions	Time Range	Target Compounds
1	57, 73, 78, 102, 111, 113	4.00-6.30	Dibromofluoromethane, MTBE
2	52, 70, 77, 78, 96, 102, 113	6.30-8.50	1,2-Dichloroethane-d4, Benzene, Fluorobenzene,
3	91, 92, 95, 106, 117, 174	8.50-14.00	Toluene-d8, Toluene, Chlorobenzene-d5, Ethylbenzene, m+p-Xylene, o-Xylene, 4-Bromofluorobenzene

NOTE: It is not necessary to use the exact parameters listed above.

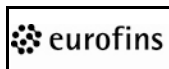
Equivalent columns and conditions that give the performance required by the method are acceptable.

B. Tuning:

Tune the GC/MS system to meet the criteria in Table 1 following a 50-ng injection of BFB. The chromatographic conditions must be the same as those under which the samples are analyzed except that the temperature ramp may be increased and the initial temperature and flow rate may be different. The BFB tune must be verified every 12 hours.

The tune must be evaluated by taking the average of the three scans across the BFB peak apex with a background subtraction of a scan within 20 scans prior to the start of the BFB peak.

NOTE: All standards, samples, and associated quality control samples must be analyzed with the same mass spectrometer parameters as those used to obtain a successful tune.

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C. Initial Calibration:

1. Perform the initial calibration by analyzing at least six distinct levels of analyte concentration. For high level soils, the surrogates are also analyzed at six distinct levels. Response factors for each analyte are determined from these levels. Six levels are required if second order regression fits are used. Refer to Figure 1 for the preparation of calibration standards. The relative standard deviation of the response factors determines the suitability of the average relative response factor for calculation of the analyte concentration.

NOTE: 5 levels are required by the method.

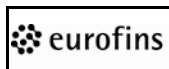
2. A method detection limit (MDL) standard must be analyzed with each initial calibration. This standard is prepared at or near the departmental MDL and is not to be included in the calibration curve. All compounds must be detected in the MDL standard.
3. For medium/high level soils, methanol is added to all calibration standards. For low-level soils prepared according to EPA Method 5035, 1 scoop of sodium bisulfate is added to all calibration standards.
4. When using an Archon (low/high) or OI 4551 (high) autosampler, blanks and standards are prepared and poured into 40-mL vials with Teflon-lined septa. For the high-level method, 5 mL is withdrawn from the vial and transferred to the sparge vessel along with the appropriate amount of the internal standard spiking solution. For the low-level method, the Archon transfers 5 mL of reagent water along with the appropriate amount of IS/SS spiking solution to the 40-mL vial.
5. Purge and desorb according to Calibration 2.
6. Collect GC/MS data until the end of the GC run.
7. Empty and rinse the purging chamber at least twice with reagent water prior to loading another sample into the vessel, to minimize the possibility of carryover contamination.

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8. Each level is analyzed as described above. Next, tabulate the area response of the characteristic ions (Table 2) against concentration for each analyte, surrogate standard, and internal standard and calculate relative response factors (RRF) for each compound (see Calculation section). The following table describes the guidelines for an acceptable initial calibration:

Frequency	Acceptance Criteria	Corrective Action
Initially and then when analytes in the daily calibration standard fail criteria.	<ol style="list-style-type: none"> 1. % RSD of $\leq 20\%$ is required for all analytes. 10% of the analytes may fail this criteria. 2. All compounds of interest must be detected in the MDL standard. 3. The relative retention times of the target compounds must agree within 0.06 relative retention time (RRT) units. The exception would be in the case of system maintenance. 4. Minimum response factors must be met for select compounds. See Table 3. 	<ol style="list-style-type: none"> 1. Any target analyte with a %RSD of $\leq 20\%$ must use the average RRF for quantitation. For any analyte in which the %RSD $> 20\%$, a first-degree linear regression can be used (providing that the correlation coefficient [CC] is ≥ 0.99). A quadratic fit ** (using 6 stds) can also be used (provided the coefficient of determination [CD] is ≥ 0.99). If the linear fit and quadratic fit pass the criteria for any given analyte, then use the line/curve with the smallest positive y-intercept. If the y-intercept quantifies to be greater than the LOQ, consult your supervisor immediately or recalibrate. If CC or CD is < 0.99, recalibrate. Supervisory approval is required for exceptions to these guidelines. If $> 10\%$ target analytes fail, recalibration is required. 2. If a compound is not detected in the MDL standard, then report to the level of the lowest standard detected. 3,4. Perform system maintenance and recalibrate.

**Consult USEPA method 8000B for non-linear curve fitting techniques/guidelines

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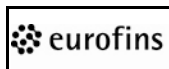
NOTE: If a linear fit is used for a compound, the lowest calibration standard point must be recalculated against the curve. The recalculated concentration must be within $\pm 30\%$ of the standard's true concentration. If this criterion is not met, notify a supervisor so that an alternate LOQ can be evaluated.

D. Initial Calibration Verification:

Following the calibration, an Initial Calibration Verification (ICV) standard must be run. The ICV is prepared according to the TSC sheet in Figure 5. The ICV acts as a second source standard to check against the initial calibration. All analytes must meet ICV acceptance windows of 70%-130%. If the ICV does not meet the aforementioned criteria, a second ICV is analyzed before invalidating the initial calibration. Upon failure of the second ICV, the system must be recalibrated after proper corrective action is taken.

E. Continuing Calibration:

Continuing Calibration Verification (CCV) – The CCV is performed by analyzing a 50-ppb calibration standard in subsequent tune periods after an initial calibration. The CCV is considered valid when the criteria listed below are met:

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Frequency	Acceptance Criteria	Corrective Action
Every 12 hours.	<ol style="list-style-type: none"> 1. % Drift of ≤20% is required for all analytes. 20% of analytes may fail this criteria if not detected in proceeding samples. 2. The relative retention times (RRT) of the target compounds must agree within 0.06 RRT units. The exception would be in the case of system maintenance. 3. The extracted ion current profile (EICP) area for each internal standard must fall within the window of –50 % to +100 % from the mid-level standard area produced during the last initial calibration. 4. Minimum response factors must be met for select compounds. See Table 3. 	1. - 4. In the event that the continuing calibration verification (CCV) standard fails <u>any</u> of these criteria, sample analysis must be suspended and the CCV must be re-analyzed. If the re-analysis fails any of the criteria then adjustments are to be made to the analytical system to return it to its original condition, followed by the analyses of 2 consecutive CCVs at the same level that failed. If both CCVs pass the criteria, then sample analysis can continue. Otherwise, the system must be recalibrated and the samples reanalyzed, or the data can be qualified.

Calibration Calculations:

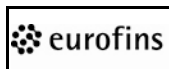
1. Calculation of the relative response factor (RRF):

$$RRF = \frac{[A(x) \times C(is)]}{[A(is) \times C(x)]}$$

Where:

- A(x) = Characteristic ion area for the compound being measured
A(is) = Characteristic ion area for the specific internal standard
C(x) = Concentration of the compound being measured
C(is) = Concentration of specific internal standard

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2. Regression equations:

$$1st\ Order\ (linear)\ regression : Y = Mx + B$$

$$2nd\ order\ (quadratic)\ regression : Y = Cx^2 + Mx + B$$

Where:

$$x = \text{Area(Std)} / \text{Area(Istd)}$$

$$Y = \text{Conc. (Std)} / \text{Conc. (Istd)}$$

$$M = 1^{st}\ \text{degree slope}$$

$$C = 2^{nd}\ \text{degree slope}$$

$$B = Y\text{-intercept}$$

3. Percent relative standard deviation (%RSD) :

$$\% \ RSD = \frac{\text{Standard Deviation}}{\text{Mean}} \times 100$$

4. Calculation of the percent drift:

$$\% \ Drift = \frac{C(i) - C(c)}{C(i)} \times 100$$

Where:

$$C(i) = \text{Calibration check compound standard concentration}$$

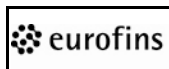
$$CI = \text{Measured concentration using selected quantification method}$$

Procedure:

A. Method Blank:

Analyze the method blank as described above for the initial calibration standards. The method blank is examined for interfering peaks. Any target compound peaks are calculated as described under the Calculations section of this procedure. All compounds must be less than the reporting limit for the associated samples. If the blank values exceed these values, corrective action must be taken and the method blank reanalyzed until the criteria are met.

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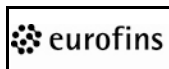
B. Laboratory Control Sample/ Duplicate and Matrix Spike/Duplicate: Refer to table in QA/QC section for specific requirements.

C. Qualitative Analysis:

Sample analysis for soil, solids, and nonaqueous matrices proceeds as described in the Calibration section. The aqueous matrix is replaced by the soil sample, which is prepared according to analysis 0374 or analysis 8389, 8390. For 0374 (low level) and 8389, 5 mL of reagent water with the internals and surrogate standards must be added to the sample prior to purging. The high level sample extract prepared by 8390 must be spiked with the appropriate amount of the 2500 µg/mL surrogate solution prior to removing an aliquot for analysis. Since the surrogate is already added for the high level (and medium level 0374), only internal standards need to be added at the time of analysis. A compound is identified by comparison of the following parameters with those of a standard of this target compound (standard reference spectra). In order to verify identification, the following criteria must be met:

1. The intensities of the characteristic ions of the compound must maximize in the same scan or within one scan of each other.
2. The compound relative retention time must compare within ± 0.06 RRT units of the RRT of the standard.
3. The characteristic ions from the reference mass spectrum are defined to be the three ions of greatest relative intensity, or any ions over 30% relative intensity if less than three such ions occur in the reference spectrum.
4. The relative intensities of the characteristic ions must agree within 30% of the relative intensities of these ions in the reference spectrum. Analyst discretion is used to determine compound identification. (Example: for an ion with an abundance of 50% in the reference spectrum, the corresponding abundance in a sample spectrum can range between 20% and 80%).

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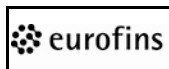
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5. The above criteria apply to hits greater than or equal to the LOQ. For hits between the MDL and the LOQ, both the above criteria and analyst discretion are used to determine compound identification.
6. The analyst must account for peaks that are greater than 10% relative intensity in the sample mass spectrum, but not present in the standard mass spectrum. Also, if a compound fails any of the criteria listed above but in the judgment of the mass spectral interpretation specialist is a correct identification, the identification is used and the quantitation of the peak is performed.

The primary and secondary ions can be found in Table 2.

D. Quantitative Analysis:

Once a compound has been identified, quantitation of identified priority pollutant compounds is performed using the equations listed in the Calculations section of this procedure. The primary ions listed in Table 2 are used for quantitation. A secondary ion may be used if there is interference with the primary ion. All calculations must report concentrations in values of $\mu\text{g/kg}$. Any analyte with a calculated concentration above the highest standard must be reanalyzed at a dilution that brings the concentration in the solution within the calibration curve. It is desirable to have the dilution fall within the top half of the calibration curve, but it is not required.

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1. Low level

$$\text{Concentration (}\mu\text{g/kg)} \frac{(A_x)(I_s)}{(A_{is})(RRF)(W_s)}$$

Where:

A_x = Area of the quantitation ion peak for the compound to be measured

A_{is} = Area of the quantitation ion peak for the appropriate internal standard

I_s = Amount of internal standard added in nanograms

W_s = Weight of sample purged

RRF = Relative response factor from the initial calibration

2. Medium/high level

$$\text{Concentration (}\mu\text{g/kg)} \frac{(A_x)(I_s)(V_t)}{(A_{is})(RRF)(W_s)(V_i)}$$

Where:

A_x = Area of the quantitation ion peak for the compound to be measured

A_{is} = Area of the quantitation ion peak for the appropriate internal standard

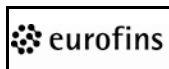
I_s = Amount of internal standard added in nanograms

V_t = Volume of the total extract in microliters

V_i = Volume of the extract used for purging in microliters

W_s = Weight of sample extracted

RRF = Relative response factor from the initial calibration

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Calculations:

A. QC Calculations:

$$\% Recovery = \frac{SSR - SR}{SA} \times 100$$

Where:

SSR = Spiked sample result

SR = Sample result

SA = Spike added

B. Relative percent difference (RPD)

$$RPD = \frac{MSR - MSRD}{(1/2)(MSR + MSRD)} \times 100$$

Where:

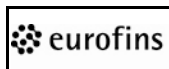
MSR = Matrix spike measured concentration

MSDR = Matrix spike duplicate measured concentration

Statistical Information/Method Performance:

The LCS must contain 80% to 100% of the compounds in the calibration mix. LCS, MS, and surrogate recoveries and RPD are compared to the limits stored on the LIMS. These limits are statistically derived but must fall within 70% to 130% recovery for South Carolina compliance samples. Historical data for MS/Ds, LCS/Ds, measurement of uncertainty, is reviewed at least annually. Reporting limits including method detection limits (MDLs) and limits of quantitation (LOQs) are set according to EPA method requirements and are evaluated annually. Refer to 1-P-QM-QMA-9017309 for specific guidelines and procedures. Updates to the LIMS are made as needed by the QA Department and only as directed by the supervisor. The department database is updated via a download from the LIMS.

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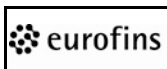
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Quality Assurance/Quality Control:

Each analysis batch must contain a method blank, a laboratory control sample (LCS), and either an unspiked background sample (US), a matrix spike (MS), a matrix spike duplicate (MSD), or a laboratory control sample/laboratory control sample duplicate (LCS/LCSD). Additional QC samples may be required to meet project or state certification requirements. Every sample or QC analysis must contain internal standards and surrogate compounds.

The GC/MS system must be tuned to meet the criteria in Table 1 following BFB injection. The chromatographic conditions must be the same as those under which the samples are analyzed except that the rate of temperature ramping may be increased and the initial temperature and column flow may be different. The BFB tune must be verified every 12 hours.

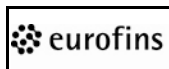
Quality Control Item	Acceptance Criteria	Corrective Action
Internal Standards <ul style="list-style-type: none"> Added to every sample, standard, method blank or QC sample 	<ol style="list-style-type: none"> Peak areas within -50% to +100% of the area in the associated reference standard. Retention time (RT) within 30 seconds of RT for associated reference standard. 	<ol style="list-style-type: none"> Check instrument for possible problems and then reanalyze samples. If re-injecting meets the criteria, report this analysis. If this reanalysis still shows the same problem, report results from first analysis and qualify data with a comment.
Surrogates <ul style="list-style-type: none"> Added to every sample, standard, method blank or QC sample 	All % recoveries must fall within statistically derived QC limits, which are reviewed and updated on a semi-annual basis.	If non-compliant, check for calculation or preparation errors. If no errors are found, check system for problems and reanalyze. If this reanalysis still shows the same problem, report first analysis and qualify data with a comment. If recoveries are outside of specification high and no target compounds are detected then a reanalysis or comment is not required.

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Quality Control Item	Acceptance Criteria	Corrective Action
Method Blank (MB) Performed during each tune period after the initial calibration or CCV (minimum of 1 MB per 20 samples) <ul style="list-style-type: none"> 1 scoop of Sodium Bisulfate is added if the preservative was added to the initial calibration. 	<ol style="list-style-type: none"> Must meet internal standard criteria. Must meet surrogate criteria. Quantitative results for all target compounds must be less than the reporting limit for the associated samples. 	<ol style="list-style-type: none"> Inspect system for possible problems and reanalyze. If the MB contains target analytes and the associated samples do not, then no corrective action is required. If the target compounds in the MB are also in the associated samples, then they must be reanalyzed after a clean MB is obtained (certain projects may allow some exceptions for common laboratory contaminants like methylene chloride and acetone up to 5X the LOQ)
Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) <ul style="list-style-type: none"> LCS analyzed with each batch of ≤ 20 samples LCSD analyzed if MS/MSD unavailable Approximately 5 grams of sand is required for low level analysis. 1 scoop of Sodium Bisulfate is added if the preservative was added to the initial calibration. See Tables 2, 3 and 4 for preparation info. 	<ol style="list-style-type: none"> Must meet internal standard criteria. Must meet surrogate criteria. All % recoveries must fall within statistically derived QC limits, which are reviewed and updated on a semi-annual basis. 	<ol style="list-style-type: none"> If non-compliant, check for calculation or preparation errors. If no errors found, check system for problems and reanalyze. If LCS/LCSD re-analysis still fails, perform appropriate system maintenance and restart the tune period. Only with an LCS % recovery failing high (for the requested target compounds) with targets non-detected in the sample, can the results be reported. Otherwise, the sample must be analyzed with a compliant LCS.
Matrix Spike/Matrix Spike Duplicate (MS/MSD) <ul style="list-style-type: none"> MS/MSD analyzed with each batch of ≤ 20 samples (if sufficient sample volume available) See Figures 2 and 3 for preparation info. 	<ol style="list-style-type: none"> % Recoveries must fall within statistically derived QC limits, which are reviewed and updated on a semi-annual basis RPDs within QC limits. 	<ol style="list-style-type: none"> If LCS within QC limits, proceed with sample analysis. If most recoveries and/or RPDs outside of QC limits, consult the supervisor.

The method blank must meet all the above criteria for internal standard recoveries and surrogate recoveries. In addition, the method blank may not contain any target compound above the reporting limit for the associated samples. All method blanks must meet these criteria; otherwise, the system is considered out of control and corrective action must be taken.

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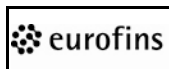
If sufficient sample volume is not available to perform MS/MSD, LCS/LCSD are prepared and analyzed and must meet the above-mentioned criteria.

NOTE: Prior to release from the analytical laboratory, all data is reviewed in accordance with 1-P-QM-PRO-9015471.

The sample is analyzed using the same instrumental conditions as the standard (whether ICAL or CCV), tune and method blank. If the QA criteria are satisfied and no target compounds are detected at concentrations above the calibration range, the results can be reported. To avoid possible matrix effects, sample carryover and re-analyses, an initial dilution may be performed if:

1. Prescreening indicates a high volatile organic content in the sample
2. Historical data (or lack thereof) and/or sample appearance indicate a need for dilution

If target compounds are detected in the sample at concentrations above the calibration range, a dilution must be performed (see 1-P-QM-PRO-9015470 for information on when cleaning blanks must be run). See method SW-846 8260C for the recommended dilution procedures.

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Attachment I

Gasoline Range Organics (GRO) by Gas Chromatography/Mass Spectroscopy (GC/MS)

This section is specific to the steps required for GRO analysis. See the main body of the SOP for general information/ processes.

Basic Principles:

The GRO analysis is typically performed in conjunction with the analysis of other volatile target compounds by SW-846 Method 8260C. The GRO quantitation range is 0.1 minutes before the peak apex of C6 (hexane) to 0.2 minutes after the peak apex of C12 (dodecane); however, other ranges can be established. By establishing a (C12) GRO window to 0.2 minutes following the elution of dodecane, the areas from a trio of unresolved peaks eluting near to the upper limit of the range must consistently be included in the total GRO area. In addition, the range remains tight enough to ensure that no C13 or greater compounds can be included in the total GRO area. The C4 range retention time is determined by selecting the first peak after the air and/or artifact peak minus 0.1 minutes in the first level of standard analyzed with the ICAL. This analysis must be performed by or under the direct supervision of an operator experienced in the analysis of volatile organics by GC/MS purge and trap methodologies. The area of the total ion chromatogram for the GRO range is determined. The area of the internal standards and surrogate standards are found and subtracted from the total area of the chromatogram within the desired time range. The resulting area is then quantitated versus the internal standard, fluorobenzene.

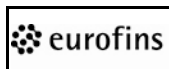
Interferences: See main body of SOP.

Safety Precautions and Waste Handling: See main body of SOP.

Personnel Training and Qualifications: See main body of SOP.

NOTE: A separate Demonstration of Capability for GRO is required.

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Sample Collection, Preservation, and Handling: See main body of SOP.

Apparatus and Equipment: See main body of SOP.

Reagents and Standards:

A. Reagents- See main body of SOP.

B. Standards- See main body of SOP for general standards.

1. GRO calibration standard – a 5500-µg/mL stock unleaded gasoline composite prepared in methanol by a commercial supplier.
2. GRO QC standard – a 20,000-µg/mL stock unleaded gasoline composite prepared in methanol by a commercial supplier

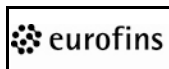
Store all standard solutions at -10° to -15°C

Calibration:

A. Initial calibration:

Prior to the analysis of any calibration level, retention time markers must be run for the GRO range of interest. The retention time markers are hexane (C6) and Dodecane (C12). Other markers can be used if different ranges are required by a project.

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Internal standard calibration for GRO consists of analyzing six distinct levels of GRO area in order to produce a response factor for the GRO quantitation range of interest using the internal standard, fluorobenzene. The relative standard deviation of the response factor determines the suitability of the average relative response factor for calculation of the GRO concentration.

NOTE: 5 levels are required by the method.

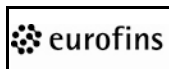
1. Prepare the calibration standards at appropriate levels. Suggested calibration levels are 44, 110, 550, 1100, 2200, and 4400 ppb for high levels soils and 110, 220, 550, 1100, 2200, 4400 ppb for low-level soils. For low-level soils prepared according to EPA Method 5035, 1 scoop of sodium bisulfate is added to all calibration standards.

To prevent confusion and assure proper calibration, a Theoretical Standard Concentration (TSC) sheet is completed for each calibration (Figure 6 and 7). The TSC sheet contains the theoretical concentration for each certified analyte in the calibration at the various levels.

2. Each level is analyzed as described in the procedure under data analysis. Next, tabulate the area response for the GRO quantitation range minus the peak areas for the internal and surrogate standards that elute within the GRO range. Calculate the relative response factor (RRF) for GRO (see Calculation section) using the internal standard peak area for fluorobenzene.

NOTE: Although four internal standard compounds are spiked for the 8260B analysis, only one, fluorobenzene, is used for the quantitation of the GRO result.

3. Calculate the average relative response factors for the GRO quantitation range of interest. The calibration levels are evaluated on the basis of the relative standard deviation of the RRF values (%RSD). The %RSD for the GRO range of interest must be $\leq 20\%$. If the calibration meets this

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requirement, then the average RRF is used to calculate sample concentrations. If the %RSD is >20% then re-analysis of one or more levels can be necessary before the calibration is valid.

B. Initial Calibration Verification (ICV):

Following the calibration, an Initial Calibration Verification (ICV) standard must be run. The ICV is prepared according to the TSC sheet in Figure 5 or 6 (QC prep). The ICV acts as a second source standard to check against the initial calibration. Results must quantitate within the 70-130% window. If the ICV does not meet the aforementioned criteria, a second ICV can be run before invalidating the initial calibration. Upon failure of the second ICV, the system must be recalibrated after proper corrective action is taken.

C. Continuing calibration verification (CCV):

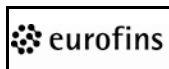
The CCV involves an analysis for the 1100-ppb standard. The calibration is considered valid if the percent drift is $\leq 20\%$. Also, the internal standard peak area of fluorobenzene for the CCV is monitored against the mid-point standard of the initial calibration and must be -50% to $+100\%$ of the area counts. If any criteria listed above fails, the CCV is considered invalid. In the case where two consecutive CCVs fail, corrective action must be taken which can include re-analysis of the calibration check, instrument maintenance, and/or recalibration. If the criteria are met, the selected quantitation method from the initial calibration is used for blank and sample calculations until the end of the 12-hour period.

Procedure:

Samples must be analyzed in accordance with the analyses listed in the main body of this SOP. However, additional requirements are required for the GRO data analysis.

- A. The Total Ion Chromatogram (TIC) is reviewed to insure proper integration around the 8260 surrogates and internal standards. Also the TIC is checked to make sure all major peaks are integrated.

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- B. The quantitation of the GRO range is performed using the equations listed in the Calculations section of this procedure. All calculations must report concentrations in values of µg/L. In the case where the total GRO concentration exceeds the calibration range, the sample is re-analyzed at a dilution that brings the GRO concentration within the calibration range of the GC/MS system.

Calculations: See main body of SOP.

Statistical Information/Method Performance: See main body of SOP.

Quality Assurance/Quality Control: See main body of SOP.

Table 1

BFB Key Ion Abundance Criteria

<u>Mass</u>	<u>Ion Abundance Criteria</u>
50	15% to 40% of mass 95
75	30% to 60% of mass 95
95	base peak, 100% relative abundance
96	5% to 9% of mass 95
173	less than 2% of mass 174
174	greater than 50% of mass 95
175	5% to 9% of mass 174
176	greater than 95% but less than 101% of mass 174
177	5% to 9% of mass 176

Table 2
Primary and Secondary Ions

Compound Name	Primary Ion	Secondary Ion
Chloromethane	50	52
Vinyl Chloride	62	64
Bromomethane	94	96
Chloroethane	64	66
1,1-Dichloroethene	96	61, 63
Acetone	43	58
Carbon Disulfide	76	78
Methylene Chloride	84	49, 86
1,1-Dichloroethane	63	65, 83
<i>trans</i> -1,2-Dichloroethene	96	61, 63
<i>cis</i> -1,2-Dichloroethene	96	61, 63
2-Butanone	43	72
Chloroform	83	85
1,2-Dichloroethane	62	98
1,1,1-Trichloroethane	97	61, 99
Carbon Tetrachloride	117	119
Benzene	78	
Trichloroethene	95	130, 132
1,2-Dichloropropane	63	76
Bromodichloromethane	83	85
<i>cis</i> -1,3-Dichloropropene	75	77, 110
<i>trans</i> -1,3-Dichloropropene	75	77, 110
1,1,2-Trichloroethane	97	83, 85
Dibromochloromethane	129	127
Bromoform	173	175
4-Methyl-2-pentanone	43	58
Toluene	92	91
Tetrachloroethene	166	131, 164
2-Hexanone	43	58
Chlorobenzene	112	77
Ethylbenzene	91	106
Xylene (total)	106	91
Styrene	104	78
1,1,2,2-Tetrachloroethane	83	85, 131
Dibromofluoromethane	113	111
1,2-Dichloroethane-d4	102	104
Fluorobenzene	96	70
Toluene-d8	98	100
Chlorobenzene-d5	117	82
4-Bromofluorobenzene	95	174
1,4-Dichlorobenzen-d4	152	115

Table 2 Continued
Primary and Secondary Ions

Compound Name	Primary Ion	Secondary Ion
Chloromethane	50	52
Vinyl Chloride	62	64
Bromomethane	94	96
Chloroethane	64	66
1,1-Dichloroethene	96	61, 63
Acetone	43	58
Carbon Disulfide	76	78
Methylene Chloride	84	49, 86
1,1-Dichloroethane	63	65, 83
<i>trans</i> -1,2-Dichloroethene	96	61, 63
<i>cis</i> -1,2-Dichloroethene	96	61, 63
2-Butanone	43	72
Chloroform	83	85
1,2-Dichloroethane	62	98
1,1,1-Trichloroethane	97	61, 99
Carbon Tetrachloride	117	119
Benzene	78	
Trichloroethene	95	130, 132
1,2-Dichloropropane	63	76
Bromodichloromethane	83	85
<i>cis</i> -1,3-Dichloropropene	75	77, 110
<i>trans</i> -1,3-Dichloropropene	75	77, 110
1,1,2-Trichloroethane	97	83, 85
Dibromochloromethane	129	127
Bromoform	173	175
4-Methyl-2-pentanone	43	58
Toluene	92	91
Tetrachloroethene	166	131, 164
2-Hexanone	43	58
Chlorobenzene	112	77
Ethylbenzene	91	106
Xylene (total)	106	91
Styrene	104	78
1,1,2,2-Tetrachloroethane	83	85, 131
Dibromofluoromethane	113	111
1,2-Dichloroethane-d4	102	104
Fluorobenzene	96	70
Toluene-d8	98	100
Chlorobenzene-d5	117	82
4-Bromofluorobenzene	95	174
1,4-Dichlorobenzene-d4	152	115

Table 3
Minimum Relative Response Factors For ICAL and CCV

Volatile Compounds	Minimum Response Factor
Dichlorodifluoromethane	0.100
Chloromethane	0.100
Vinyl Chloride	0.100
Bromomethane	0.100
Chloroethane	0.100
Trichlorofluoromethane	0.100
1,1-Dichloroethene	0.100
1,1,2-Trichloro-1,2,2-trifluoroethane	0.100
Acetone	0.100
Carbon Disulfide	0.100
Methyl Acetate	0.100
Methylene Chloride	0.100
trans-1,2-Dichloroethene	0.100
cis-1,2-Dichloroethene	0.100
Methyl tert-Butyl Ether	0.100
1,1-Dichloroethane	0.200
2-Butanone	0.100
Chloroform	0.200
1,1,1-Trichloroethane	0.100
Cyclohexane	0.100
Carbon Tetrachloride	0.100
Benzene	0.500
1,2-Dichloroethane	0.100
Trichloroethene	0.200
Methylcyclohexane	0.100
1,2-Dichloropropane	0.100
Bromodichloromethane	0.200
cis-1,3-Dichloropropene	0.200
trans-1,3-Dichloropropene	0.100
4-Methyl-2-pentanone	0.100
Toluene	0.400
1,1,2-Trichloroethane	0.100
Tetrachloroethene	0.200
2-Hexanone	0.100
Dibromochloromethane	0.100
1,2-Dibromoethane	0.100
Chlorobenzene	0.500
Ethylbenzene	0.100

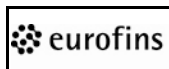
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Table 3 Continued

Volatile Compounds	Minimum Response Factor
m&p-Xylene	0.100
o-Xylene	0.300
Styrene	0.300
Bromoform	0.100
Isopropylbenzene	0.100
1,1,2,2-Tetrachloroethane	0.300
1,3-Dichlorobenzene	0.600
1,4-Dichlorobenzene	0.500
1,2-Dichlorobenzene	0.400
1,2-Dibromo-3-chloropropane	0.050
1,2,4-Trichlorobenzene	0.200

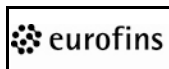
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Figure 1

Theoretical Standard Concentrations
Initial Calibration for Large Curve
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C

Date: _____
Instrument: _____

VOA1= 1:5 dilution of VCS#1B, VCS#2B, and VCS#4C

VOA2= 1:5 dilution of VCS#2B

VOA6= 1:5 dilution of VCS#6

VOA3= 1:5 dilution of VCS#3B and Vacrolein

2CEVE= 1:5 dilution of VCS#1B-2CEVE

Stock mix name	VOA1	VOA3	VOA2	VOA6	EOH	CYC	Restek Gases (2000 ppm) Lt#	IH826SS 250 ppm @ 2500 ppm 8260 SS \$ Lt#	Flask mL	MeOH mL	
	2CEVE			EE						Lt#	
				Custom V Freon							
300 ppb std	15 µL	6 µL		15µL	60 µL	30 µL	7.5 µL	60 µL @/ 6 µL \$	50	1	
100 ppb std	5 µL	2 µL		5 µL	20 µL	10µL	2.5 µL	20 µL @/ 2 µL \$	50	1	
50 ppb std	5 µL	2 µL		5 µL	20 µL	10µL	2.5 µL	20ul @/ 2ul \$	100	2	
20 ppb std	4 µL	1.6 µL	4 µL	4 µL	32 µL	16µL	2.0 µL	16 µL@/1.6 \$	200	4	
10 ppb std	2 µL	0.8 µL	2 µL	2 µL	16 µL	8µL	1.0 µL	8 µL@/0.8 \$	200	4	
4 ppb std	4 µL	1.6 µL	12 µL	4 µL	40 µL	32µL	2.0 µL	16 µL@/1.6 \$	1000 *	20	
								@ µL of 250 ppm std used			
								\$ µL of 2500 ppm std used			
1 ppb std	* Aliquot 12.5 mL of 1000 mL flask into 50 mL flask										
Compound name			std mix	Stock ppm	300 ppb	100 ppb	50 ppb	20 ppb	10 ppb	4 ppb	1 ppb
Benzene			CS#1B	5000	300	100	50	20	10	4	1
Bromobenzene				5000	300	100	50	20	10	4	1
Bromodichloromethane				5000	300	100	50	20	10	4	1
Bromoform				5000	300	100	50	20	10	4	1
n-Butylbenzene				5000	300	100	50	20	10	4	1
sec-Butylbenzene				5000	300	100	50	20	10	4	1
tert-Butylbenzene				5000	300	100	50	20	10	4	1
Carbon Tetrachloride				5000	300	100	50	20	10	4	1
Chlorobenzene				5000	300	100	50	20	10	4	1
Chloroform				5000	300	100	50	20	10	4	1
2-Chlorotoluene				5000	300	100	50	20	10	4	1
4-Chlorotoluene				5000	300	100	50	20	10	4	1
Dibromochloromethane				5000	300	100	50	20	10	4	1
1,2-Dibromo-3-chloropropane				5000	300	100	50	20	10	4	1
1,2-Dibromoethane (EDB)				5000	300	100	50	20	10	4	1
Dibromomethane				5000	300	100	50	20	10	4	1
1,2-Dichlorobenzene				5000	300	100	50	20	10	4	1
1,3-Dichlorobenzene				5000	300	100	50	20	10	4	1
1,4-Dichlorobenzene				5000	300	100	50	20	10	4	1

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Figure 1 Continued

Theoretical Standard Concentrations
 Initial Calibration for Large Curve
 Purchased Standards
 HP Capillary Column
 EPA SW846 Method 8260C

Compound name	std mix	Stock ppm	300 ppb	100 ppb	50 ppb	20 ppb	10 ppb	4 ppb	1 ppb
1,1-Dichloroethane	CS#1B	5000	300	100	50	20	10	4	1
1,2-Dichloroethane		5000	300	100	50	20	10	4	1
1,1-Dichloroethene		5000	300	100	50	20	10	4	1
cis-1,2-Dichloroethene		5000	300	100	50	20	10	4	1
trans-1,2-Dichloroethene		5000	300	100	50	20	10	4	1
1,2-Dichloropropane		5000	300	100	50	20	10	4	1
1,3-Dichloropropane		5000	300	100	50	20	10	4	1
2,2-Dichloropropane		5000	300	100	50	20	10	4	1
1,1-Dichloropropene		5000	300	100	50	20	10	4	1
cis-1,3-Dichloropropene		5000	300	100	50	20	10	4	1
trans-1,3-Dichloropropene		5000	300	100	50	20	10	4	1
Ethylbenzene		5000	300	100	50	20	10	4	1
Hexachlorobutadiene		5000	300	100	50	20	10	4	1
Isopropylbenzene (Cumene)		5000	300	100	50	20	10	4	1
p-Isopropyltoluene		5000	300	100	50	20	10	4	1
Methylene Chloride		5000	300	100	50	20	10	4	1
Naphthalene		5000	300	100	50	20	10	4	1
n-Propylbenzene		5000	300	100	50	20	10	4	1
Styrene		5000	300	100	50	20	10	4	1
1,1,1,2-Tetrachloroethane		5000	300	100	50	20	10	4	1
1,1,2,2-Tetrachloroethane		5000	300	100	50	20	10	4	1
Tetrachloroethene		5000	300	100	50	20	10	4	1
Toluene		5000	300	100	50	20	10	4	1
1,2,3-Trichlorobenzene		5000	300	100	50	20	10	4	1
1,2,4-Trichlorobenzene		5000	300	100	50	20	10	4	1
1,3,5-Trichlorobenzene		5000	300	100	50	20	10	4	1
1,1,1-Trichloroethane		5000	300	100	50	20	10	4	1
1,1,2-Trichloroethane		5000	300	100	50	20	10	4	1
Trichloroethene		5000	300	100	50	20	10	4	1
1,2,3-Trichloropropane		5000	300	100	50	20	10	4	1
1,2,4-Trimethylbenzene		5000	300	100	50	20	10	4	1
1,3,5-Trimethylbenzene		5000	300	100	50	20	10	4	1
m-Xylene		5000	300	100	50	20	10	4	1
o-Xylene		5000	300	100	50	20	10	4	1
p-Xylene		5000	300	100	50	20	10	4	1
2-Chloroethyl Vinyl Ether	2CEVE	5000	300	100	50	20	10	4	1
Bromomethane	Gas mix	2000	300	100	50	20	10	4	1
Chloroethane		2000	300	100	50	20	10	4	1
Chloromethane		2000	300	100	50	20	10	4	1
Dichlorodifluoromethane		2000	300	100	50	20	10	4	1
Trichlorofluoromethane		2000	300	100	50	20	10	4	1
Vinyl Chloride		2000	300	100	50	20	10	4	1

Page 2 of 4

Figure 1 Continued

Theoretical Standard Concentrations
Initial Calibration for Large Curve
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C

Compound name	std mix	Stock ppm	300 ppb	100 ppb	50 ppb	20 ppb	10 ppb	4 ppb	1 ppb
Methacrylonitrile	CS#2B	12500	750	250	125	100	50	40	10
Propionitrile		25000	1500	500	250	200	100	80	20
trans-1,4-Dichloro-2-Butene		12500	750	250	125	100	50	40	10
t-Butyl Alcohol		25000	1500	500	250	200	100	80	20
2-Propanol		25000	1500	500	250	200	100	80	20
Isobutyl Alcohol		62500	3750	1250	625	500	250	200	50
n-Butanol		125000	7500	2500	1250	1000	500	400	100
1,4-Dioxane		62500	3750	1250	625	500	250	200	50
2-Butanone	CS#3B	25000	600	200	100	40	20	8	2
2-Hexanone		25000	600	200	100	40	20	8	2
4-Methyl-2-Pentanone		25000	600	200	100	40	20	8	2
Acetone		25000	600	200	100	40	20	8	2
Acrylonitrile		12500	300	100	50	20	10	4	1
2-Nitropropane		25000	600	200	100	40	20	8	2
Tetrahydrofuran		25000	600	200	100	40	20	8	2
Methyl-t-butyl Ether	CS#4C	5000	300	100	50	20	10	4	1
Ethyl Methacrylate		5000	300	100	50	20	10	4	1
Methyl Methacrylate		5000	300	100	50	20	10	4	1
Freon 113		5000	300	100	50	20	10	4	1
Hexane		5000	300	100	50	20	10	4	1
Heptane		5000	300	100	50	20	10	4	1
Cyclohexane		5000	300	100	50	20	10	4	1
Benzyl Chloride		5000	300	100	50	20	10	4	1
Methyl Iodide		5000	300	100	50	20	10	4	1
Carbon Disulfide		5000	300	100	50	20	10	4	1
2-Chloro-1,3-Butadiene		5000	300	100	50	20	10	4	1
di-Isopropyl Ether		5000	300	100	50	20	10	4	1
tert-Amyl Methyl Ether		5000	300	100	50	20	10	4	1
Ethyl-t-butyl Ether		5000	300	100	50	20	10	4	1
Pentachloroethane		5000	300	100	50	20	10	4	1
Allyl Chloride		5000	300	100	50	20	10	4	1
Bromochloromethane		5000	300	100	50	20	10	4	1
Methyl Acetate		5000	300	100	50	20	10	4	1
Methylcyclohexane		5000	300	100	50	20	10	4	1
2-Methylnaphthalene		5000	300	100	50	20	10	4	1
1,2,3-Trimethylbenzene		5000	300	100	50	20	10	4	1
1,2-Diethylbenzene		5000	300	100	50	20	10	4	1
1,3-Diethylbenzene		5000	300	100	50	20	10	4	1
1,4-Diethylbenzene		5000	300	100	50	20	10	4	1

Page 3 of 4

Figure 1 Continued

Theoretical Standard Concentrations
Initial Calibration for Large Curve
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C

Compound name	std mix	Stock ppm	300 ppb	100 ppb	50 ppb	20 ppb	10 ppb	4 ppb	1 ppb
Ethyl Ether	EE	1000	300	100	50	20	10	4	1
n-Pentane	n-PEN	1000	300	100	50	20	10	4	1
Acrolein	VACR	125000	3000	1000	500	200	100	40	10
Cyclohexanone	CYC	6250	3750	1250	625	500	250	200	50
Ethanol	EOH	12500	15000	5000	2500	2000	1000	500	125
Dichlorofluoromethane	Custom	1000	300	100	50	20	10	4	1
Freon 123a	V Freon	1000	300	100	50	20	10	4	1

ppb of analytical standard = (stock ppm)(μ L stock) / flask mL

Analyst: _____

Date: _____

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Figure 2

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C
Low Soil and NJ MeOH Prep

QVOA1= 1:25 QCS#1B, QCS#2B, QCS3B,QCS#4C
QVOA6 = 1: 25 QCS#6 QGASES=1:50 Restek 502.2 "Q" Gas mix
QARC = 1: 25 QCS#1B2CEVE, QACR stock
Qn-pentane = 40ul of n-pentane lot# _____ to 960ul MEOH lot# _____
QBUT = 40ul of 1,3-Butadiene lot# _____ to 960ul MEOH lot# _____
Custom Freon Q = 40ul of Custom Freon Q lot# _____ to 960 ul MEOH lot# _____

Date: _____
Instrument: _____

Stock mix Name	QVOA1 QARC QBUT	QVOA6 QEE QCYC	QEOH	8260 SS 2500 ppm Lot# MeOH Prep Only	QGASES Qn-pentane Custom FreonQ	Final Volume	MeOH Lot# MeOH Prep Only	Used
20 ppb	2.5 µL	2.5 µL	5.0 µL	0.1 ul	2.5 µL	5 mL Syringe	.1 mL	
20 ppb	21.5 µL	21.5 µL	43.0 µL	-	21.5 µL	43 mL Vial	-	
20 ppb	25.0 µL	25.0 µL	50.0 µL	1.0 ul	25.0 µL	50 mL Flask	1 mL	
Compound name			std mix	Stock ppm	20 ppb			
			QCS#1B	1000	20			
Benzene				1000	20			
Bromobenzene				1000	20			
Bromodichloromethane				1000	20			
Bromoform				1000	20			
n-Butylbenzene				1000	20			
sec-Butylbenzene				1000	20			
tert-Butylbenzene				1000	20			
Carbon Tetrachloride				1000	20			
Chlorobenzene				1000	20			
Chloroform				1000	20			
2-Chlorotoluene				1000	20			
4-Chlorotoluene				1000	20			
Dibromochloromethane				1000	20			
1,2-Dibromo-3-chloropropane				1000	20			
1,2-Dibromoethane (EDB)				1000	20			
Dibromomethane				1000	20			
1,2-Dichlorobenzene				1000	20			
1,3-Dichlorobenzene				1000	20			
1,4-Dichlorobenzene				1000	20			
1,1-Dichloroethane				1000	20			
1,2-Dichloroethane				1000	20			
1,1-Dichloroethene				1000	20			
cis-1,2-Dichloroethene				1000	20			
trans-1,2-Dichloroethene				1000	20			
1,2-Dichloropropane				1000	20			
1,3-Dichloropropane				1000	20			
2,2-Dichloropropane				1000	20			
1,1-Dichloropropene				1000	20			
cis-1,3-Dichloropropene				1000	20			
trans-1,3-Dichloropropene				1000	20			
Ethylbenzene				1000	20			
Hexachlorobutadiene				1000	20			

Figure 2 Continued

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C
Low Soil and NJ MeOH Prep

Compound name	std mix	Stock ppm	20 ppb
p-Isopropyltoluene	QCS#1B	1000	20
Methylene Chloride		1000	20
Isopropylbenzene (Cumene)		1000	20
Naphthalene		1000	20
n-Propylbenzene		1000	20
Styrene		1000	20
1,1,1,2-Tetrachloroethane		1000	20
1,1,2,2-Tetrachloroethane		1000	20
Tetrachloroethene		1000	20
Toluene		1000	20
1,2,3-Trichlorobenzene		1000	20
1,2,4-Trichlorobenzene		1000	20
1,3,5-Trichlorobenzene		1000	20
1,1,1-Trichloroethane		1000	20
1,1,2-Trichloroethane		1000	20
Trichloroethene		1000	20
1,2,3-Trichloropropane		1000	20
1,2,4-Trimethylbenzene		1000	20
1,3,5-Trimethylbenzene		1000	20
m-Xylene		1000	20
o-Xylene		1000	20
p-Xylene		1000	20
Bromomethane	QGas mix	2000	20
Chloroethane		2000	20
Chloromethane		2000	20
Dichlorodifluoromethane		2000	20
Trichlorofluoromethane		2000	20
Vinyl Chloride		2000	20
Methacrylonitrile	QCS#2B	7500	150
Propionitrile		7500	150
trans-1,4-Dichloro-2-Butene		5000	100
t-Butyl Alcohol		10000	200
2-Propanol		7500	150
Isobutyl Alcohol		25000	500
n-Butanol		50000	1000
1,4-Dioxane		25000	500
2-Butanone	QCS#3B	7500	150
2-Hexanone		5000	100
4-Methyl-2-Pentanone		5000	100
Acetone		7500	150
Acrylonitrile		5000	100
2-Nitropropane		1000	20

Page 2 of 4

Figure 2 Continued

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C
Low Soil and NJ MeOH Prep

Compound name	std mix	Stock ppm	20 ppb
Tetrahydrofuran	QCS#3B	5000	100
Methyl-t-butyl Ether	QCS#4C	1000	20
Ethyl Methacrylate		1000	20
Methyl Methacrylate		1000	20
Freon 113		1000	20
Hexane		1000	20
Heptane		1000	20
Cyclohexane		1000	20
Benzyl Chloride		1000	20
Methyl Iodide		1000	20
Carbon Disulfide		1000	20
2-Chloro-1,3-Butadiene		1000	20
di-Isopropyl Ether		1000	20
tert-Amyl Methyl Ether		1000	20
Ethyl-t-butyl Ether		1000	20
Pentachloroethane	QCS#6	1000	20
Allyl Chloride		1000	20
Bromochloromethane		1000	20
Methyl Acetate		1000	20
Methylcyclohexane		1000	20
2-Methylnaphthalene		1000	20
1,2,3-Trimethylbenzene		1000	20
1,2-Diethylbenzene		1000	20
1,3-Diethylbenzene		1000	20
1,4-Diethylbenzene		1000	20
Acrolein	QACR	7500	150
2- Chloroethyl Vinyl Ether	QCS#1B 2CEVE	1000	20
Cyclohexanone	QCYC	1000	500
Ethyl Ether	QEE	40	20
n-Pentane	Qn-PEN	40	20
1,3-Butadiene	QBUT	40	20
Ethanol	QEOH	1000	1000

Figure 2 Continued

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C
Low Soil and NJ MeOH Prep

Compound name	std mix	Stock ppm	20 ppb
Dichlorofluoromethane	Custom	1000	20
Freon 123a	Freon Q	1000	20

ppb of analytical standard = (stock ppm)(ul stock) / final volume

Analyst: _____
Date: _____

Figure 3

Theoretical Standard Concentrations
Quality Control for Large Curve
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C
High Level Prep with QC

Prep date: _____
Instrument: _____
exp. date: _____

*LCS/LCSD = DF 50 of final volume

Stock mix name	QCS#1B Lt# QCS#3B Lt# QCS#4C Lt# QCS#1B-2CEVE Lt# QCS#2B Lt# QCS#6 Lt#	QACR EE Freon Q Std. Lot #	CYC	EtOH	2000 ppm Restek 502.2 "Q" Gas mix Lt#	8260 SS \$ Lt# 2500 ppm \$	Final Volume * MeOH Lot#
High Level	10 µL	10 µL	40 µL	40 µL	5 µL	10 µL	10 mL
Compound name	std mix	Stock ppm	20 ppb				
Benzene	QCS#1B	1000	20				
Bromobenzene		1000	20				
Bromodichloromethane		1000	20				
Bromoform		1000	20				
n-Butylbenzene		1000	20				
sec-Butylbenzene		1000	20				
tert-Butylbenzene		1000	20				
Carbon Tetrachloride		1000	20				
Chlorobenzene		1000	20				
Chloroform		1000	20				
2-Chlorotoluene		1000	20				
4-Chlorotoluene		1000	20				
Dibromochloromethane		1000	20				
1,2-Dibromo-3-chloropropane		1000	20				
1,2-Dibromoethane (EDB)		1000	20				
Dibromomethane		1000	20				
1,2-Dichlorobenzene		1000	20				
1,3-Dichlorobenzene		1000	20				
1,4-Dichlorobenzene		1000	20				
1,1-Dichloroethane		1000	20				
1,2-Dichloroethane		1000	20				
1,1-Dichloroethene		1000	20				
cis-1,2-Dichloroethene		1000	20				
trans-1,2-Dichloroethene		1000	20				
1,2-Dichloropropane		1000	20				
1,3-Dichloropropane		1000	20				
2,2-Dichloropropane		1000	20				
1,1-Dichloropropene		1000	20				
cis-1,3-Dichloropropene		1000	20				
trans-1,3-Dichloropropene		1000	20				

Figure 3 Continued

Theoretical Standard Concentrations
Quality Control for Large Curve
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C
High Level Prep with QC

Ethylbenzene		1000	20
Compound name	std mix	Stock ppm	20 ppb
Hexachlorobutadiene	QCS#1B	1000	20
Isopropylbenzene (Cumene)		1000	20
p-Isopropyltoluene		1000	20
Methylene Chloride		1000	20
Naphthalene		1000	20
n-Propylbenzene		1000	20
Styrene		1000	20
1,1,1,2-Tetrachloroethane		1000	20
1,1,2,2-Tetrachloroethane		1000	20
Tetrachloroethene		1000	20
Toluene		1000	20
1,2,3-Trichlorobenzene		1000	20
1,2,4-Trichlorobenzene		1000	20
1,3,5-Trichlorobenzene		1000	20
1,1,1-Trichloroethane		1000	20
1,1,2-Trichloroethane		1000	20
Trichloroethene		1000	20
1,2,3-Trichloropropane		1000	20
1,2,4-Trimethylbenzene		1000	20
1,3,5-Trimethylbenzene		1000	20
m-Xylene		1000	20
o-Xylene		1000	20
p-Xylene		1000	20
2-Chloroethyl Vinyl Ether	QCS#1B 2CLEVE	1000	20
Bromomethane	Gas mix	2000	20
Chloroethane		2000	20
Chloromethane		2000	20
Dichlorodifluoromethane		2000	20
Trichlorofluoromethane		2000	20
Vinyl Chloride		2000	20
Methacrylonitrile	QCS#2B	7500	150
Propionitrile		7500	150
trans-1,4-Dichloro-2-Butene		5000	100
t-Butyl Alcohol		10000	200
2-Propanol		7500	150
Isobutyl Alcohol		25000	500
n-Butanol		50000	1000
1,4-Dioxane		25000	500

Page 2 of 4

Figure 3 Continued

Theoretical Standard Concentrations
Quality Control for Large Curve
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C
High Level Prep with QC

2-Hexanone	QCS#3B	5000	100
2-Butanone		7500	150

Compound name	std mix	Stock ppm	20 ppb
4-Methyl-2-Pentanone	QCS#3B	5000	100
Acetone		7500	150
Acrylonitrile		5000	100
2-Nitropropane		1000	20
Tetrahydrofuran		5000	100
Methyl-t-butyl Ether	QCS#4C	1000	20
Ethyl Methacrylate		1000	20
Methyl Methacrylate		1000	20
Freon 113		1000	20
Hexane		1000	20
Heptane		1000	20
Cyclohexane		1000	20
Benzyl Chloride		1000	20
Methyl Iodide		1000	20
Carbon Disulfide		1000	20
2-Chloro-1,3-Butadiene		1000	20
di-Isopropyl Ether		1000	20
tert-Amyl Methyl Ether		1000	20
Ethyl-t-butyl Ether		1000	20
Pentachloroethane	QCS#6	1000	20
Allyl Chloride		1000	20
Bromochloromethane		1000	20
2-Methylnaphthalene		1000	20
Methyl Acetate		1000	20
Methylcyclohexane		1000	20
1,2,3-Trimethylbenzene		1000	20
1,2-Diethylbenzene		1000	20
1,3-Diethylbenzene		1000	20
1,4-Diethylbenzene		1000	20

Figure 3 Continued

Theoretical Standard Concentrations
Quality Control for Large Curve
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C
High Level Prep with QC

Compound name	std mix	Stock ppm	20 ppb
Freon 123a	Freon Q	1000	20
Dichlorofluoromethane		1000	20
Acrolein	QACR	7500	150
Cyclohexanone	CYC	6250	500
Ethanol	EtOH	12500	1000
Ethyl Ether	EE	1000	20

ppb of analytical standard = (stock ppm)(μ l stock) / final volume

Analyst: _____
Date: _____

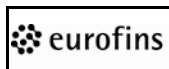
 Lancaster Laboratories Environmental	Document Title: Determination of Volatile Target Compounds and Gasoline Range Organics (GRO) by GC/MS in Soils and Solids by Method 8260C	Eurofins Document Reference: 1-P-QM-WI -9013077
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Figure 4

Theoretical Standard Concentrations
Quality Control for Large Curve
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C
MeOH Prep

QVOA6= 1:25 QCS#6
QARC = 1: 25 QCS#1B2CEVE, QACR stock
QVOA1= 1:25 QCS#1B, QCS#2B, QCS3B, QCS#4C
QFREON = 40uL of Custom Freon Q lot# to 960uL MEOH lot#
Prepped: _____
Instrument: _____
exp. date: _____
QGASES=1:50 Restek 502.2 "Q" Gas mix

Stock mix name	QVOA1	QVOA6	QGASES	QEOH	826SS \$	Final Volume	Prep Used
	QARC	QEE	QCYC		25 ppm \$	MeOH	
	QFREON				8260 SS@	Lot#	
					2500ppm @		
As Rec'd Med	250 µL	250 µL	250 ul	500 µl	1.0 mL \$	10 mL MeOH	
High Level NO QC	250 µL	250 µL	250 ul	500 µL	10 µL @	10 mL MeOH	

Compound name	std mix	Stock ppm	20 ppb
Benzene	QCS#1B	1000	20
Bromobenzene		1000	20
Bromodichloromethane		1000	20
Bromoform		1000	20
n-Butylbenzene		1000	20
sec-Butylbenzene		1000	20
tert-Butylbenzene		1000	20
Carbon Tetrachloride		1000	20
Chlorobenzene		1000	20
Chloroform		1000	20
2-Chlorotoluene		1000	20
4-Chlorotoluene		1000	20
Dibromochloromethane		1000	20
1,2-Dibromo-3-chloropropane		1000	20
1,2-Dibromoethane (EDB)		1000	20
Dibromomethane		1000	20
1,2-Dichlorobenzene		1000	20
1,3-Dichlorobenzene		1000	20
1,4-Dichlorobenzene		1000	20
1,1-Dichloroethane		1000	20
1,2-Dichloroethane		1000	20
1,1-Dichloroethene		1000	20
cis-1,2-Dichloroethene		1000	20
trans-1,2-Dichloroethene		1000	20
1,2-Dichloropropane		1000	20
1,3-Dichloropropane		1000	20
2,2-Dichloropropane		1000	20
1,1-Dichloropropene		1000	20
cis-1,3-Dichloropropene		1000	20
trans-1,3-Dichloropropene		1000	20

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Figure 4 Continued

Theoretical Standard Concentrations
Quality Control for Large Curve
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C
MeOH Prep

Compound name	std mix	Stock ppm	20 ppb
Ethylbenzene	QCS#1B	1000	20
Hexachlorobutadiene		1000	20
Isopropylbenzene (Cumene)		1000	20
p-Isopropyltoluene		1000	20
Methylene Chloride		1000	20
Naphthalene		1000	20
n-Propylbenzene		1000	20
Styrene		1000	20
1,1,1,2-Tetrachloroethane		1000	20
1,1,2,2-Tetrachloroethane		1000	20
Tetrachloroethene		1000	20
Toluene		1000	20
1,2,3-Trichlorobenzene		1000	20
1,2,4-Trichlorobenzene		1000	20
1,3,5-Trichlorobenzene		1000	20
1,1,1-Trichloroethane		1000	20
1,1,2-Trichloroethane		1000	20
Trichloroethene		1000	20
1,2,3-Trichloropropane		1000	20
1,2,4-Trimethylbenzene		1000	20
1,3,5-Trimethylbenzene		1000	20
m-Xylene		1000	20
o-Xylene		1000	20
p-Xylene		1000	20
Bromomethane	Gas mix	2000	20
Chloroethane		2000	20
Chloromethane		2000	20
Dichlorodifluoromethane		2000	20
Trichlorofluoromethane		2000	20
Vinyl Chloride		2000	20
Methacrylonitrile	QCS#2B	7500	150
Propionitrile		7500	150
trans-1,4-Dichloro-2-Butene		5000	100
t-Butyl Alcohol		10000	200
2-Propanol		7500	150
Isobutyl Alcohol		25000	500
n-Butanol		50000	1000
1,4-Dioxane		25000	500
2-Hexanone	QCS#3B	5000	100
4-Methyl-2-Pentanone		5000	100
Acetone		7500	150
Acrylonitrile		5000	100

Page 2 of 4

Figure 4 Continued

Theoretical Standard Concentrations
Quality Control for Large Curve
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C
MeOH Prep

Compound name	std mix	Stock ppm	20 ppb
2-Nitropropane	QCS#3B	1000	20
Tetrahydrofuran		5000	100
2-Butanone		7500	150
Methyl-t-butyl Ether	QCS#4C	1000	20
Ethyl Methacrylate		1000	20
Methyl Methacrylate		1000	20
Freon 113		1000	20
Hexane		1000	20
Heptane		1000	20
Cyclohexane		1000	20
Benzyl Chloride		1000	20
Methyl Iodide		1000	20
Carbon Disulfide		1000	20
2-Chloro-1,3-Butadiene		1000	20
di-Isopropyl Ether		1000	20
tert-Amyl Methyl Ether		1000	20
Ethyl-t-butyl Ether		1000	20
2-Chloroethyl Vinyl Ether	QCS#1B 2CEVE	1000	20
Pentachloroethane	QCS#6	1000	20
Allyl Chloride		1000	20
Bromochloromethane		1000	20
2-Methylnaphthalene		1000	20
Methyl Acetate		1000	20
Methylcyclohexane		1000	20
1,2,3-Trimethylbenzene		1000	20
1,2-Diethylbenzene		1000	20
1,3-Diethylbenzene		1000	20
1,4-Diethylbenzene		1000	20
Ethanol	QEOH	1000	1000
Cyclohexanone	QCYC	1000	500
Ethyl Ether	QEE	40	20

Figure 4 Continued

Theoretical Standard Concentrations
Quality Control for Large Curve
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C
MeOH Prep

Compound name	std mix	Stock ppm	20 ppb
Acrolein	QACR	7500	150
Freon123a	QFREON	1000	20
Dichlorofluoromethane		1000	20

ppb of analytical standard = (stock ppm)(ul stock) / final volume .

Analyst: _____
Date: _____

Figure 5

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C
Low Soil and NJ MeOH Prep

Date: _____
Instrument: _____

Qn-pentane = 40ul of n-pentane lot# _____ to 960ul MEOH lot# _____
QBUT = 40ul of 1,3-Butadiene lot# _____ to 960ul MEOH lot# _____
Custom Freon Q = 40ul of Custom Freon Q lot# _____ to 960 ul MEOH lot# _____

Stock mix Name	QCS#1B	QCYC	QEOH	8260 SS 2500 ppm Lot#	Restek 502.2 "Q" Gas mix	Final Volume	MeOH Lot#	Used
	QCS#2B	QEE		QCS#1B				
	QCS#3B	QBUT		2CEVE				
	QCS#4C	Qn-pentane		QCS#6				
	QACR			Cust. Freon Q				
20 ppb	2.0 µL	50.0 µL	100.0 µL	2.0 ul	1.0 µL	100 mL Flask	2 mL	

Compound name	std mix	Stock ppm	20 ppb
Benzene	QCS#1B	1000	20
Bromobenzene		1000	20
Bromodichloromethane		1000	20
Bromoform		1000	20
n-Butylbenzene		1000	20
sec-Butylbenzene		1000	20
tert-Butylbenzene		1000	20
Carbon Tetrachloride		1000	20
Chlorobenzene		1000	20
Chloroform		1000	20
2-Chlorotoluene		1000	20
4-Chlorotoluene		1000	20
Dibromochloromethane		1000	20
1,2-Dibromo-3-chloropropane		1000	20
1,2-Dibromoethane (EDB)		1000	20
Dibromomethane		1000	20
1,2-Dichlorobenzene		1000	20
1,3-Dichlorobenzene		1000	20
1,4-Dichlorobenzene		1000	20
1,1-Dichloroethane		1000	20
1,2-Dichloroethane		1000	20
1,1-Dichloroethene		1000	20
cis-1,2-Dichloroethene		1000	20
trans-1,2-Dichloroethene		1000	20
1,2-Dichloropropane		1000	20
1,3-Dichloropropane		1000	20
2,2-Dichloropropane		1000	20
1,1-Dichloropropene		1000	20

Page 1 of 4

Figure 5 Continued

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C
Low Soil and NJ MeOH Prep

Compound name	std mix	Stock ppm	20 ppb
cis-1,3-Dichloropropene	QCS#1B	1000	20
trans-1,3-Dichloropropene		1000	20
Ethylbenzene		1000	20
Hexachlorobutadiene		1000	20
p-Isopropyltoluene		1000	20
Methylene Chloride		1000	20
Isopropylbenzene (Cumene)		1000	20
Naphthalene		1000	20
n-Propylbenzene		1000	20
Styrene		1000	20
1,1,1,2-Tetrachloroethane		1000	20
1,1,2,2-Tetrachloroethane		1000	20
Tetrachloroethene		1000	20
Toluene		1000	20
1,2,3-Trichlorobenzene		1000	20
1,2,4-Trichlorobenzene		1000	20
1,3,5-Trichlorobenzene		1000	20
1,1,1-Trichloroethane		1000	20
1,1,2-Trichloroethane		1000	20
Trichloroethene		1000	20
1,2,3-Trichloropropane		1000	20
1,2,4-Trimethylbenzene		1000	20
1,3,5-Trimethylbenzene		1000	20
m-Xylene		1000	20
o-Xylene		1000	20
p-Xylene		1000	20
Bromomethane	QGas mix	2000	20
Chloroethane		2000	20
Chloromethane		2000	20
Dichlorodifluoromethane		2000	20
Trichlorofluoromethane		2000	20
Vinyl Chloride		2000	20
Methacrylonitrile	QCS#2B	7500	150
Propionitrile		7500	150
trans-1,4-Dichloro-2-Butene		5000	100
t-Butyl Alcohol		10000	200
2-Propanol		7500	150
Isobutyl Alcohol		25000	500
n-Butanol		50000	1000
1,4-Dioxane		25000	500
2-Butanone	QCS#3B	7500	150
2-Hexanone		5000	100

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Figure 5 Continued

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C
Low Soil and NJ MeOH Prep

Compound name	std mix	Stock ppm	20 ppb
4-Methyl-2-Pentanone	QCS#3B	5000	100
Acetone		7500	150
Acrylonitrile		5000	100
2-Nitropropane		1000	20
Tetrahydrofuran		5000	100
Methyl-t-butyl Ether	QCS#4C	1000	20
Ethyl Methacrylate		1000	20
Methyl Methacrylate		1000	20
Freon 113		1000	20
Hexane		1000	20
Heptane		1000	20
Cyclohexane		1000	20
Benzyl Chloride		1000	20
Methyl Iodide		1000	20
Carbon Disulfide		1000	20
2-Chloro-1,3-Butadiene		1000	20
di-Isopropyl Ether		1000	20
tert-Amyl Methyl Ether		1000	20
Ethyl-t-butyl Ether		1000	20
Pentachloroethane	QCS#6	1000	20
Allyl Chloride		1000	20
Bromochloromethane		1000	20
Methyl Acetate		1000	20
Methylcyclohexane		1000	20
2-Methylnaphthalene		1000	20
1,2,3-Trimethylbenzene		1000	20
1,2-Diethylbenzene		1000	20
1,3-Diethylbenzene		1000	20
1,4-Diethylbenzene		1000	20
Acrolein	QACR	7500	150
2- Chloroethyl Vinyl Ether	QCS#1B 2CEVE	1000	20
Cyclohexanone	QCYC	1000	500
Ethyl Ether	QEE	40	20
n-Pentane	Qn-PEN	40	20
1,3-Butadiene	QBUT	40	20
Ethanol	QEOH	1000	1000

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Figure 5 Continued

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C
Low Soil and NJ MeOH Prep

Compound name	std mix	Stock ppm	20 ppb
Dichlorofluoromethane	Custom	1000	20
Freon 123a	Freon Q	1000	20

ppb of analytical standard = (stock ppm)(μl stock) / final volume

Analyst: _____
Date: _____

Figure 6

**Theoretical Standard Concentrations
Gasoline Range Organics
Low Level Soil Prep**

Instrument: _____
Date: _____

Restek Certified BTEX in Unleaded Gas Composite

Lot: _____ Exp: _____

INITIAL CALIBRATION TSC

Compound Name	CAS #	ul stock FV H2O MI	Stock ppm	level 6	level 5	level 4	level 3	level 2	level 1	MDL
				40 Conc. ug/Kg	20 Conc. ug/Kg	10 Conc. ug/Kg	10 Conc. ug/Kg	4 Conc. ug/Kg	2 Conc. ug/Kg	4 Conc. ug/Kg
Unleaded gasoline Composite	8006-61-9		5500	4400	2200	1100	550	220	110	44

Analyst: _____
Date: _____

QUALITY CONTROL TSC

Supelco Gasoline Lot _____ 20000ug/mL
QGRO=1:10 Supelco Gasoline

Stock mix	QGRO	Final Volume	Prep Used
1000 ppb GRO	2.5 ul	5 mL Syringe	
1000 ppb GRO	25.0 ul	50 mL Flask	

Analyst: _____
Date: _____

Figure 7

**Theoretical Standard Concentrations
Gasoline Range Organics
High Level Soil Prep**

Instrument: _____
Date: _____

INITIAL CALIBRATION TSC

Restek Certified BTEX in Unleaded Gas Composite
Lot: _____ Exp: _____
8260 SS Lt# _____

Compound Name	CAS #	uL stock uL SS stock FV H2O mL	Stock ppm	level 6 40 1	level 5 20 1	level 4 10 1	level 3 10 2	level 2 2 2	level 1 4 10	MDL 2 10
				Conc. ug/Kg	Conc. ug/Kg	Conc. ug/Kg	Conc. ug/Kg	Conc. ug/Kg	Conc. ug/Kg	Conc. ug/Kg

Unleaded gasoline Composite 8006-61-9
MeOH Man./lot _____

Analyst: _____
Date: _____

QUALITY CONTROL TSC

	uL stock	Extract Vol
Supelco Gasoline Lot _____	20000ug/mL	5mL
8260 SS lot _____	2500ug/mL	5mL

Then dilute 1.0mL of spiked extract into a 50.0mL flask
Final Spike Concentration = 1000 ppb GRO

Analyst: _____
Date: _____

Reactive Sulfide**Approvals:**

Prepared by: Susan E. Hhner Date: 10/27/11
Chemist

Approved by: Kenneth A Bell Date: 10/28/11
Water Quality Management

Approved by: Paula Heedy Date: 10/31/11
Quality Assurance

Revision Log:

Revision: 09	Effective Date:	This version
Section	Justification	Changes
Revision Log	Formatting requirement per LOM-SOP-LAB-201	Removed revision logs up to the previous version
Cross-Reference	Reflect applicable documents	Added LOM-SOP-ES-207
Personnel Training and Qualifications	Formatting requirement per LOM-SOP-LAB-201	Replaced first sentence with exact wording of required text
Reagents and Standards 1.	Clarification	Added container information
Calibration	Formatting requirement per LOM-SOP-LAB-201	Added required section
Statistical Information/ Method Performance	Clarification	Updated to include QC acceptance windows reference
Quality Assurance/ Quality Control	State specific QC requirement	Added South Carolina QC requirements

Revision: 08	Effective Date:	10/14/09
Section	Justification	Changes
Revision Log	Formatting requirements per LOM-SOP-LAB-201	Reformatted to include Justification and removed revision logs up to the previous version.
Entire Document	Mandatory procedures/requirements must be clearly indicated as such	Changed wording to imperative and/or present tense
Reference 1. and 2.	Correction/clarification	Added "modified" to references
Reference Modifications	Required information	Explain analysis is a blending of the cited references
Safety Precautions and Waste Handling	Required statement	Added "All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local laws and regulations."
Standardization 1.	Reflect current practice	Increased the amount of starch indicator
Procedure 4.	Reflect current practice	Increased the amount of starch indicator
Quality Assurance/ Quality Control	Required information	Refers to Analysis #1121 for the LCS preparation
	State specific QC requirement	Added information on West Virginia's usable precision measurement requirements.

1122_09.DOC
102711

Reference:

1. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 9034 Modified, December 1996.
2. *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, 1998, 4500-S²⁻ F, (modified).
3. *Chemical Hygiene Plan*, Lancaster Laboratories, current version.

Cross Reference:

Document	Document Title
Analysis #1121	Reactivity
LOM-SOP-ES-203	Determining Method Detection Limits and Limits of Quantitation
LOM-SOP-ES-207	Establishing Control Limits
LOM-SOP-ES-225	Reagents and Standards
LOM-SOP-LAB-208	Laboratory Balances
LOM-SOP-LAB-220	Laboratory Notebooks, Logbooks, and Documentation
SOP-WQ-017	Quality Control Data for Wet Chemistry

Scope:

This method is applicable to the measurement of sulfide following Analysis #1121.

Basic Principles:

Sulfide is extracted from a sample using Analysis #1121 and is trapped in a sodium hydroxide scrubber solution. Excess iodine is added to a portion of the scrubber solution. Under acidic conditions, the iodine oxidizes the sulfide in the scrubber solution to sulfur. The excess iodine is then backtitrated with sodium thiosulfate to determine the concentration of sulfide in the scrubber solution.

Reference Modifications:

The scope listed in SW-846 9034 indicates that this reference is the determinative step following the distillation method SW-846 9030. This analysis is modified to use only the determinative titration method of SW-846 9034. Samples are extracted (not distilled) using Analysis #1121.

This analysis is a blend of the cited references. All quality control performance requirements are attained and supported through ongoing MDL studies and demonstration of capabilities/quad studies.

Interferences:

The iodometric method suffers interference from reducing substances that react with iodine including thiosulfate, sulfite, and various organic compounds.

Safety Precautions and Waste Handling:

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability.

Analysts are considered proficient when they have successfully completed a Demonstration of Capability. Demonstration of Capability consists of four check standards that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Demonstration of Capability is performed annually and is maintained in the analyst's training records.

Sample Collection, Preservation, and Handling:

Analyze scrubber solution obtained in Analysis #1121 as soon as possible after extraction is completed.

Apparatus and Equipment:

1. Analytical balance or equivalent. Refer to LOM-SOP-LAB-208.
2. Class A burette with burette stand, or equivalent
3. 500-mL Erlenmeyer flasks or equivalent

Reagents and Standards:

Alternate weights and volumes are acceptable as long as final concentrations remain the same. Refer to LOM-SOP-ES-225 for the proper labeling and documentation of reagent preparations.

1. Hydrochloric acid (1 + 1) – Mix equal portions of concentrated hydrochloric acid (HCl) and deionized water. Store in a glass container at room temperature and re-evaluate yearly.
2. Starch indicator – Purchased. Store at room temperature. See manufacturer's label for expiration date.

3. Potassium iodide (KI) crystals – Purchased. Store at room temperature and re-evaluate yearly.
4. 0.025 N potassium bi-iodate – Dry KH (IO₃)₂ for at least 2 hours at 103° to 105°C and cool approximately one hour in a desiccator. Dissolve 0.8124 ± 0.0002 g KH (IO₃)₂ in deionized water and dilute to 1000 mL in a volumetric flask. Store in amber glass bottle at room temperature. Stable 1 year.
5. 0.1 N sodium thiosulfate – Purchased. Store at room temperature. See manufacturer's label for expiration date.
6. 0.025 N sodium thiosulfate (Na₂S₂O₃) – Dilute 250 mL of 0.1 N Na₂S₂O₃ (purchased) to 1000 mL with deionized water. Hold time is determined by manufacturer's expiration date for 0.1 N sodium thiosulfate. Store at room temperature. **Standardize weekly** against 0.025 N potassium bi-iodate.
7. 0.025 N iodine solution – Dissolve 20 to 25 g KI in approximately 800 mL of deionized water and add 3.20 ± 0.05 g iodine. Allow plenty of time to dissolve and then dilute to 1000 mL with deionized water in a volumetric flask. Hold time is 1 year. Store in amber glass bottle at room temperature. **Standardize weekly** against 0.025 N sodium thiosulfate.

Calibration:**A. Standardization:**

Record all standardization in department's solution standardization logbook.

1. Sodium thiosulfate – Dissolve approximately 2.0 g KI in an Erlenmeyer flask with approximately 150 mL deionized water. Add a few drops of concentrated H₂SO₄. Swirl. Use a pipette to add 20 mL of 0.025 N potassium bi-iodate.

Dilute to approximately 200 mL with deionized water. Immediately titrate the liberated iodine with 0.025 N $\text{Na}_2\text{S}_2\text{O}_3$ titrant to a pale yellow color. Add enough starch indicator to turn the solution blue, then titrate to the first colorless endpoint. Perform duplicate trials and average the results.

$$\text{Na}_2\text{S}_2\text{O}_3 \text{ N} = \frac{[20 \text{ mL KH}(\text{IO}_3)_2] \times [0.025 \text{ N KH}(\text{IO}_3)_2]}{\text{mL of sodium thiosulfate titrated}}$$

2. Iodine – Pipette 10 mL of 0.025 N iodine solution into an Erlenmeyer flask and add approximately 90 mL of deionized water. Titrate immediately with the $\text{Na}_2\text{S}_2\text{O}_3$ (previously standardized) to a pale yellow color. Then add a few drops of starch solution and titrate to the first colorless endpoint. Perform duplicate trials and average the results.

$$\text{Iodine N} = \frac{(\text{mL of Na}_2\text{S}_2\text{O}_3 \text{ titrated}) (\text{standardized normality of Na}_2\text{S}_2\text{O}_3)}{10.0 \text{ mL iodine solution}}$$

B. Balances must be calibrated each day before use. Refer to LOM-SOP-LAB-208.

Procedure:

Record data in a raw data logbook following instructions in LOM-SOP-LAB-220.

Add reagents to the Erlenmeyer flask in the exact order stated in this procedure to ensure no sulfide gas is liberated before the titration is performed.

1. Pipette 10 mL of the standardized iodine solution into a 500-mL Erlenmeyer flask.
2. Bring the volume up to approximately 20 mL with deionized water.
3. Add approximately 10 mL of 1 + 1 HCl.

4. Pipette 200 mL of the scrubber solution into the flask.
5. Discharge the scrubber solution under the iodine solution surface. Swirl gently.

If the iodine color disappears, add more iodine until the color remains. Record the total amount of iodine solution used. Titrate as usual. Then perform a second trial, adding enough iodine before the scrubber solution to maintain the yellow color after the scrubber solution addition.

6. Titrate immediately with standardized $\text{Na}_2\text{S}_2\text{O}_3$ solution to a pale yellow.
7. Add enough starch indicator to turn the solution blue and titrate to a colorless endpoint. Record the amount of titrant used.

Calculations:

$$\frac{\text{mg sulfide}}{\text{kg}} = [(A \times B) - (C \times D)] \times \frac{500}{200} \times \frac{16,030}{\text{g sample}}$$

Where:

A = mL iodine solution

B = Normality of iodine solution

C = mL titrant ($\text{Na}_2\text{S}_2\text{O}_3$)

D = normality of titrant ($\text{Na}_2\text{S}_2\text{O}_3$)

Statistical Information/Method Performance:

The method detection limit (MDL) is determined annually by following the procedure outlined in LOM-SOP-ES-203.

The quality control acceptance windows are generated annually by following the procedure outlined in LOM-SOP-ES-207.

Quality Assurance/Quality Control:

One method blank and a 570 mg/kg sulfide LCS (See Analysis #1121) must be analyzed with each batch. A batch is limited to 20 samples or less.

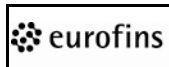
When sample volume permits, a matrix spike (MS) and a matrix spike duplicate (MSD) must be analyzed with each batch. See Analysis #1121 for the spike preparation instructions.

When sample volume does not permit the analysis of the MS and MSD, then a 570 mg/kg sulfide LCSD must be analyzed to demonstrate method precision.

Samples from West Virginia require a usable precision measurement for each batch. Analyzing one of the following on a batch containing a West Virginia sample fulfills this requirement: an MS/MSD or an LCSD.

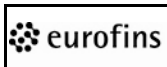
A matrix duplicate is not required unless a batch contains an NPDES sample(s) from South Carolina.

See LIMS for current quality control (QC) acceptance windows. Follow guidelines in SOP-WQ-017 for outlier QC data.

 Lancaster Laboratories Environmental	Document Title: Reactivity of Waste	Eurofins Document Reference: 1-P-QM-WI -9013027
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Eurofins Document Reference	1-P-QM-WI -9013027	Revision	14
Effective Date	Aug 7, 2014	Status	Effective
Historical/Local Document Number	Analysis 1121		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

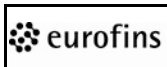
Prepared by	Susan Hibner
Reviewed and Approved by	Erik Frederiksen;Review;Monday, July 21, 2014 3:00:03 PM EDT Christiane Sweigart;Approval;Thursday, July 24, 2014 3:56:29 PM EDT

 <div> Lancaster Laboratories Environmental </div>	Document Title: Reactivity of Waste	Eurofins Document Reference: 1-P-QM-WI -9013027
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Revision Log:

Revision: 14		Effective Date:	This version
Section	Justification	Changes	
Title	Formatting requirement	Change title to <i>Reactivity of Waste</i>	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Throughout Document	Reflects re-identification of documents in EtQ No longer in use	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers Replaced LOM-SOP-LAB-208 with 1-P-QM-QMA-9015389	
Reference	Additional documentation is applicable	Added 40 CFR 261.23	
Cross Reference	Reflects applicable documents	Replaced LOM-SOP-LAB-208 with 1-P-QM-QMA-9015389	
Sample Collection, Preservation and Handling	Compliance	Changed 4° ± 2°C to 0° to 6°C, not frozen	

Revision: 13		Effective Date:	Aug 09, 2012
Section	Justification	Changes	
Revision Log	Formatting requirement per LOM-SOP-LAB-201	Removed revision logs up to the previous version	
Sample Collection, Preservation and Handling	Resolve disparity between procedure and Parallax	Hold time from 'within 30 days of collection' to 'not regulated'.	

 Lancaster Laboratories Environmental	Document Title: Reactivity of Waste	Eurofins Document Reference: 1-P-QM-WI -9013027
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Reference:

1. *Test Methods for Evaluating Solid Wastes*, SW-846 Chapter 7.3, December 1996.
2. U.S. Government (1999), *Characteristic of reactivity*, 40 CFR 261.23, Appendix C.
3. *Chemical Hygiene Plan*, current version.

Cross Reference:

Document	Document Title
Analysis 0237, 1123, 1549, 5895, 5898, 8255, 0241, 4814, 0961, 0957, 0959	Determination of Total and Amenable Cyanide in Water, Wastewater, and Soils, Free Cyanide in Water and Wastewater, Reactive Cyanide of Solids, and Weak Acid Dissociable Cyanide in Waters and Soils
Analysis #1122	Reactive Sulfide
1-P-QM-QMA-9017328	Reagents and Standards
1-P-QM-QMA-9015389	Balance, Syringe, Pipette Verification
1-P-QM-QMA-9021767	Laboratory Notebooks, Logbooks, and Documentation for Environmental Testing

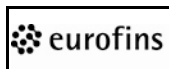
Scope:

This method is applicable to all wastes except those that form explosive mixtures when acidified. This method measures only the hydrocyanic acid and hydrogen sulfide evolved under these test conditions. It is not intended to measure other forms of cyanide or sulfide. This method is applicable for all concentration ranges.

Basic Principles:

A measured amount of sample is treated with diluted acid in a closed system. This may convert the cyanide and the sulfide in the sample to gas. The gas is carried by a nitrogen stream into a gas-scrubbing bottle containing sodium hydroxide solution. The base traps the cyanide and sulfide. The sulfide is quantitated using Analysis #1122 and the cyanide is quantitated using the method described in analysis 0237.

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 <div>Lancaster Laboratories Environmental</div>	<p>Document Title: Reactivity of Waste</p>	<p>Eurofins Document Reference: 1-P-QM-WI -9013027</p>
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Definitions:

The regulation in 40 CFR 261.23 defines reactive wastes to include wastes that have any of the following properties:

1. Readily undergo violent chemical change.
2. React violently or form potentially explosive mixtures with water.
3. Generate toxic fumes when mixed with water.
4. Explode when subjected to a strong initiating force.
5. Explode at normal temperatures and pressures.
6. Fit within the Department of Transportation's forbidden explosives.

A definition of reactivity for this method is as follows: A cyanide or sulfide bearing waste is considered reactive if it, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or to the environment.

Interferences:

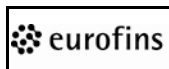
Interferences are undetermined.

Safety Precautions and Waste Handling:

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

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 Lancaster Laboratories Environmental	Document Title: Reactivity of Waste	Eurofins Document Reference: 1-P-QM-WI -9013027
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Use special precautions when handling KCN and $\text{Na}_2\text{S} \cdot 9\text{H}_2\text{O}$ as they are extremely toxic. Perform analysis in a hood or well-ventilated area to avoid inhalation.

Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability.

Analysts are considered proficient when they have successfully completed a Demonstration of Capability. Demonstration of Capability consists of four check standards that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Demonstration of Capability is performed annually and is maintained in the analyst's training records.

Sample Collection, Preservation and Handling:

Collect samples in glass containers with no headspace. Refrigerate at 0° to 6°C, not frozen, until analysis. The holding time is not regulated.

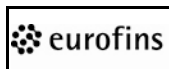
Do not homogenize samples before analysis to prevent unwanted aeration.

Use bottle code #74 when possible.

Apparatus and Equipment:

1. Each analytical setup requires the following:
 - a. Stirring apparatus – To achieve approximately 30 rpm
 - b. Round-bottom distillation flask – 500 mL, tri-neck, with 24/40 ground glass joints or equivalent

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- c. Addition funnel with pressure equalizing tube and 24/40 ground-glass joints or equivalent
- d. 24/40 ground-glass stopper and keck clips or equivalent
- e. Gas washing bottle (sufficient size to accommodate 500 mL of sodium hydroxide as the scrubbing solution) with scrubber assembly or equivalent
- f. Flexible tubing

(Assembly of this apparatus is shown in Figure 1.)

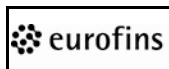
- 2. Flowmeter or equivalent
- 3. Balance capable of weighing to 0.001 gram. Refer to 1-P-QM-QMA-9015389.

Reagents and Standards:

Alternate weights and volumes are acceptable as long as final concentrations remain the same. Refer to 1-P-QM-QMA-9017328 for the proper labeling and documentation of reagent preparations.

- 1. Sulfuric acid (0.05M)
 - a. Pipette 2.8 mL concentrated H_2SO_4 into reagent water and dilute to 1000 mL.
 - b. Stable one year.
 - c. Store in plastic container at room temperature.

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2. Sodium hydroxide solution (1.25 N)

- a. Dissolve 50 ± 1 g of NaOH in reagent water and dilute to 1000 mL.
- b. Stable one year.
- c. Store in plastic container at room temperature.

3. Sulfide reference solution

- a. Dissolve 2.01 ± 0.01 g $\text{Na}_2\text{S} \cdot 9\text{H}_2\text{O}$ in reagent water and dilute to 500 mL in a volumetric flask.
- b. **Prepare fresh daily.** (This solution is approximately 570 mg/L hydrogen sulfide). Use for LCS and spiking solution.

NOTE: The cyanide reference solution is provided by the department that performs analysis 0237. The preparation of the cyanide reference solution is not covered in this method.

Calibration:

Check the flow rate every 6 months using an NIST traceable flow meter. Record the NIST reading for each flow meter in the flow meter logbook. The acceptance range of the flow rate is $\pm 10\%$ of the flow meter setting.

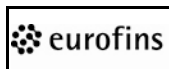
Balances must be calibrated each day before use. Refer to 1-P-QM-QMA-9015389.

Procedure:

Record the data in a raw data logbook following instructions in 1-P-QM-QMA-9021767.

1. Place 100 mL of 1.25 N NaOH and 400 mL of reagent water into the gas-washing bottle.

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2. Weigh 10.000 ± 0.5 g of sample (solid or liquid) directly into the tri-neck distillation flask and record the amount in the raw data logbook.

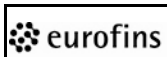
Blank, LCS, and MS/MSD Preparation

- a. For the blank and LCS, weigh 10 ± 0.5 g sea sand or glass beads.
 - b. Before closing the system add 10mL of the standard reference solution to the LCS, MS and MSD flasks.
3. Add a magnetic stirring bar into the flask.
 4. In a hood, assemble the glassware apparatus as shown in Figure 1.
 5. Place 25 mL of 0.05M H_2SO_4 and 225 mL reagent water into the addition funnel with the stopcock closed.
 6. Check all the clips and securely close the system.
 7. Begin purging the system with nitrogen gas. Adjust the flow rate to 60 mL/min.
 8. With the nitrogen gas flowing, open the addition funnel stopcock to add the diluted H_2SO_4 directly into the flask.
 9. Begin magnetically stirring the sample as the acid is entering the tri-neck flask and continue to stir at a constant rate throughout the test.

NOTE: Avoid creating a vortex while stirring.

10. After 30 minutes, turn off the nitrogen gas flow and disconnect the scrubber assembly.
11. Analyze the contents of the scrubber solution for reactive sulfide using Analysis #1122.

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12. Subsample a small portion of the scrubber solution into a vial to be analyzed for cyanide using analysis 0237.

Calculations:

Not applicable to this procedure.

Statistical Information/Method Performance:

Not applicable to this procedure.

Quality Assurance/Quality Control:

A batch is limited to 20 samples or less.

One method blank, a 570 mg/kg sulfide LCS, and a 1000 mg/kg cyanide LCS must be analyzed with each batch.

A matrix spike (MS) and a matrix spike duplicate (MSD) must be analyzed with each batch.

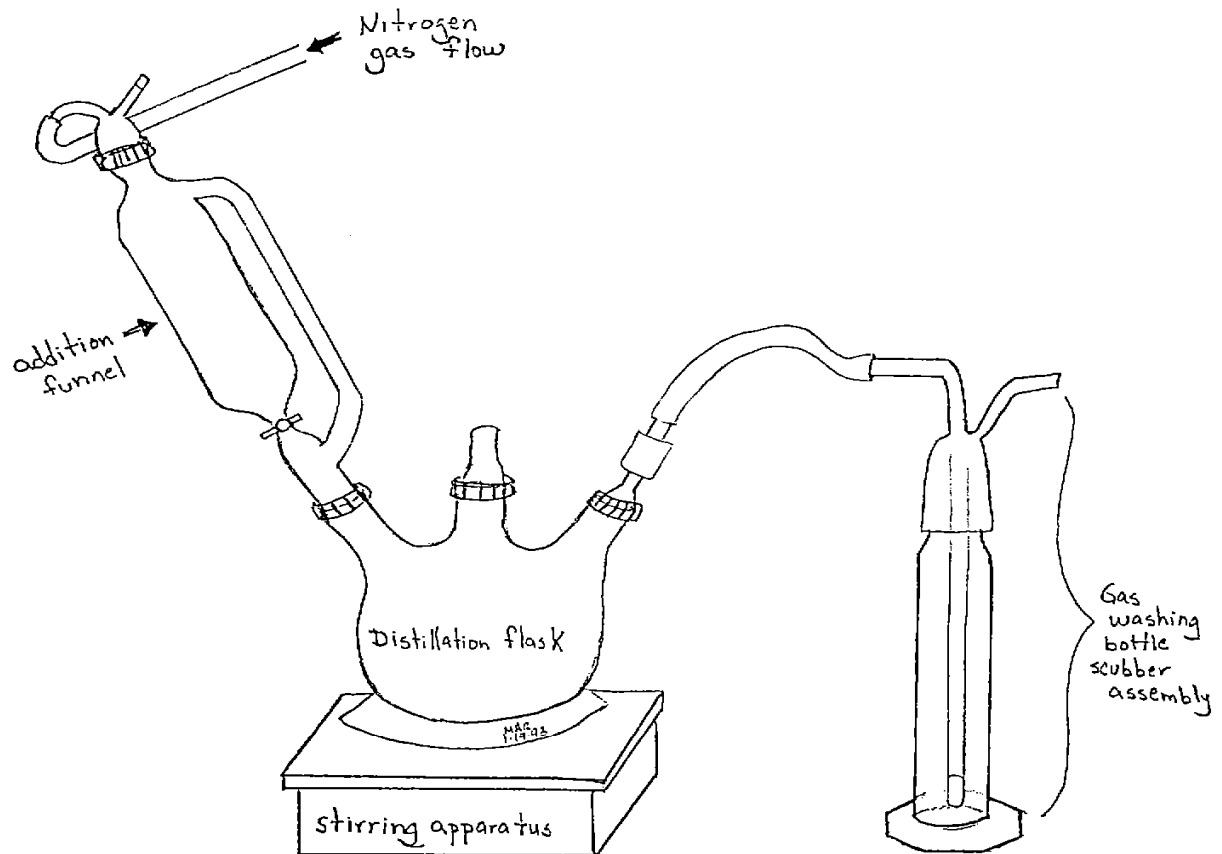
When sample volume does not permit the analysis of an MS and MSD, then a 570 mg/kg sulfide LCSD and a 1000 mg/kg cyanide LCSD must be analyzed to demonstrate method precision.

Samples from West Virginia require a usable precision measurement for each batch. Analyzing one of the following on a batch containing a West Virginia sample fulfills this requirement: an MS/MSD, a non-program deleted duplicate, or an LCSD.

A sample matrix duplicate is not required unless a batch contains a NPDES sample(s) from South Carolina.

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Figure 1



Ignitability of Solids**Approvals:**

Prepared by: Susan E. Helmer Date: 4/28/11
Chemist

Approved by: Kenneth A Bell Date: 4/28/11
Water Quality Management

Approved by: Brian Flady Date: 4/29/11
Quality Assurance

MAY 13 2011
Revision Log:

Revision: 07		Effective Date:	This version
Section	Justification	Changes	
Revision Log	Formatting requirements per LOM-SOP-LAB-201	Removed revision logs up to the previous version.	
Safety Precautions and Waste Handling	Formatting requirements per LOM-SOP-LAB-201	Added required text	
Personnel Training and Qualifications	Formatting requirements per LOM-SOP-LAB-201	Added required text	
Sample Collection, Preservation and Handling	Clarification	Expanded container and storage condition information	
Calibration	Formatting requirements per LOM-SOP-LAB-201	Added required section	

Revision: 06		Effective Date:	04/06/09
Section	Justification	Changes	
Revision Log	Formatting requirements per LOM-SOP-LAB-201	Added Justification and removed revision logs up to the previous version.	
Scope	Clarification- to remove ambiguous language from document	Reworded to remove "should"	

0542_07.DOC
042511

Reference:

1. 40 CFR, Part 261.21.
2. Chemical Hygiene Plan, Lancaster Laboratories, current version.

Cross Reference:

Document	Document Title
Analysis #0430	Determination of Flash Point for Liquids and Solids
LOM-SOP-LAB-208	Laboratory Balances
LOM-SOP-LAB-220	Laboratory Notebooks, Logbooks, and Documentation

Scope:

This method is applicable to testing solid samples for ignitability. Analyze liquid samples using Analysis #0430.

The overall test allows clients to classify their solid waste for the RCRA characteristic of ignitability using the definitions listed in the *Code of Federal Regulations* (40 CFR 261.21).

Basic Principles:

The CFR defines a solid waste as ignitable if "it is not a liquid and is capable, under conditions of standard temperature and pressure, of causing fire through friction, absorption of moisture or spontaneous chemical changes and, when ignited, burns so vigorously and persistently that it creates a hazard."

Since no official method exists for checking ignitability of solids, this in-house method was developed after consultation with the US EPA and Texas Water Commission.

Interferences:

Not applicable to this procedure.

Safety Precautions and Waste Handling:

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability.

Analysts are considered proficient when they have successfully demonstrated competency under supervision of a group leader or other trained analyst. Documentation for these studies is in each analyst's training records.

Sample Collection, Preservation, and Handling:

Samples for the analysis must be unpreserved, collected in glass containers and refrigerated at $4^{\circ} \pm 2^{\circ}\text{C}$ up to the time of analysis. Analyze at room temperature within 28 days of collection.

Apparatus and Equipment:

1. Crucible, aluminum pan, or equivalent
2. 400 grit size sandpaper, or equivalent

3. Pensky-Martens closed cup tester
4. Glass stirring rod, or equivalent
5. Pan balance or equivalent. Refer to LOM-SOP-LAB-208.
6. Bunsen burner (needed for samples that yield a positive flash during the closed-cup portion of the analysis)

Reagents and Standards:

Not applicable to this procedure.

Calibration:

Balances must be calibrated each day before use. Refer to LOM-SOP-LAB-208.

Procedure:

Record data in a raw data logbook following instructions in LOM-SOP-LAB-220.

1. Weigh approximately 5 g of sample. Leave the sample in contact with air for 10 minutes. If the sample shows any signs of spontaneous combustion upon exposure to air, it is considered spontaneously ignitable.
2. Add approximately 5 mL of reagent water dropwise, to approximately 5 g of sample. Observe the sample at all times for signs of combustion. If the sample shows any signs of combustion upon contact with water, it is considered ignitable.

3. Using a glass-stirring rod, rub approximately 1 g of sample against extremely fine sandpaper (400 grit size). Perform this test under a hood. Maintain a safe working distance from the sample. If the sample shows any signs of combustion during the test, it is considered ignitable by friction.
4. Fill the cup of a closed-cup flash point tester half full with sample. Allow the sample to sit in the closed cup for 5 minutes at room temperature, then test the sample for ignitable fumes following Analysis #0430, **except do not stir and do not heat the sample**. If the fumes ignite, it is considered ignitable by a closed-flame source. If the fumes do ignite, proceed to Step 5.
5. If the fumes do ignite in Step 4, hold an approximately 5 g portion of the sample over a Bunsen burner to confirm the sample itself is ignitable. Remove sample from the flame and carefully document all reactions in the raw data logbook.

NOTE: After all portions of the analysis are complete, edit Comment #252 appropriately in LIMS.

Calculations:

No calculations are needed for this analysis.

Statistical Information/Method Performance:

Not applicable to this procedure.

Quality Assurance/Quality Control:

No quality assurance procedures are available for this analysis.

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Eurofins Document Reference	1-P-QM-WI -9011689	Revision	9
Effective Date	Oct 6, 2014	Status	Effective
Historical/Local Document Number	Analysis 0430		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

Prepared by	Susan Hibner
Reviewed and Approved by	Erik Frederiksen;Review;Tuesday, September 30, 2014 1:39:59 PM EDT Barbara Reedy;Approval;Friday, October 3, 2014 11:48:35 AM EDT

 Lancaster Laboratories Environmental	Document Title: Determination of Flash Point for Liquids and Solids	Eurofins Document Reference: 1-P-QM-WI -9011689
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Revision Log:

Revision: 9		Effective Date:	This version
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Throughout Document	Reflects re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers	
Cross Reference	Analysis does not use electronic monitoring	Removed MC-WQ-003 Replaced with 1-P-QM-QMA-9017314	
Sample Collection Preservation and Handling	Requirement	Changed temperature range from 4° ± 2°C to 0° to 6°C, not frozen	
Apparatus and Equipment	Analysis does not use electronic monitoring	Removed MC-WQ-003 Replaced with 1-P-QM-QMA-9017314	
Calibration	Requirement	Removed MC-WQ-003 Replaced with 1-P-QM-QMA-9017314	

Revision: 08		Effective Date:	Sep 13, 2012
Section	Justification	Changes	
Revision Log	Formatting requirement per LOM-SOP-LAB-201	Removed revision logs up to the previous version	
Reference	Updated to current procedure	Added #2. method reference and renumbered remainder of section	
Procedure	Clarification	Reorganized and expanded steps to reflect current procedure.	

 Lancaster Laboratories Environmental	Document Title: Determination of Flash Point for Liquids and Solids	Eurofins Document Reference: 1-P-QM-WI -9011689
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Reference:

1. Annual Book of ASTM Standards, Method D93-07.
2. Annual Book of ASTM Standards, Method D93-90.
3. Test Methods for Evaluating Solid Wastes, SW-846 Method 1010A, August 2002.
4. *Chemical Hygiene Plan*, current version.

Cross Reference:

Document	Document Title
1-P-QM-PRO-9015535	Quality Control Data for Wet Chemistry
1-P-QM-QMA-9017314	Thermometer Use and Calibration
1-P-QM-QMA-9021767	Laboratory Notebooks, Logbooks, and Documentation for Environmental Testing

Scope:

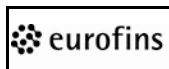
This method covers the determination of flash point by Pensky-Martens closed-cup tester of fuel oils, lube oils, suspensions of solids, liquids that tend to form surface film under test conditions, and other liquids over a temperature range of 20° to 700°F.

Procedure A is the default procedure for this analysis. Procedure B applies to samples whose viscosity would prevent them from being uniformly heated under Procedure A. Procedure C is used when flashpoint is requested for a solid sample.

Basic Principles:

A sample is heated in a closed cup at a slow, constant rate while also being stirred at a specified rate. A small flame is lowered into the cup at regular intervals. The flash point is the lowest temperature corrected to a barometric pressure of 760 mm Hg at which introduction of the test flame causes the vapor above the sample to ignite. The barometric pressure used in the calculation is the ambient pressure for the lab at the time of the test.

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Interferences:

Flash point may not be accurate on materials not stored in sealed-glass or metal containers. This is due to the possibility of diffusion of volatile material through the walls of plastic containers.

Samples containing volatile, halogenated compounds, and/or large volumes of water may not give a well-defined flash.

Safety Precautions and Waste Handling:

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

A fire extinguisher must be easily accessible to the operator of the flash point apparatus. Some liquid mixtures have a potential to superheat prior to their flash point and may boil out of the apparatus in flames. Show special precautions during the initial application of the test flame to a sample. Samples containing low-flashing material can give a strong flash when the test flame is first applied. *p*-xylene is extremely flammable and harmful if inhaled. Dispose of *p*-xylene in the solvent waste can.

Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability.

Analysts are considered proficient when they have successfully completed a documented Demonstration of Capability. This consists of four laboratory control standards that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Demonstration of Capability is performed annually and documentation is in each individual's training records.

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Sample Collection, Preservation, and Handling:

Collect samples for flash point in glass or metal containers and store at 0° to 6°C, not frozen, until analyzed. Holding time is not specified. Do not store in gas-permeable containers. Do not open containers unnecessarily to avoid loss of volatile material.

Apparatus and Equipment:

Refer to 1-P-QM-QMA-9017314 for information on thermometer use and calibration.

1. Pensky-Martens closed-cup flash tester
2. ASTM standard thermometer (20° to 230°F) for low range temperatures
3. ASTM standard thermometer (50° to 392°F) for medium range temperatures
4. ASTM standard thermometer (200° to 700°F) for high range temperatures.

Reagents and Standards:

p-xylene – purchased, store at room temperature and re-evaluate yearly. Use as purchased for LCS.

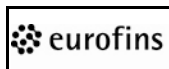
Calibration:

The stir rate must be checked each day the analysis is performed and recorded in the raw data logbook following 1-P-QM-QMA-9021767.

Adjust the stir rate to between 90 and 120 rpm (15 to 20 revolutions per 10 seconds).

Thermometers must be calibrated periodically against a NIST traceable thermometer, following 1-P-QM-QMA-9017314.

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Procedure

A. Procedure A - liquid samples

1. Adjust the test flame and the support flame to the size of the bead on the post next to the test flame (4 mm in diameter) and adjust the stir rate to between 90 and 120 rpm (15 to 20 revolutions per 10 seconds).
2. Thoroughly clean and dry all parts of the cup prior to testing a sample. Make sure no cleaning solvent is present.
3. Fill the cup with the sample to be tested to the level indicated by the filling mark, and reassemble the apparatus in the standard operating configuration described in ASTM D 93.
 - a. For the Laboratory Control Standards (LCS/D), fill the cup to the filling mark with *p*-xylene (as purchased) and refrigerate for a short time prior to analysis.
 - b. Analyze a sample matrix duplicate that flashes above the LOQ, each day the analysis is performed and with each group of not more than 10 samples.
 - c. When sample volume does not permit, or samples do not meet the above requirement of flashing above the LOQ, then a *p*-xylene LCSD must be analyzed to demonstrate method precision.
 - d. For samples with more than one layer, analyze the surface layer or oil/water emulsion layer. Document the layer analyzed.
 - e. Place samples known to flash below 75°F in the cup, cover with aluminum foil, and place in a freezer prior to an analysis.
4. Engage the locking device.

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5. Insert the thermometer.
6. Heat sample at a rate of 9° to 11°F/min.

NOTE: For samples with high suspensions of solids and for highly viscous materials, see Procedure B. Analyst will need to make technical decision.

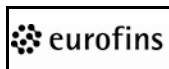
7. Stop the stirrer during each test flame application.
8. Apply test flame on every other degree Fahrenheit by lowering the test flame into the vapor space of the cup in ½ second, holding the test flame in place for 1.0 second, and then quickly releasing the controls.

NOTE: If the approximate flash point of a sample is known, the test flame need not be applied until the temperature is within 30° to 50°F of this point.

9. The observed flash point is the temperature, recorded to the nearest degree Fahrenheit, at the time the test flame application causes a distinct flash inside the test chamber.

Do not confuse the true flash point with the “enhanced” flame (bluish halo surrounding the test flame during applications preceding the one that causes the actual flash).

10. If the flash has not occurred by 220°F, quickly switch to the medium- or high-range thermometer.
11. If the test flame extinguishes due to nonflammable vapors, continue the analysis for at least 20°F to be sure the flame continues to extinguish.
12. Always continue the analysis until at least 150°F.

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13. Add Comment #50 when entering analysis results into the LIMS. Edit this comment to include either an enhanced temperature for samples that flashed or the temperature at which the test flame first consistently extinguished. Also, include the temperature at which the analysis ended.

B. Procedure B - viscous samples

For samples with high suspensions of solids and for highly viscous materials, follow Procedure A using the following modifications:

- a. Increase stir rate to 250 ± 10 rpm.
- b. Decrease heating rate to 2° to 3°F/min .

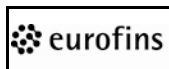
C. Solid samples

Since EPA does not have an official method for the Flash Point determination of solid samples, analyze solid samples using Procedure A with the following modifications:

1. Do not attempt to stir the sample at any time during the Flash Point analysis, as stirring a solid may damage the Pensky-Martens closed-cup flash tester.
2. Report the results with the following disclaimer (Comment #171):

The Pensky Martens closed cup apparatus is designed to determine the flash point of a liquid sample. The sample submitted could not be mixed well enough to obtain uniform heating. The temperature being measured was that of the material near the top of the cup. The material at the bottom of the cup would have a higher temperature. The temperature reported may not be accurate.

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Calculations:

$$\text{Corrected flash point} = F + 0.06 (760 - P)$$

Where:

F = Observed flash point in degrees Fahrenheit

P = Ambient barometric pressure, mm Hg

Statistical Information/Method Performance:

The practical limit of quantitation is 50°F.

The acceptable range for the *p*-xylene LCS is 78.5 to 83.49°F.

Quality Assurance/Quality Control:

The barometric pressure must be recorded each day the analysis is performed.

Batch size is limited to 20 samples or less.

A LCS of *p*-xylene must be analyzed with each batch of not more than 20 samples.

When sample volume permits, analyze a sample matrix duplicate that flashes above the LOQ, each day the analysis is performed and with each group of not more than 10 samples. When sample volume does not permit, or samples do not meet the above requirement of flashing above the LOQ, then a *p*-xylene LCSD must be analyzed to demonstrate method precision.

Samples from West Virginia require a usable precision measurement for each batch. Analyzing one of the following on a batch containing a West Virginia sample fulfills this requirement: a non-program deleted duplicate or an LCSD.

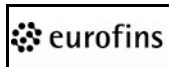
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See LIMS for current quality control acceptance limits. Follow guidelines in 1-P-QM-PRO-9015535 for outlier QC data.

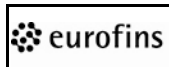
A second sample matrix duplicate is not required unless a batch contains an NPDES sample(s) from South Carolina and the batch contains more than 10 samples.

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 <div> Lancaster Laboratories Environmental </div>	Document Title: pH (SW) (Electrometric)	Eurofins Document Reference: 1-P-QM-WI -9011685
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Eurofins Document Reference	1-P-QM-WI -9011685	Revision	10
Effective Date	Aug 8, 2014	Status	Effective
Historical/Local Document Number	Analysis 0394, 0496		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

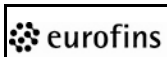
Prepared by	Michele Graham
Reviewed and Approved by	Erik Frederiksen;Review;Friday, July 25, 2014 1:46:48 PM EDT Dorothy Love;Approval;Friday, July 25, 2014 3:02:29 PM EDT

 Lancaster Laboratories Environmental	Document Title: pH (SW) (Electrometric)	Eurofins Document Reference: 1-P-QM-WI -9011685
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Revision Log:

Revision: 10		Effective Date: This version
Section	Justification	Changes
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version
Procedure 7. NOTE	New Requirement	Added NOTE dealing with pH results reporting with qualifying flag if outside calibration standards

Revision: 9		Effective Date: Dec 25, 2013
Section	Justification	Changes
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version
Throughout Document	Reflect re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers
Cross Reference	No longer used	Replaced LOM-SOP-LAB-208 with 1-P-QM-QMA-9015389
Sample Collection, Preservation, and Handling	Reflect current practice	Updated temp to 0° to 6°C not frozen
Reagents and Standards 1.	New requirement	Replaced buffer 6.86 with buffer 7.00 ISO 17025 approved vendor
Quality Assurance/Quality Control	New requirement	Replaced LCS/CCV buffer 6.86 with buffer 7.00

 Lancaster Laboratories Environmental	Document Title: pH (SW) (Electrometric)	Eurofins Document Reference: 1-P-QM-WI -9011685
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Reference:

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 9045C Modified, January 1995.
2. Test Methods for Evaluating Solid Wastes, SW-846 Method 9045D Modified, November 2004.
3. Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, p. 150.1.
4. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, pp. 4-87 to 4-91.
5. Test Methods for Evaluating Solid Wastes, SW-846 Chapter 7.
6. *Chemical Hygiene Plan*, current version.

Cross Reference:

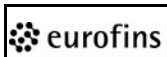
Document	Document Title
1-P-QM-PRO-9015421	pH Probes and Meters
1-P-QM-PRO-9015535	Quality Control Data for Wet Chemistry
1-P-QM-QMA-9015389	Balance, Syringe, Pipette Verification
1-P-QM-QMA-9017328	Reagents and Standards

Scope:

This SOP provides the guidelines for analysts performing pH on solid, soil, and solvent samples. This procedure is applicable to solid/soil/solvent samples.

The sensitivity limit for this technique is 0.01 pH units.

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 <div>Lancaster Laboratories Environmental</div>	<p>Document Title: pH (SW) (Electrometric)</p>	<p>Eurofins Document Reference: 1-P-QM-WI -9011685</p>
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Basic Principles:

The electrometric pH is a measure of the activity of hydrogen ions in a sample using a combination pH electrode.

Reference Modifications:

Method 9045C/D has been modified for the analysis of solid, soil, and solvent samples in the following ways. An Automatic Temperature Compensator is used for all samples instead of manually performing calculations to correct measured pH values if the sample and buffer solution temperatures differ by more than 2°C. The method is modified by using 25 g of soil to 25 g reagent water instead of the 20 g: 20 mL ratio. Also, the samples are tumbled for approximately 30 minutes instead of stirred with a stir bar for 5 minutes. These modifications are performed in order to allow for adequate agitation and to provide sufficient supernatant to immerse the pH electrode during analysis.

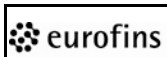
Reference Modifications specific to tobacco samples:

Method 9045C has been modified for the analysis of tobacco samples in the following ways. An Automatic Temperature Compensator is used for all samples. The method is modified by using 2 g of tobacco to 25 mL reagent water and the samples are tumbled for approximately 30 minutes. These modifications are performed in order to allow for adequate agitation and to provide sufficient supernatant to immerse the pH electrode during analysis.

Interferences:

Interferences occur when oily or particulate matter adheres to the electrodes and reduces the response. Gentle wiping or rinsing with reagent water usually corrects this problem. Temperature effects are compensated for by calibrating the pH meter at the temperature of the sample or using a pH meter equipped with temperature compensators. There are no means of controlling temperature effects caused by shifts in ionic equilibria of the sample.

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Safety Precautions and Waste Handling:

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention. Standard safe laboratory procedure must be followed as outlined in the Chemical Hygiene Plan.

Personnel Training and Qualifications:

All analysts performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability.

A Demonstration of Capability usually consists four laboratory control samples that are carried through all steps of the analysis and meet the acceptance criteria for the LCS. Documentation for these studies is in each individual's training records.

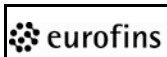
Sample Collection, Preservation, and Handling:

Sample must be collected in an unpreserved container and stored at 0° to 6°C; not frozen, until the time of analysis. There is no published holding time for pH analysis on soil; analysis is performed as soon as possible after sample is received in the laboratory.

Apparatus and Equipment:

1. Analytical balance capable of weighing 0.0001 g
2. pH meter equipped with an ATC probe (Automatic Temperature Compensator)
3. Combination electrode or equivalent

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4. Stir bar and stir plate

Reagents and Standards:

Alternative weights and volumes are acceptable provided final concentrations remain the same. Refer to 1-P-QM-QMA-9017328 for appropriate labeling and documentation of reagents and standards preparation.

1. 7.00 pH Buffer (**ISO 17025 approved vendor**) – purchased; see container for shelf life information.
2. Appropriate pH electrode filling solution for electrode, purchased. Store at room temperature. See label for expiration date.

Calibration:

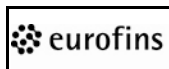
Balances must be calibrated each day before use. Refer to 1-P-QM-QMA-9015389.

Calibrate pH meter as described in 1-P-QM-PRO-9015421.

Procedure:

1. Calibrate the pH meter as described in 1-P-QM-PRO-9015421.
2. If sample is tobacco refer to step #11. If sample is not tobacco then proceed with step 2. Weigh 25 ± 0.5 g of sample into a clean specimen cup and add 25 ± 0.5 mL of reagent water (makes a 1:1 slurry). If the sample absorbs the water, add an additional 25 ± 0.5 mL of reagent water (makes a 1:2 slurry). If a 1:2 slurry does not provide sufficient supernatant to immerse the pH electrode, use less sample and add reagent water in proportion to the weight selected. Enter a comment in the databook indicating the dilution.
3. Tightly place the screw-cap lid on the sample and mix the slurry in the tumbler for approximately 30 minutes.

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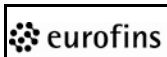
 <div>Lancaster Laboratories Environmental</div>	<p>Document Title: pH (SW) (Electrometric)</p>	<p>Eurofins Document Reference: 1-P-QM-WI -9011685</p>
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4. Remove the sample from the tumbler and allow the sample to settle for about 1 hour.
5. Rinse and shake off any water on the electrodes.
6. Dip the electrodes into the supernatant (aqueous layer) of the sample and allow to equilibrate. If necessary, decant or pipette this layer into another container.
7. Using the calibrated pH meter note the pH value of the sample after the meter equilibrates, and enter the value in the corresponding laboratory data notebook.

NOTE: If pH reading is < 4.00 or >10.00, then the pH result will be reported with a qualifying flag.

8. Note the temperature of the sample and record the value in the corresponding laboratory data notebook.
9. Rinse and clean the electrodes before proceeding to the next sample.
10. This method is also used to determine corrosivity (analysis 0496). To do this, the pH value and the corresponding corrosivity determination are entered as a "see below" Comment. (A sample is typically considered corrosive if the pH is <2 or >12). When determining corrosivity, three repeat pH measurements must be performed on each sample to verify that the pH does not differ by more than 0.1 pH unit. Record each measurement in the laboratory data notebook.
11. This step is to be followed when sample is tobacco. Weigh 2 ± 0.5 g of tobacco into a clean specimen cup and add 25 ± 0.5 mL of reagent water (makes a 1:13 slurry). If the sample absorbs the water, add an additional 25 ± 0.5 mL of reagent water. If this slurry does not provide sufficient supernatant to immerse the pH electrode, use less sample and add reagent water in proportion to the weight selected. Enter a comment in the databook indicating the dilution. Proceed to Procedure 3.

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Calculations:

Not applicable.

Statistical Information/Method Performance:

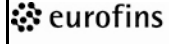
For statistical information, refer to Test Methods for Evaluating Solid Wastes, SW-846 Method 9045C Modified, September 1994.

Quality Assurance/Quality Control:

A Laboratory Control Sample (LCS; 7.00 pH Solution) must be analyzed at the beginning of each batch. A CCV (7.00 pH Solution) must be analyzed after every ten samples and at the end of the day's run. If the meter is resloped, a LCS must be analyzed after calibration is performed. One batch consists of no more than 20 samples.


Two matrix duplicates must be analyzed per batch of 20 samples. If 10 or less samples are on a batch than only one matrix duplicate is needed. When analyzing for Corrosivity, a pH check using buffers 2 and 12 must be run before analyzing the sample. See Analysis Summary in the LIMS for current quality control acceptance windows. Refer to 1-P-QM-PRO-9015535 if any of the QC samples do not meet required specifications.

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Eurofins Document Reference	1-P-QM-WI -9011646	Revision	17
Effective Date	Apr 28, 2014	Status	Effective
Historical/Local Document Number	Analysis 0237, 1123, 1549, 5895, 5898, 8255, 0241, 4814, 0961, 0957, 0959		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		


Prepared by	Nicole Kepley
Reviewed and Approved by	Erik Frederiksen;Review;Monday, April 14, 2014 8:58:00 AM EDT Barbara Reedy;Approval;Monday, April 14, 2014 9:10:30 AM EDT

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Revision Log:


Revision: 17		Effective Date: This version
Section	Justification	Changes
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version
Document title	Clarification	Changed from Weak and Dissociable Cyanide to Weak Acid Dissociable

Revision: 16		Effective Date: Dec 20, 2013
Section	Justification	Changes
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version
Throughout Document	Reflect re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers
	Method Update	Updated temperature to 0° to 6°C not frozen. Clarified method title changed from Weak and Dissociable Cyanide to Weak Acid Dissociable.

 Lancaster Laboratories Environmental	Document Title: Determination of Total and Amenable Cyanide in Water, Wastewater, and Soils, Free Cyanide in Water and Wastewater, Reactive Cyanide of Solids, and Weak Acid Dissociable Cyanide in Waters and Soils	Eurofins Document Reference: 1-P-QM-WI -9011646
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Reference:

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 9012A, December 1996.
2. Method 335.4, Methods for Chemical Analysis of Water and Wastes, USEPA 600, Revision 1.0, 1993.
3. Test Methods for Evaluating Solid Wastes, SW-846 Method 9012B, August 2002.
4. Method 335.3, Methods for Chemical Analysis of Water and Wastes USEPA 600.
5. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 4500 CN G.
6. Test Methods for Evaluating Solid Wastes, SW-846 Chapter 7.3, December 1996.
7. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 4500 CN E
8. Document No. 000585, *Cyanide, The Flow Solution Methodology*, Alpkem Publication, Rev. A, December 1991.
9. *Flow Diagram for Cyanide Analysis*, Astoria-Pacific International, 1996.
10. *Chemical Hygiene Plan*, current version.

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Cross Reference:

Document	Document Title
Analysis #0492, 1548, 5896, 5897, 8256, 0956, 0958	Total and Amenable Cyanide Distillation (As Preparation for Analysis on the Automatic Flow Analyzer)
1-P-QM-FOR-9007828	Bottles and Analyses for Preservation Check and Subsampling
1-P-QM-PRO-9015459	Quality Control for Auto-Analyzer Analyses Performed in Instrumental Water Quality
1-P-QM-PRO-9018264	Packing Bottle Orders
1-P-QM-QMA-9017309	Determining Method Detection Limits and Limits of Quantitation
1-P-QM-QMA-9017313	Establishing Control Limits
1-P-QM-QMA-9017328	Reagents and Standards


Scope:

This method is applicable to the determination of various forms of cyanide in potable water, groundwater, and wastewater. The amenable cyanide method applies to any water or wastewater where the dissociable cyanide content is to be determined.

All samples for total or amenable cyanide must be manually distilled (analysis 0492, 1548, 5896, 5897, or 8256). Analysis 0237 is cyanide in water by EPA 335.4, analysis 8255 is cyanide in water by SW-846 9012A, analysis 1123 is reactive cyanide, analysis 1549 is amenable cyanide in water, analysis 5895 is cyanide in solids, and analysis 5898 is amenable cyanide in solids. Analysis 4814 is used for weak acid dissociable cyanide in water, and analysis 0961 is used for weak acid dissociable cyanide in soil. The samples for free cyanide (analysis 0241) are analyzed without preparation on the flow analyzer. Analyses 0957 and 0959 are used for solid and water samples referencing CT RCP or MA MCP requirements.

For samples dominated by iron-cyanide complexes, there is a potential for the current Weak Acid Dissociable Cyanide procedure to destabilize the iron-cyanide precipitate formed during the process and recover this strong cyanide complex as Weak Acid Dissociable Cyanide. Samples analyzed for this method will be analyzed using LL analysis 11069.

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 Lancaster Laboratories Environmental	Document Title: Determination of Total and Amenable Cyanide in Water, Wastewater, and Soils, Free Cyanide in Water and Wastewater, Reactive Cyanide of Solids, and Weak Acid Dissociable Cyanide in Waters and Soils	Eurofins Document Reference: 1-P-QM-WI -9011646
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Basic Principles:

Cyanide exists in aqueous solutions either as the simple CN^- ion or coordinated with various metal ions to form metallic complexes. Iron, cobalt, zinc, and copper commonly complex with CN (e.g., $\text{Fe}(\text{CN})_6^{-3}$, $\text{Co}(\text{CN})_6^{-3}$, $\text{Zn}(\text{CN})_4^{-2}$, $\text{Cu}(\text{CN})_4^{-2}$). Other species also occupy coordination sites in conjunction with cyanide making a myriad of compounds possible.

Cyanide is released from cyanide complexes by distillation only. The liberated hydrogen cyanide and simple cyanides are converted to cyanogen chloride by reaction with Chloramine T. The cyanogen chloride then reacts with the pyridine-barbituric reagent to form a red-colored complex. The complex is measured at 570 nm.

Samples analyzed for free cyanide show the cyanide released without preliminary distillation of the sample. (Free cyanide does not determine or quantify cyanide from tight complexes). For the amenable cyanide determination, the sample is pretreated with chlorine to release the dissociable cyanide. Both a treated and untreated aliquot of sample is analyzed, and the difference between the two results is the cyanide amenable to chlorination.


Weak Acid Dissociable cyanide measures the cyanide liberated from a slightly acidified sample. This method does not recover cyanides from tight complexes.

Reference Modifications:

SW846 9012A specifies the pyridine-barbituric acid reagent be brought to a final volume of 250 mL with reagent water. This method utilizes pyridine-barbituric acid reagent that is brought to a final volume of 1000 mL with reagent water. This modification is performance based and meets all requirements set forth in method SW846 9012A, Section 8.0, Quality Control.

This method utilizes the flow diagram from the manufacturer of the cyanide block. This modification is performance based and meets all of the requirements set forth in EPA 335.4, Section 9.0, Quality Control.

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There are no procedural differences in the determinative step between EPA 335.3 and EPA 335.4.


There are no procedural differences between amenable cyanide by EPA 335.3, or 4 and SM20 4500-CN-G.

For samples dominated by iron-cyanide complexes, there is a potential for the current Weak Acid Dissociable Cyanide procedure to destabilize the iron-cyanide precipitate formed during the process and recover this strong cyanide complex as Weak Acid Dissociable Cyanide. Samples analyzed for this method will be analyzed using LL analysis 11069.

Interferences:

The method is prone to numerous interferences. These are cited below.

1. Sulfides adversely affect the colorimetric procedures. The samples are checked in the Sample Support area and treated for sulfide. If the samples are treated for sulfide, the distilled standard and blank, and calibration curve standards must also be treated in the same manner.
(Use 1-P-QM-PRO-9018264 and Form 1-P-QM-FOR-9007828.) These treated standards are then run with the corresponding treated samples.
2. Aldehydes convert cyanide to cyanohydrin, which forms nitrite under the distillation conditions causing poor recoveries. Formaldehyde interference is noticeable in concentrations exceeding 0.5 mg/L.
3. Glucose and other sugars, especially at alkaline pH, lead to the formation of cyanohydrin by reaction of cyanide with aldose.
4. Fatty acids and oils interfere with the distillation and color development if they form soaps under the alkaline conditions.

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5. Prior to distillation, samples are checked for residual chlorine and treated with ascorbic acid to prevent destruction of cyanides during storage and the course of the analysis.

6. Samples high in NO₃ or NO₂ cause high readings in certain types of industrial waste. This is eliminated by pretreatment with sulfamic acid.

Safety Precautions and Waste Handling:

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local laws and regulations.

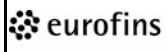
See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Normal laboratory safety practices must be followed. Because of the toxicity of CN, special care must be taken in handling standards and samples. Breathing pyridine vapors also presents a risk. Be sure to prepare the pyridine reagent in a hood. Inspect the glassware before use; discard or send for repair any glassware that is chipped, flawed, or broken. Discard cyanide waste samples in appropriate cyanide waste containers.

Personnel Training and Qualifications:

Personnel performing this procedure must have documentation of reading, understanding and agreeing to follow the current version of this SOP. Analysts are considered proficient when they have a documented Demonstration of Capability for the analysis. Demonstration of Capability consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. This is preformed annually and is maintained in the analyst's training records.

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Sample Collection, Preservation, and Handling:

Samples are collected in either glass or plastic containers. They must be preserved with NaOH to pH >12 and refrigerated at 0° to 6°C not frozen. Analysis must be performed within 14 days of sample collection for all types of cyanide except reactive cyanide, which must be analyzed as soon as possible after sample collection.

Apparatus and Equipment:

An automated flow analyzer is required for this method. The flow analyzer consists of the following parts:

1. Astoria-Pacific automatic sampler (Model 301A) or equivalent
2. Alpkem proportioning pump (Model 502) or equivalent
3. Pump tubes and pump tube harness
4. Astoria-Pacific Model 315 detector with 10-mm flow cell or equivalent
5. Astoria-Pacific glass Cyanide block
6. PC with Astoria-Pacific FasPac™ software, or equivalent


Reagents and Standards:

All chemicals used must be ACS reagent grade unless otherwise noted.

Different volumes or weights are acceptable in the preparation of reagents or standards as long as the ratios remain equivalent.

See 1-P-QM-QMA-9017328 for the appropriate labeling and documentation of reagent and standard preparation.

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1. Dilution water and receptacle wash (0.25 N NaOH)

Sodium hydroxide (NaOH) 20.0 ±.2 g

- a. Carefully dissolve 20 ±.2 g of sodium hydroxide into approximately 1800 mL reagent water in a 2-L volumetric flask.
- b. Dilute to volume with reagent water.
- c. Stable for 3 months at room temperature.

2. Phosphate buffer

Sodium phosphate, monobasic (NaH₂PO₄•H₂O) 138 ±1 g
Brij-35 1.0 mL

- a. Dissolve 138 ±1 g of NaH₂PO₄•H₂O in reagent water and dilute to 1 L in a volumetric flask.
- b. Add 1.0 mL of Brij-35. Store at 0° to 6°C not frozen in a plastic container.
- c. Prepare every 30 days.


NOTE: The amount of Brij-35 added is an estimated amount. Adjust as needed.

3. Chloramine T reagent

Chloramine T (C₇H₇ClNO₂SNa•3H₂O) 1.0 ±.05 g

- a. Dissolve 1.0 ±.05 g of chloramine T in 200 mL of reagent water and dilute to 250 mL in a volumetric flask.
- b. Make fresh each day.

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4. Pyridine barbituric acid reagent


Barbituric acid ($C_4H_4N_2O_3$)	15 \pm .2 g
Pyridine (C_5H_5N)	75 mL
Hydrochloric acid (HCl)	15 mL

- a. Place 15 \pm .2 g barbituric acid in a 1000-mL volumetric flask and add about 100 mL reagent water to wash the sides of the flask and wet down the barbituric acid.
- b. Add 75 mL of pyridine and mix.
- c. Add 15 mL of concentrated hydrochloric acid and mix.
- d. Dilute to about 800 mL with reagent water and mix until all the barbituric acid has dissolved.
- e. Dilute to volume with reagent water.
- f. This solution must be made in a hood due to the use of pyridine.
- g. Store in an amber glass bottle at 0° to 6°C not frozen for no longer than 2 weeks.

5. Sodium hydroxide 5 N

Sodium Hydroxide (NaOH)	200 \pm 2 g
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- a. Dissolve 200 \pm 2 g of NaOH in reagent water and dilute to 1 L in a volumetric flask.
- b. Store at room temperature in a glass volumetric.
- c. Prepare every 6 months.

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6. Stock standard for calibration (1000 mg/L CN^-)

Potassium cyanide (KCN)	1.255 \pm 0.005 g
Potassium hydroxide (KOH)	1 \pm .05 g

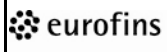
- a. Dissolve 1.255 \pm 0.005 g of potassium cyanide in 400 mL reagent water containing 1 \pm .05 g of potassium hydroxide.
- b. Dilute to 500 mL with reagent water in a volumetric flask (1.00 mg CN^- /mL).
- c. Prepare every 30 days.
- d. Keep refrigerated at 0° to 6°C not frozen in an amber glass bottle.
- e. Standardize weekly.

7. Stock standard for quality control (1000 mg/L CN^-)

- a. Same procedure as for the stock solution for calibration standards using potassium cyanide from a different source.
- b. Standardize weekly.

8. Standard silver nitrate solution, 0.0192 N

Purchased – This reagent is standardized by the manufacturer against potassium chloride. A certificate of analysis is supplied with each bottle that confirms the standardized value to be 0.0192 \pm 0.0001 N. Store at room temperature. See label for expiration date.

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9. Rhodanine indicator

p-methyl-aminobenzalrhodanine 0.020 ±0.001 g
Acetone 100 mL

- a. Dissolve 0.020 ±0.001-g *p*-methyl-aminobenzalrhodanine in 100 mL of acetone in a volumetric flask.
- b. Prepare every 6 months.
- c. Store at room temperature.

Weekly Standardization of Cyanide Stock Solutions:

1. Prepare two blanks by diluting 12.5 mL 5 N sodium hydroxide solution to 250 mL with reagent water and pouring each 250-mL aliquot into a separate 500-mL Erlenmeyer flask.
2. Add 20 to 25 drops of rhodanine indicator to each flask.
3. Titrate each solution with standard silver nitrate to the first change in color from yellow to brownish-pink.
4. Average the titration volumes used.
5. Measure 4 mL of the stock solution into two 500-mL Erlenmeyer flasks containing 12.5 mL 5 N sodium hydroxide and 237.5 mL reagent water.
6. Titrate each solution with standard silver nitrate to the first change in color from yellow to brownish-pink.
7. Average the titration volumes used.

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8. Calculate the true value of the cyanide stock standard

$$\frac{(A - B) \times 1000 \text{ mg/L}}{\text{mL standard used}} = \text{CN}_- \text{ mg/L}$$

Where:

A = Volume of AgNO₃ from titration of standard

B = Volume of AgNO₃ from titration of blank

Calibration:


1. Working Standard A, 10 mg/L

- a. Pipette a volume of the calibration standard derived from the standardization procedure to equal 10 mg/L of cyanide (see calculation below) into a 50-mL volumetric flask containing approximately 40 mL of cyanide wash solution.
- b. Dilute to 50 mL with wash solution.
- c. Prepare daily.

NOTE: Calculate the volume of stock standard required to achieve a final concentration of 10 mg/L using this formula:

$$\text{Volume required (mL)} = \frac{500}{\text{standardized value of } 1000 \text{ mg / L stock}}$$

2. Using the Working Standard A, prepare the following calibration standards in volumetric flasks. Dilute to volume with wash solution. Prepare daily.

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<u>Standard Name</u>	<u>mL Working Standard A</u>	<u>Final Volume (mL)</u>	<u>mg/L CN⁻</u>
S6	1.75	50	0.350
S5	1.0	50	0.200
S4	0.5	50	0.100
S3	0.25	50	0.050
S2	0.1	50	0.020
S1	0.05	50	0.010

Quality Control Standards:


1. Working Standard B, 10 mg/L
 - a. Pipette a volume of the calibration standard derived from the standardization procedure to equal 10 mg/L of cyanide (see calculation below) into a 50-mL volumetric flask containing approximately 40 mL of cyanide wash solution.
 - b. Dilute to 50 mL with wash solution.
 - c. Prepare daily.

NOTE: Calculate the volume of stock standard required to achieve a final concentration of 10 mg/L using this formula:

$$\text{Volume required (mL)} = \frac{500}{\text{standardized value of 1000 mg / L stock}}$$

2. Using the Working Standard B, prepare the following quality control standard in a 100-mL volumetric flask containing approximately 40 mL of wash solution. Dilute to volume with wash solution. Prepare daily.

Standard	Working Standard B (mL)	mg/L CN⁻
Mid CCV2 (also serves as LCS for free cyanide)	1.5	.15

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NOTE: For analyses 0957 and 0959, the CCV is prepared using working Standard A.

Procedure:

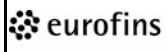
1. Configure the flow analyzer with the glass cyanide block according to Figure 1.
2. Set up the pump, the detector, the sampler, and the data system, using Table I as a guide.

NOTE: Adjust the range to keep the highest standard on range if there is a change in the system.

3. Turn on the power to all units.
4. Wash the system with reagent water for at least 5 minutes.
5. Place the reagent lines in the appropriate containers and pump the system for at least 10 minutes to allow the baseline to stabilize. Autozero the detector after the baseline has stabilized.
6. Monitor the signal from the detector using the software to ensure that the baseline has stabilized.
7. Load the CN sample template that is shown in Table II. This template lists the order in which the calibration standards, blanks, and quality control standards must be run to calibrate the system and to verify that analytical system is in control. Sample names are typed in after Position 13 and analyzed, if calibration and QC criteria have been met. Save the CN template using the following numbering system:

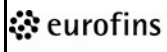
e.g., 03 290 CN
 ↓ ↓
 year Julian day

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8. Load the sample tray according to the cyanide template list (see Procedure 7).
9. Start the sampler and begin acquiring data. The data system recognizes the “Sync” peak and activates data collection. A standard greater than half the calibration maximum is normally placed in the Sync position.
10. Following the initial calibration blank (W) in Position 13, load samples with the appropriate laboratory control standard and preparation blank. A continuing calibration verification standard (CCV) and continuing calibration blank (W) must be run after every ten injections.
11. After the calibration standards have been analyzed, check the linearity of the calibration curve. The correlation coefficient must be >0.995 for the curve to be valid and for any sample data to be reported.
12. If any sample peak is greater than the highest point on the calibration, dilute the sample with dilution water and analyze the dilution to obtain a peak that is within the calibration range. Prepare the dilution so that the peak falls above 10% of full scale.
13. Shutdown procedure – End the run with a calibration verification standard and calibration blank. Shut off the autosampler. Place all reagent lines and sample line in reagent water and pump for approximately 20 minutes. Remove all lines from the water. Turn off the system.

NOTE: For samples dominated by iron-cyanide complexes, there is a potential for the current Weak Acid Dissociable Cyanide procedure to destabilize the iron-cyanide precipitate formed during the process and recover this strong cyanide complex as Weak Acid Dissociable Cyanide. Samples analyzed for this method will be analyzed using LL analysis 11069.

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Calculations:

The data system automatically prepares a standard curve by plotting peak heights of standards against their concentration values and computes the concentrations of the samples (the raw result) by comparing sample peak heights with the standard curve. The blank is not used as a point on the calibration curve.

If the sample was not distilled, apply any dilution factors used to the raw result to determine the final result (calculated automatically by the software):

$$\text{Final result} = \text{raw result} \times \text{dilution factor}$$

If the sample was distilled for total or weak acid dissociable cyanide, the calculation as performed by the software is as follows:

1. Waters

$$\text{Final result} = \frac{\text{raw result} \times \text{dil. factor} \times 50 \text{ mL}}{\text{mL of sample distilled}}$$

2. Soils

$$\text{Final result} = \frac{\text{raw result} \times \text{dil. factor} \times 0.05 \text{ L}}{\text{g of sample distilled}} \times 1000$$

3. Cyanide amenable to chlorination (manual calculation)


$$\text{Final result} = \text{untreated result} - \text{treated result}$$

4. Reactive cyanide (manual calculations)

a. Samples and blank

$$\text{Final result (mg/kg)} = \frac{\text{raw result} \times \text{DF} \times .5}{\text{wt (g)}} \times 1000$$

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b. Reactivity standards (LCS)

$$Final\ result\ (\% \ Rec) = \frac{Reac\ std}{result\ (mg / L) \times DF \times .5} + \frac{Reac\ flask}{(mg / L) \times DF \times .26} \times 100$$

Statistical Information/Method Performance:

1. The method detection limit (MDL) must be determined every 6 months for analysis 0237 by following the procedure outlined in 1-P-QM-QMA-9017309. For all other cyanide methods, the MDL is determined annually.
2. The quality control acceptance windows are generated annually for EPA method references and every 6 months for SW846 method references following the procedure outlined in 1-P-QM-QMA-9017313.


Quality Assurance/Quality Control:

The following steps are taken as part of the quality assurance program for this method:


1. A calibration curve of six standards and a blank are analyzed at the beginning of every run. The correlation coefficient of the curve must be >0.995. If this is not met, the curve is invalid and must be rerun. The blank is not used in the correlation coefficient calculation. The blank intercept of the W must not be greater than the MDL or less than the negative LOQ.
2. An initial calibration verification standard (ICV) must be run immediately after every calibration. The acceptable range is $\pm 10\%$ of the true value (0.150 mg/L). If the ICV does not meet this acceptance criterion, see 1-P-QM-PRO-9015459 for handling outliers and the corrective action that must be taken.

NOTE: For analyses 0957 and 0959, this ICV must be distilled.


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3. An initial calibration blank (W) must be run after the ICV. The acceptable result is <MDL. If the calibration blank does not meet this requirement, see 1-P-QM-PRO-9015459 for handling outliers and the corrective action that must be taken.
4. A continuing calibration verification standard (CCV) and a continuing calibration blank (W) must be run every ten injections. The acceptable range for the CCV is $\pm 10\%$ of the true value. An acceptable calibration blank result is <LOQ. If this criteria is not met, see 1-P-QM-PRO-9015459 for handling outliers and the corrective action that must be taken.
5. The linearity of the calibration must be determined every 6 months by analyzing a blank and three standards. If any verification data exceeds the initial values by $\pm 10\%$, linearity must be reestablished. The values of the three standards are taken from the calculated values of the standards used for the calibration curve.
6. Total Cyanide
 - a. A batch must contain no more than 20 samples.
 - b. A laboratory control standard (LCS) must be prepared and analyzed with every batch or each day samples are prepared. The acceptable range is $\pm 10\%$ of the true value. If the LCS does not meet this acceptance criterion, see 1-P-QM-PRO-9015459 for handling outliers and the corrective action that must be taken. For samples of the solid matrix, the recovery must be $\pm 10\%$ of the concentration of the spike added.

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- c. Based upon client requirements, when appropriate, a laboratory control standard duplicate (LCSD) is prepared and analyzed under the same conditions as the LCS. The acceptable range is $\pm 10\%$ of the true value. The RPD between the LCS and LCSD is statistical and is found in the LIMS. If the LCSD does not meet these acceptance criteria, see 1-P-QM-PRO-9015459 for handling outliers and the corrective action that must be taken. If the RPD between the LCS and LCSD is outside specifications, consult your group leader or manager to determine if reanalysis is necessary.
- d. A batch blank (PB) must be prepared and analyzed every batch or each day samples are prepared or analyzed. An acceptable result is <MDL. If the batch blank does not meet this criterion, see 1-P-QM-PRO-9015459 for handling outliers and the corrective action that must be taken.
- e. A duplicate must be prepared and analyzed for every ten samples, except for analyses 0957 and 0959, which are every 20 samples. See the LIMS for current quality control acceptance criteria. If the acceptance criterion is not met, see 1-P-QM-PRO-9015459 for handling outliers and the corrective action that must be taken.
- f. One spike must be prepared and analyzed for every ten samples, except for analyses 0957 and 0959, which are every 20 samples. An acceptable result is 90% to 110% recovery for samples referencing EPA 335.4 (analysis 0237). For all other cyanide methods, see LIMS for current quality control acceptance limits. If a spike recovery does not meet the acceptance criterion and the sample concentration exceeds the spike concentration by a factor of four or more, no further action is necessary.

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However, if this criterion is not met, a post-distillation spike (PDS) must be performed. If this recovery is still out of specifications, a standard additions analysis of the data for samples referencing method SW-846 9012A must be performed. No further action is required for other references.

7. Amenable Cyanide

- a. A batch must contain no more than 20 samples.
- b. An LCS must be prepared and analyzed with every batch or each day samples are prepared. When analyzing for Amenable Cyanide, an LCS that is both Treated and Untreated by alkaline chlorination is analyzed. Refer to the Total Cyanide LCS (section 6.b) for the Untreated LCS criteria. The Treated LCS has a true value is 0.20 mg/L for waters and 10 mg/kg for solids. **The expected value of these standards is 0% recovery.** This 0% recovery indicates that the treatment step is completed. See LIMS for current quality control acceptance criteria. If the LCS does not meet this acceptance criterion, see 1-P-QM-PRO-9015459 for handling outliers and the corrective action that must be taken.
- c. Based upon client requirements, when appropriate, a laboratory control standard duplicate (LCSD) (both Treated and Untreated) is prepared and analyzed under the same conditions as the LCS. If the LCSD does not meet the acceptance criterion, see 1-P-QM-PRO-9015459 for handling outliers and corrective action that must be taken. The RPD between the LCS and LCSD must be $\leq 20\%$. If the RPD exceeds 20%, consult your group leader or manager to determine if reanalysis is necessary.


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- d. A batch blank (PB) must be prepared and analyzed every batch or each day samples are prepared or analyzed. An acceptable result is <MDL. If the batch blank does not meet this criterion, see 1-P-QM-PRO-9015459 for handling outliers and the corrective action that must be taken.
- e. A duplicate must be prepared and analyzed for every ten samples. See LIMS for current quality control acceptance criteria. If the acceptance criterion is not met, see 1-P-QM-PRO-9015459 for handling outliers and the corrective action that must be taken.
- f. A matrix spike must be prepared and analyzed for every ten samples. See LIMS for current quality control acceptance criteria. If this criterion is not met, see 1-P-QM-PRO-9015459 for handling outliers and the corrective action that must be taken.

8. Reactive Cyanide

- a. A batch must consist of no more than 20 samples.
- b. An LCS must be prepared and analyzed with every batch or each day samples are prepared. See LIMS for current quality control acceptance criteria. If the LCS does not meet this acceptance criterion, see 1-P-QM-PRO-9015459 for handling outliers and the corrective action that must be taken.
- c. Based upon client requirements, when appropriate, a laboratory control standard duplicate (LCSD) is prepared and analyzed under the same conditions as the LCS. See LIMS for current quality control acceptance criteria. If the LCSD does not meet these acceptance criteria, see 1-P-QM-PRO-9015459 for handling outliers and the corrective action that must be taken. The RPD between the LCS and LCSD is statistical and is found in the LIMS. If the RPD is outside the control limit, consult your group leader or manager to determine if reanalysis is necessary.


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- d. A batch blank must be prepared and analyzed with every batch or each day samples are prepared. An acceptable result is <MDL. If the batch blank does not meet this criterion, see 1-P-QM-PRO-9015459 for handling outliers and the corrective action that must be taken.
- e. A spike and spike duplicate must be prepared and analyzed per batch. See LIMS for current quality control acceptance criteria. If the acceptance criteria are not met, see 1-P-QM-PRO-9015459 for handling outliers and the corrective action that must be taken. The relative percent difference between the spike and spike duplicate is statistically derived and found in the LIMS. If the RPD falls outside this criteria, see your group leader or manager to determine if reanalysis is necessary.
- f. Based upon client requirements, when appropriate, a duplicate is prepared and analyzed. See LIMS for current quality control acceptance criteria. If the acceptance criterion is not met, see 1-P-QM-PRO-9015459 for handling outliers and the corrective action that must be taken.

9. Free Cyanide

- a. A batch must contain no more than 20 samples.
- b. A laboratory control standard (LCS) must be analyzed with every batch of samples. The acceptable range for a free cyanide LCS is $\pm 10\%$ of the true value. If the LCS does not meet this acceptance criterion, see 1-P-QM-PRO-9015459 for handling outliers and the corrective action that must be taken.
- c. Based upon client requirements, when appropriate, a laboratory control standard duplicate (LCSD) is analyzed under the same conditions as the LCS. The acceptable range is the same for that of the LCS. The RPD between the LCS and LCSD is statistically derived and is found in the LIMS. If the LCSD does not meet these acceptance

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criteria, see 1-P-QM-PRO-9015459 for handling outliers and the corrective action that must be taken. If the RPD between the LCS and LCSD is outside the control limits, consult your group leader or manager to determine if reanalysis is necessary.

- d. A batch blank (PB) must be analyzed every batch or each day samples are analyzed. An acceptable result is $<1/2$ RL. If the batch blank does not meet this criterion, see 1-P-QM-PRO-9015459 for handling outliers and the corrective action that must be taken.
- e. A duplicate must be analyzed for every ten samples. See LIMS for current quality control acceptance criteria. If the acceptance criterion is not met, see 1-P-QM-PRO-9015459 for handling outliers and the corrective action that must be taken.
- f. One matrix spike must be analyzed for every ten samples. See LIMS for current quality control acceptance criteria. If a spike recovery does not meet the acceptance criterion and the sample concentration exceeds the spike concentration by a factor of four or more, no further action is necessary. If these criteria are not met, see 1-P-QM-PRO-9015459 for handling outliers and the corrective action that must be taken.

10. Weak Acid Dissociable Cyanide

- a. A batch must contain no more than 20 samples.
- b. A laboratory control standard (LCS) must be prepared and analyzed with every batch or each day samples are prepared. The acceptable range is $\pm 20\%$ of the true value. If the LCS does not meet this acceptance criterion, see 1-P-QM-PRO-9015459 for handling outliers and the corrective action which must be taken. For samples of a solid matrix, the recovery must be $\pm 20\%$ of the concentration of the spike added.

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- c. Based upon client requirements, when appropriate, a laboratory control standard duplicate (LCSD) is prepared and analyzed under the same conditions as the LCS. The acceptable range is $\pm 20\%$ of the true value. The RPD between the LCS and LCSD is statistical and is found in the LIMS. If the LCSD does not meet these acceptance criteria, see 1-P-QM-PRO-9015459 for handling outliers and the corrective action which must be taken. If the RPD between the LCS and LCSD is outside specifications, consult your group leader or manager to determine if reanalysis is necessary.
- d. A batch blank (PB) must be prepared and analyzed every batch or each day samples are prepared or analyzed. An acceptable result is <MDL. If the batch blank does not meet this criterion, see 1-P-QM-PRO-9015459 for handling outliers and the corrective action which must be taken.
- e. A duplicate must be prepared and analyzed for every ten samples. See LIMS for current quality control acceptance criteria. If the acceptance criterion is not met, see 1-P-QM-PRO-9015459 for handling outliers and the corrective action which must be taken.
- f. One spike must be prepared and analyzed for every ten samples. An acceptable result is 75% to 125% recovery.

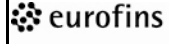
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Table I
Cyanide Table

R a n g e		10 – 350 µg/L
P u m p		
Speed	Percent	60
Tubes	Sample	blk/blk
	Air	orn/yel
	Buffer	blk/blk
	Chloramine-T	orn/grn
	Pyridine-barb. (2 lines)	blk/blk
	Pull-off	red/red
	Sampler wash	grn/grn
D e t e c t o r		
315	Wavelength	570 nm
	Rise time	10 sec.
	Range	.20 AUFS
	Heater	None
S a m p l e r		
	Rate	50/hr.
	Sample time	25 sec.
	Wash time	25 sec.
	Pecking	OFF
	Start-up soln.	DI water/Brij
	Wash soln.	0.25 N NaOH

NOTE: The pump tube sizes listed for the wash solution and pull-off lines are minimum requirements. Larger sized tubes are acceptable. The range, wash time and sample time are merely guidelines; adjust to achieve maximum instrument performance.

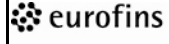
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Table II
Table Name: CN

<u>Cup #</u>	<u>Sample ID</u>	<u>Dil</u>	<u>Wt</u>	<u>Cup #</u>	<u>Sample ID</u>	<u>Dil</u>	<u>Wt</u>
1	SYNC	1	1			1	1
2	Rinse	1	1	3	W	1	1
4	S1	1	1	5	S2	1	1
6	S3	1	1	7	S4	1	1
8	S5	1	1	9	S6	1	1
10	Rinse	1	1	11	W	1	1
12	ICV	1	1	13	W	1	1

Table III
Standards Table

	Units: mg/L
S1	0.01
S2	0.02
S3	0.05
S4	0.10
S5	0.20
S6	0.35

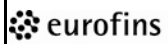
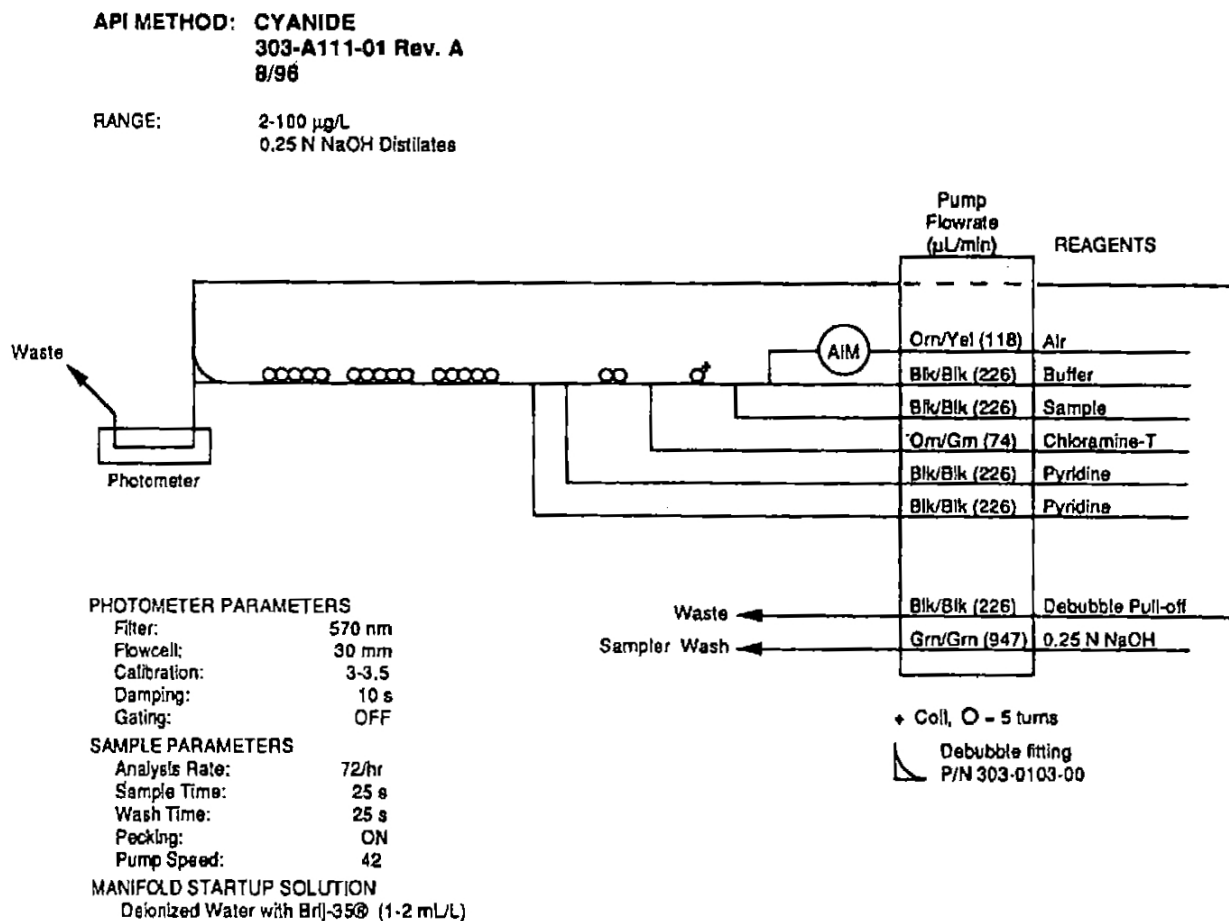

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Figure 1



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Appendix I

Determination of Total and Amenable Cyanide in Water, Wastewater, and Soils, Free Cyanide in Water and Wastewater, Reactive Cyanide of Solids, and Weak Acid Dissociable Cyanide in Waters and Soils

Reference:

1. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 9012A, December 1996.
2. Method 335.4, *Methods for Chemical Analysis of Water and Wastes*, USEPA 600, Revision 1.0, 1993.
3. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 9012B, August 2002.
4. Document No. 000585, *Cyanide, The Flow Solution Methodology*, Alpkem Publication, Rev. A, December 1991.
5. *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, 1998, Method 4500 CN G
6. Method 335.3, *Methods for Chemical Analysis of Water and Wastes*, EPA 600/4-79-020, March 1979.
7. Method 335.1, *Methods for Chemical Analysis of Water and Wastes*, EPA 600/4-79-020, 1974.
8. *AQ2 Discrete Multi-Chemistry Analyzer Operator Handbook*, SEAL Analytical Inc., Rev. 2, March 2006.
9. *AQ2 Series Software Guide*, SEAL Analytical, Inc., Version 4, 2005.
10. *Chemical Hygiene Plan*, Lancaster Laboratories, current version.

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Appendix I - Continued

Cross Reference:

Identical to attached analytical method.

Scope:

Identical to attached analytical method.

Basic Principles:

Identical to attached analytical method

Reference Modifications:

Identical to attached analytical method, except for the second paragraph which is not applicable.

Interferences:

Identical to attached analytical method.

Safety Precautions, Waste Handling, and Pollution Prevention:

Identical to attached analytical method.

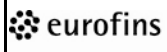
Personnel Training and Qualifications:

Identical to attached analytical method.

Sample Handling and Preservation:

Identical to attached analytical method.

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Appendix I - Continued

Apparatus and Equipment:

SEAL AQ2 Discrete Analyzer

Reagents and Standards:

Identical to attached analytical method with the exception of the Phosphate Buffer and Chloramine T reagent. The phosphate buffer is prepped as in the analytical method except that no Brij-35 is added. The chloramine-T is prepped as below:

Chloramine T ($C_7H_7ClNO_2SNa \cdot 3H_2O$) 1.0 \pm .05 g

Dissolve 1.0 \pm .05 g of chloramine T in 80 mL of reagent water and dilute to 100 mL in a volumetric flask. Make fresh each day.

Standardization of Cyanide Stock Solutions: Weekly

Identical to attached analytical method.


Calibration Standards:

Identical to attached analytical method, except that only the Working Standard A and the S6 (0.350 mg/L) standard are manually prepared. Curve points S5 - S1 are autoprepared by the instrument.

Quality Control Standards:

Identical to attached analytical method.


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Appendix I - Continued

Procedure:

1. Log into the SEAL AQ2 software.
2. Switch on reagent cooling (small auxiliary switch). **NOTE:** This must be done before switching on the main power switch.
3. Power on the analyzer with the main switch (larger on right side) at rear of instrument.
4. Empty and refill wash bottle with reagent water.
5. Ensure waste container is empty and waste tubing is not below the surface of the waste liquid.
6. Ensure clean segments are loaded into the reaction wheel and the well count is zeroed.
7. Replenish any necessary reagents.
8. Perform Daily Start-up routine. This is initiated by selecting *Settings* and *Daily Start-up* from the menu bar. **NOTE:** This does not need to be completed on a daily basis, only as needed or at the start of each week.
9. Double click on the *Scheduling* icon and select an empty tray.

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Appendix I - Continued

10. Enter the appropriate calibration, if applicable, and sample IDs. Using the *sample type* column to enter either unknown values (U1, U2, U3, etc.) or check standards (ICV, CCV, CCB).

Leave the first line empty if an auto standardization is planned for the analysis. The instrument automatically populates a curve and auto prepares the calibration.

If a manually prepared calibration is being analyzed, you must hand enter the standards into the *type* column as follows: S1, S2, S3, S4 S5, S6, S7, S8, with the S1 and S8 being blank values analyzed by the instrument.

11. Once samples and standards are loaded and the tray is complete, click on File and Save the new data.
12. Double click on the *Run* tab and select the correct file name for the tray. When this is complete a box pops up with the following options: *Set Tube Counter to Zero* (which resets the reaction segments back to sample at number 1), *Perform Waterbaselines* (this step is performed during the daily start-up), and *Auto Standardize* (this option is only checked when the instrument is preparing the calibration).
13. After this step has been performed, the instrument automatically starts up and begins to check reagent volumes. The current state of the analyzer is displayed on the status window, letting you know which sample is being analyzed and the expected length of time to run.

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Appendix I - Continued

Test Parameters:

PARAMETER	AQ2 SETTING
Test Name	CYANIDE 335.4
Units	µg CN/L
Decimals	4
Test type	End point
Sample volume (µL)	250
Water volume (µL)	0
Number of mixes	1
Cuvette primes	1
Cuvette wash	2
Reaction time (seconds)	480
Wavelength (nm)	578
Polynomial order	1
Number of reagents	3
1. CN Phosphate Buffer(µL)	80
2. CN Chloramine-T (µL)	25
3. CN Pyridine Barbituric Acid (µL)	240
Reagent 3 Delay (sec)	85

Calculations:

Identical to attached analytical method.


Statistical Information/Method Performance:

Identical to attached analytical method.

Quality Assurance/Quality Control:

Identical to attached analytical method.

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Attachment 1

ENVIRONMENTAL ENGINEERING SCIENCE
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Refinement of Weak Acid Dissociable (WAD) Method for Measuring Weak Metal Cyanide Complexes in Aqueous Samples

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ABSTRACT

The primary objective of this study was to correct deficiencies that had been identified in the current weak-acid dissociable (WAD) cyanide analytical method. These deficiencies became apparent when the method was applied to groundwater and surface water samples dominated by iron–cyanide complexes (>50% of the total cyanide content); the analytical method, as is, is fine for determining WAD cyanide in any aqueous sample where weak metal cyanide complexes and free cyanide ions dominate the cyanide speciation (i.e., iron–cyanide complexes are <50% of the total cyanide content). It was also determined that the means required to correct these deficiencies depended upon which iron–cyanide complex was present (i.e., ferricyanide/ferrocyanide or an iron–pentacyano methylamino species, $[\text{Fe}(\text{CN})_5\text{NHCH}_3]^{4-}$). For the samples dominated by the ferri- and ferrocyanide complexes, addition of the prescribed amount of zinc acetate under mildly acidic conditions was sufficient to entirely remove these complexes from solution via formation of an iron cyanide precipitate. However, the high-temperature distillation step of the analytical method was found to destabilize the iron–cyanide precipitate thus formed, resulting in the recovery of some of this strong acid dissociable cyanide complex as WAD cyanide. To rectify the method deficiency, an intermediate filtration step using a 0.45-micron filter was introduced to remove the precipitate before distillation is performed. A slightly different modified method was required when the iron–cyanide complexes were dominated by the iron–pentacyano methylamino complex, that is, $[\text{Fe}(\text{CN})_5\text{NHCH}_3]^{4-}$. In this instance, it was necessary to add three times the prescribed amount of zinc acetate to remove the complex from the solution. Also, the precipitate was comprised of smaller size particles, and hence, a smaller filter size (0.2 micron) was required to remove the precipitate before distillation. These modifications to

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WAD METHOD FOR MEASURING WEAK METAL CYANIDE COMPLEXES

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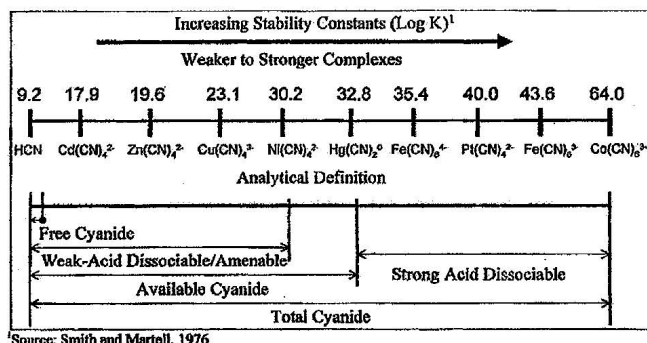


Figure 1. Stability and analytical detections of dissolved cyanide compounds.

inate groundwater at many MGP sites (Olsen *et al.*, 1999; Theis *et al.*, 1999; NYGAS, 2001; Ghosh *et al.*, 2004). This complex was first detected in the ion chromatograms of groundwater samples from certain MGP sites as a signal peak distinctly different from ferri-/ferrocyanide and other metal-cyanide complexes (Theis *et al.*, 1994; Olsen *et al.*, 1999). A series of wet chemical and spectroscopic methods was used to identify the chemical structure of this complex (Ghosh *et al.*, 2004; NGA, 2004). Preliminary research suggests this complex to be a strong metal-cyanide complex with photodissociative properties similar to the conventional ferrocyanide complex (Olsen *et al.*, 1999; Ghosh *et al.*, 2004; NGA, 2004). Other physicochemical properties of this complex are discussed in detail in Ghosh *et al.* (2004).

Operationally, the WAD cyanide method is defined as a weak acid distillation method performed at a pH of 4.5 and capable of recovering cyanide from all cyanide species present in an aqueous sample as free cyanide (HCN/CN^-) and/or as metal-cyanide complexes such as $[\text{Ni}(\text{CN})_4]^{2-}$, $[\text{Cu}(\text{CN})_4]^{3-}$, $[\text{Zn}(\text{CN})_4]^{2-}$, and $[\text{Cd}(\text{CN})_4]^{2-}$ that dissociate under weak acid conditions to release the cyanide anion (APHA, 1996a; ASTM, 2004a). It is also important to note that the EPA-approved available cyanide analytical method (OIA-1677; U.S. EPA, 1999) detects the same cyanide species as the WAD analytical method, with the exception that it also detects mercury-cyanide complexes, like $[\text{Hg}(\text{CN})_2]^0$ and $[\text{Hg}(\text{CN})_4]^{2-}$. Since $\text{Hg}(\text{CN})_2$ or $[\text{Hg}(\text{CN})_4]^{2-}$ are generally absent from groundwaters at MGP and aluminum production sites, the cyanide concentration determined by these two methods should be identical, as long as no interference is present in the WAD cyanide method.

METHODS

A series of experiments was conducted using spiked reagent water, MGP site groundwaters, and aluminum production site wastewater. These experiments were designed to refine the WAD cyanide analytical method and to test its application on field samples of cyanide-impacted waters.

WAD cyanide analytical method refinement study

Cyanide spiking studies with reagent water. Laboratory-grade reagent water (ASTM Type I reagent water) was spiked with five different concentrations of 99.2% pure reagent grade potassium ferrocyanide trihydrate $[\text{K}_4\text{Fe}(\text{CN})_6 \cdot 3\text{H}_2\text{O}]$ (Sigma-Aldrich, Milwaukee, WI) and 99.99% pure reagent-grade potassium ferricyanide $[\text{K}_3\text{Fe}(\text{CN})_6]$ (EM Science, Gibbstown, NJ) to produce solutions with total cyanide concentrations of 0.02, 0.1, 1.0, 5.0, and 10.0 mg/L. Each of the respective spiked solutions was prepared in duplicate. Following spiking, total cyanide (Method 4500-CN-C, APHA, 1996b) and original WAD cyanide analyses (Method 4500-CN-I, APHA, 1996a; Method D2036C-98, ASTM, 2004a) were performed on the 10 spiked solutions in triplicate. The Midi-distillation unit was employed for all weak-acid distillations performed in this study. Note, this scaled-back version of the conventional macrodistillation technique employs one-tenth the reagents and sample volume, and is used by many commercial and industrial laboratories as a means to reduce waste and analyze multiple samples at the same time. Midi-distillation is approved by the EPA for total cyanide analysis (Method 335.4, U.S. EPA,

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1993). The WAD Midi-distillation is referred to as the "original WAD cyanide analysis" or "WAD-std" hereinafter in this paper. As a perspective, Fig. 2 provides the schematic of the original WAD cyanide method and the two principal variants of the original WAD cyanide method investigated in this study.

Variable zinc acetate addition to spiked samples. In another set of experiments, another batch of the 10 spiked solutions described above was prepared, and 50-mL aliquots of each sample were subjected to 2- or 4-mL additions of 100-g/L zinc acetate solution [as $\text{Zn}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot \text{H}_2\text{O}$] followed by pH adjustment to 4.5 with acetate buffer and weak-acid distillation. This procedure was performed in triplicate for each zinc acetate addition. Hereinafter in this paper, "WAD-4" is referred to as the refined WAD analytical method with 4-mL zinc acetate solution addition.

Variable zinc acetate addition and filtration of spiked samples. This step was meant to refine the original WAD cyanide method in terms of optimizing the volume of 100-g/L zinc acetate solution that must be added to ensure complete precipitation of the iron-cyanide complexes and to investigate the effect of filtration on the final measured concentration of WAD cyanide. In this set of experiments, another batch of the 10 spiked solutions described earlier was prepared and again subjected to incremental additions (2 and 4 mL) of 100-g/L zinc acetate solution. However, unlike the previous set

of experiments the solutions were filtered (0.45 μm) after each addition of zinc acetate and pH adjustment. The solutions were then subjected to weak-acid distillation in triplicate except for the samples where 4 mL of zinc acetate was added. Only one replicate of the sample with 4-mL zinc acetate was analyzed. Hereinafter in this paper, "WAD-2-0.45F" is referred to as the refined WAD method with 2 mL of zinc acetate solution addition followed by 0.45- μm filtration (Fig. 2) and "WAD-4-0.45F" is referred to as the refined WAD method with 4 mL of zinc acetate solution addition followed by 0.45- μm filtration.

Characterization of WAD cyanide in MGP groundwater samples. Groundwater samples from three monitoring wells, two from one MGP site in the State of New York (well nos. MW-9008 and MW-9009), and one from a different MGP site in the same state (well no. MW-2), were acquired for this study. These samples were previously tested for WAD cyanide using the "WAD-std" analytical method, and were found to contain WAD cyanide in excess of what was reported (Ghosh *et al.*, 2004) by the available cyanide analysis method OIA-1677 (U.S. EPA, 1999). The available cyanide method employs ligand exchange agents that are specific to weak metal-cyanide complexes and therefore provides a good quantification of weak metal-cyanide complexes, including free cyanide and mercury cyanide (Fig. 1; Sebroski and Ode, 1997). However, as previously noted, mercury cyanide is not associated with MGP or an alu-

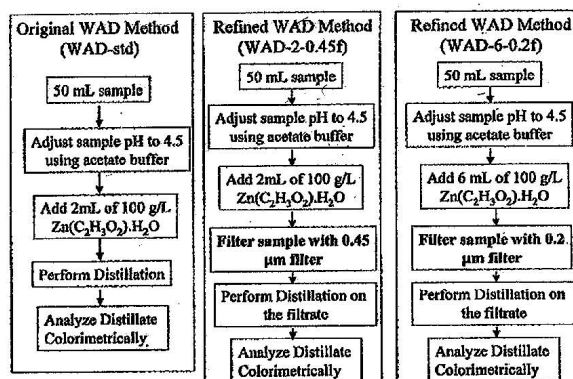
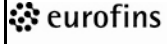


Figure 2. Schematic showing original WAD cyanide method and the two key modifications to the original WAD cyanide method investigated in this study.

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minum production site waters, and the available cyanide analytical method should report the same cyanide concentration as the "WAD-std" analytical method for these waters.

Following acquisition, the three groundwater samples were sent to the laboratory under unpreserved conditions in amber glass bottles packed in ice coolers at 4°C. Upon receipt (within 24 h of sample collection), the laboratory pretreated the samples with sodium arsenite and lead carbonate, respectively to eliminate any chlorine and sulfide interferences following the procedure prescribed by Standard Methods (Method 4500 CN-B, APHA, 1996c), preserved with NaOH (pH = 12) and subjected to detailed analysis using analytical methods for total cyanide (Method 4500 CN-C, APHA, 1996b), available cyanide (OIA-1677, USEPA, 1999), original WAD cyanide (Method 4500 CN-I, APHA, 1996a; Method D2036C-98, ASTM, 2004a), free cyanide (by microdiffusion) (Method D4282-02, ASTM, 2004b), and individual metal-cyanide complexes (by ion chromatography) (Method D6994-04, ASTM, 2005). Note that the ion chromatography procedure does not distinguish between the two iron-cyanide complexes, ferricyanide and ferrocyanide. Both are detected as the ferrocyanide complex. All analyses were performed in triplicate, with minimal intrusion of light.

WAD cyanide analytical method refinement using MGP groundwater samples. Following removal of chlorine and sulfide and pH adjustment, 50 mL of sample aliquots from MW-9008 and MW-9009 were individually subjected to four levels of 100 g/L zinc acetate solution addition (i.e., 2, 4, 6, and 8 mL). WAD cyanide was analyzed in each sample in triplicate with and without prior filtration through either a 0.45- μ m or a 0.2- μ m filter. Portions of the MW-9008 and MW-9009 samples were also subjected to ion chromatography analysis to quantify individual metal-cyanide complexes following treatment with 100 g/L zinc acetate solution and filtration through 0.45-micron filter. The ion chromatographic analysis was done to confirm the extent of removal of the iron-cyanide complexes $[\text{Fe}(\text{CN})_6]^{3-4-}$ by the addition of zinc acetate followed by filtration (0.45 μ m). Hereinafter in this paper, "WAD-6-0.2f" is referred to as the refined WAD method with 6 mL of zinc acetate solution addition followed by 0.2- μ m filtration (Fig. 2).

Application of refined WAD cyanide analytical method

Spiked reagent water. Laboratory-grade reagent water sample was initially spiked with 5 mg/L (as CN) of 99.2% pure reagent-grade potassium ferrocyanide

$[\text{K}_4\text{Fe}(\text{CN})_6 \cdot 3\text{H}_2\text{O}]$ and then subjected to analysis of total cyanide, original WAD cyanide, available cyanide, and individual iron-cyanide complexes. In addition, the sample was analyzed in triplicate for WAD cyanide using two different modified versions of the current method: (1) filtration by a 0.45- μ m filter following 2 mL of zinc acetate addition and pH adjustment (WAD-2-0.45f); and (2) filtration by a 0.2- μ m filter following 6 mL of zinc acetate addition and pH adjustment (WAD-6-0.2f).

Another batch of fresh reagent-grade water was spiked with 4 mg/L of copper cyanide $[\text{Cu}(\text{CN})_2]^{2-}$ and 5 mg/L of sodium cyanide NaCN (sum of all concentrations as CN). The sample was then analyzed for total cyanide, "WAD-std" analytical method, available cyanide, and copper cyanide by ion chromatography. In addition, the sample was analyzed in triplicate using "WAD-2-0.45f" and "WAD-6-0.2f" methods (Fig. 2).

Spiked field water samples. Two MGP Site Groundwaters (MW-9008 and MW-2) and one wastewater sample from an aluminum production site (Grab 001) were spiked with 10 mg/L (as CN) of 99.2% pure reagent grade potassium ferrocyanide $[\text{K}_4\text{Fe}(\text{CN})_6 \cdot 3\text{H}_2\text{O}]$ from Sigma-Aldrich. The spiked and unspiked samples were both analyzed in triplicate for total cyanide, "WAD-std" analytical method, available cyanide, and metal cyanide complexes. As before, the samples were also analyzed in triplicate using "WAD-2-0.45f" and "WAD-6-0.2f" methods (Fig. 2).

Another set of subsamples from MW-9008, MW-2 and Grab-001 were spiked individually with a cocktail comprising of 4 mg CN/L of copper cyanide and 5 mg CN/L of sodium cyanide (all concentrations reported as CN). These samples were then analyzed in triplicate for total cyanide, "WAD-std" analytical method, available cyanide, and metal-cyanide complexes. As before, the spiked and the unspiked samples were also analyzed in triplicate using "WAD-2-0.45f" and "WAD-6-0.2f" methods (Fig. 2).

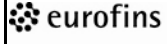
RESULTS

WAD cyanide analytical method refinement study

Cyanide spiking studies with reagent water. Table 1 provides the result of the "WAD-std" analysis on the ferri- and ferrocyanide spiked Type I reagent water samples. As shown in Table 1, the "WAD-std" method did detect cyanide, which for most of the cases (i.e., up to a spike concentration of 10 mg CN/L), increased linearly with an increase in the ferri- and ferrocyanide spike concentration.

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Table 1. WAD cyanide concentrations using the original and refined WAD cyanide analytical procedures on ferri- and ferrocyanide spiked reagent waters.^a

Spike level (mg/L CN)	Ferricyanide				Ferrocyanide			
	Mean (SD)							
	WAD-std	WAD-4	WAD-2-0.45f	WAD-4-0.45f	WAD-std	WAD-4	WAD-2-0.45f	WAD-4-0.45f
0.020	0.0033 (0.00064)	0.00167 (0.00071)	0.00063 (0.00061)	0.00057 ^b	0.0047 (0.00084)	0.00059 (0.00052)	0.0033 (0.00048)	0.0028 ^b
0.100	0.0039 (0.0005)	0.0027 (0.00089)	0.00057 (0.00031)	0.00069 ^b	0.0060 (0.0021)	0.00087 (0.0001)	0.0027 (0.00033)	0.0030 ^b
1.00	0.0075 (0.0018)	0.0037 (0.00047)	0.0025 (0.0004)	0.002 ^b	0.0086 (0.0060)	0.0045 (0.00077)	0.0040 (0.00052)	0.0042 ^b
5.00	0.015 (0.0071)	0.0061 (0.00083)	0.0028 (0.00)	0.00320 ^b	0.030 (0.0010)	0.010 (0.00053)	0.0046 (0.00023)	0.0068 ^b
10.0	0.033 (0.0035)	0.0075 (0.00057)	0.0056 (0.0007)	0.0045 (0.00028)	0.0430 (0.0031)	0.016 (0.0022)	0.0076 (0.00048)	0.0091 (0.0034)

^aAll concentrations reported as mg/L; quantitation limit (QL) for WAD cyanide in reagent waters = 0.0005 mg/L; ^bsingle analysis results.

Variable zinc acetate addition to spiked samples. Table 1 provides the result of the "WAD-4" analysis on the ferri- and ferrocyanide spiked Type I reagent water samples. As shown in Fig. 3, the higher amounts of zinc acetate resulted in concentrations of WAD cyanide that were lower than those obtained with the APHA or the ASTM methods.

Variable zinc acetate addition and filtration of spiked samples. Table 1 presents the result of the WAD cyanide analysis with the addition of the filtration step prior to distillation. As shown in Table 1, the "WAD-2-0.45f" yielded lower concentrations than measured by "WAD-std" and "WAD-4" methods. As before, WAD cyanide increased linearly with spike concentration up to 10 mg CN/L (Fig. 3c) and ferrocyanide spikes produced higher WAD cyanide concentrations for a given spike concentration. Table 1 also shows the results of the analysis by "WAD-4-0.45f" method. As shown in Table 1, WAD cyanide did not change appreciably from the results of

"WAD-2-0.45f." Table 2 provides the data on the percent of total cyanide reported as WAD cyanide as a function of ferri- and ferricyanide concentrations. The over-estimation of WAD cyanide is more pronounced below 1 mg/L total cyanide than at higher concentrations.

Characterization of WAD cyanide in MGP groundwaters. Table 3 presents the total, available, and free cyanide data for groundwaters from MW-9008, MW-9009, and MW-2 wells. Unlike cyanide-contaminated waters from electroplating, heap leaching, and metals mining processes, the metal speciation in these groundwaters was dominated by iron with minor contributions from cobalt and nickel based on historical site data. The majority of the iron was complexed with cyanide (>99%), and was not available as the free metal. The data for individual metal cyanide complexes is presented in Table 4 (Samples MW-9008 and MW-9009 only). The metal cyanide complex data show that, despite high total cyanide concentrations (Table 3), $[\text{Fe}(\text{CN})_6]^{4-}$ and/or $[\text{Fe}(\text{CN})_6]^{3-}$ are present in insignifi-

Table 2. WAD cyanide reported as percent recovery of total cyanide in spiked samples.

Spike level (mg/L CN)	WAD-std		WAD-4		WAD-2-0.45f		WAD-4-0.45f	
	Ferri	Ferro	Ferri	Ferro	Ferri	Ferro	Ferri	Ferro
0.02	17.00%	23.50%	8.50%	2.95%	3.00%	16.50%	3.00%	15.00%
0.1	3.90%	6.00%	2.70%	0.88%	0.57%	2.70%	0.70%	3.00%
1	0.75%	1.45%	0.37%	0.45%	0.25%	0.41%	0.20%	0.42%
5	0.30%	0.61%	0.12%	0.20%	0.06%	0.09%	0.06%	0.14%
10	0.33%	0.43%	0.08%	0.16%	0.06%	0.08%	0.05%	0.09%

Attachment 1 Continued

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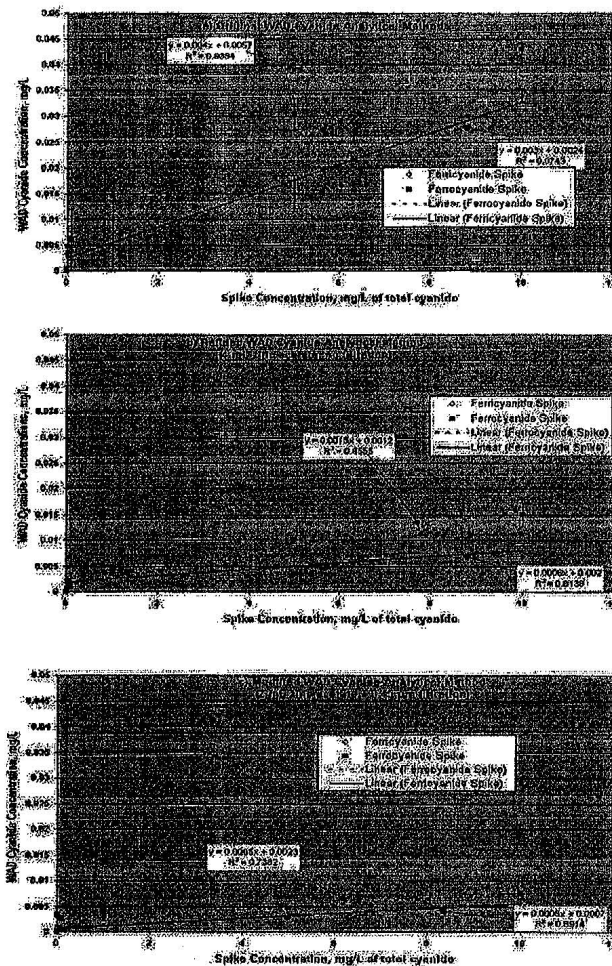
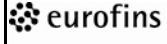


Figure 3. WAD cyanide concentration vs. spike concentrations of ferri- and ferrocyanide in reagent waters (cyanide concentration data is reported as an average of triplicate analysis and error bars show ± 1 standard deviation).

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Table 3. Characterization of total, available, and free cyanide in groundwater samples from MGP sites.^a

Sample ID	Total cyanide (mg/L)	Available cyanide by OIA-1677 (mg/L)	Free cyanide (mg/L)
	Mean (SD)	Mean (SD)	Mean (SD)
MW-9008	16.79 (2.074)	0.036 (0.00058)	<0.003 (0)
MW-9009	1.33 (0.138)	0.015 (0.0)	<0.003 (0)
MW-2	9.65 (0.306)	0.007 (0.0015)	<0.003 (0)

^aAll concentrations are average of triplicate analyses and are reported as CN.

cant amounts. In addition, when the groundwater samples of both MW-9008 and MW-9009 were subjected to ion chromatography analysis, following the addition of 2 mL of zinc acetate and filtration (0.45 μ m), the previously detected $[\text{Fe}(\text{CN})_6]^{4-}$ peak became nondetectable. These observations provide further confirmation that the addition of 2 mL of zinc acetate is sufficient to precipitate the ferri- or ferrocyanide complex in a 50 mL solution of these groundwaters. Detailed investigation of the ion chromatograms of these groundwaters revealed that an iron-pentacyano complex, with a postulated stoichiometric formula of $[\text{Fe}(\text{CN})_5\text{NHCH}_3]^{4-}$ dominated both of the groundwater samples (Ghosh et al., 2004; NGA, 2004).

WAD cyanide analytical method refinement using MGP groundwaters. Table 5 presents the WAD cyanide results using the "WAD-std" analytical method as well as the "WAD-2-0.45f" method for MGP groundwaters MW-9008 and MW-9009. The cyanide concentrations indicated by the "WAD-2-0.45f" were much lower than those indicated by the

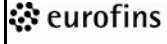
original method. In fact, for MW-9009, an analysis of variance showed that "WAD-2-0.45f" result, was statistically identical to the available cyanide concentration (see Table 3), and both of these concentrations were significantly lower than the original WAD cyanide concentration (ANOVA probability level of 0.000 and Duncan's Multiple-Comparison Test at alpha = 0.05). For MW-9008, however, the "WAD-2-0.45f" was four times the corresponding available cyanide concentration. This particular sample was subjected to the addition of even more zinc acetate (6 and 8 mL) and the effect of filtration following each incremental addition of zinc acetate was examined.

Table 6 shows the result of the WAD method refinement using groundwater from MW-9008. An analysis of variance shows that application of "WAD-6-0.2f" to remove the precipitate prior to distillation is closest to the available cyanide concentration (see Table 3), and that both of these results were statistically less than the "WAD-std" method (Table 6) (ANOVA probability level of 0.000 and Duncan's Multiple-Comparison Test at alpha = 0.05).

Table 4. Concentrations of metal cyanide species in groundwater samples: MW-9008 and MW-9009.

Sample ID	Sample treatment	$\text{Ag}(\text{CN})_2^-$ mg/L ^a	$\text{Au}(\text{CN})_2^-$ mg/L ^a	$\text{Cu}(\text{CN})_2^{2-}$ mg/L ^a	$\text{Ni}(\text{CN})_4^{2-}$ mg/L ^a	$\text{Fe}(\text{CN})_6^{4-}$ mg/L ^a	$\text{Co}(\text{CN})_6^{3-}$ mg/L ^a
MW-9008	Untreated	<0.01	<0.005	<0.0005	<0.01	0.0015	<0.001
	2 mL zinc acetate + 0.45 μ m filtration	<0.01	<0.005	<0.0005	<0.01	<0.0005	<0.001
MW-9009	Untreated	<0.01	<0.005	<0.0005	<0.01	0.02	<0.001
	2 mL zinc acetate + 0.45 μ m filtration	<0.01	<0.005	<0.0005	<0.01	<0.0005	<0.001

^aAll concentrations reported as CN; Note: MW-9008 had 16.78 mg/L of $[\text{Fe}(\text{CN})_5\text{NHCH}_3]^{4-}$ and MW-9009 had 1.3 mg/L of $[\text{Fe}(\text{CN})_5\text{NHCH}_3]^{4-}$. The $[\text{Fe}(\text{CN})_5\text{NHCH}_3]^{4-}$ concentrations were obtained by difference using the total cyanide concentrations from Table 3 and the concentration data in this table. Except for the iron cyanide complexes, $[\text{Fe}(\text{CN})_5\text{NHCH}_3]^{4-}$ and $[\text{Fe}(\text{CN})_6]^{4-}$, no other strong metal-cyanide complex peaks were detected in the ion chromatograms. The ion chromatography method does not distinguish between ferricyanide and ferrocyanide. Therefore, the results presented for ferrocyanide in the table actually represent the sum of ferricyanide and ferrocyanide species.

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Table 5. Comparison of WAD cyanide concentrations of groundwater samples MW-9008 and MW-9009: original and refined WAD cyanide analytical methods.^a

Sample ID	Total CN (mg/L)	WAD-std (mg/L)	WAD-2-0.45f (mg/L)
	Mean (SD)	Mean (SD)	Mean (SD)
MW-9008	16.79 (2.07)	0.25 (0.0086)	0.15 (0.0025)
MS-9009	1.33 (0.14)	0.026 (0.0018)	0.017 (0.00075)

^aAll concentrations are average of triplicate analyses and reported as CN.

Application of refined WAD cyanide analytical method

Spiked reagent water samples. Table 7 presents the result of several cyanide analyses of spiked solutions prepared with reagent-grade Type I water. Note that the only form of cyanide that might be present in the distilled ferrocyanide spiked reagent water other than the iron-cyanide complex would be minor amounts of free cyanide, which could be generated by the photodissociation of the ferrocyanide complex under mild acid conditions prior to precipitation. As shown in Table 7, amounts of free cyanide up to 0.01 mg/L were found in this sample by the microdiffusion and the available cyanide analysis methods. Thus, theoretically, the WAD cyanide concentration should be close to 0.01 mg/L. As shown in Table 7, for the 5 mg/L ferrocyanide level, the "WAD-std" analytical method resulted in a WAD cyanide concentration of 0.028 mg/L, significantly higher than the available and the free cyanide concentration (both the available and the free cyanide concentrations were statistically similar; ANOVA probability level = 0.000 and Duncan's Multiple-Comparison Test at alpha = 0.05). However, the "WAD-2-0.45f" method resulted in a WAD cyanide concentration (0.011 mg/L) that closely resembles the available and the free cyanide values (i.e., the three test results were not significantly different; ANOVA probability level = 0.228). Increasing the amount of zinc acetate to 6 mL did not result in any

significant change in the WAD cyanide concentration (i.e., 0.007 mg/L).

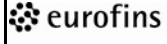
For the samples spiked with 4 mg/L of $[\text{Cu}(\text{CN})_3]^{2-}$ and 5 mg/L of NaCN, slightly different results were obtained. For all three replicates, the "WAD-std" analytical method yielded cyanide concentrations (8.29 mg/L), resembling the total (8.62 mg/L) and available cyanide (8.49 mg/L) concentrations as expected (ANOVA probability level = 0.207). The sum of the copper cyanide complex concentration (3.947 mg/L) and the free cyanide concentration (5.29 mg/L) equaled the total, available, and the original WAD cyanide concentrations, indicating a good mass balance. However, "WAD-2-0.45f" and "WAD-6-0.2f" methods, respectively, resulted in lower WAD cyanide concentrations. This is also the case for the Grab-001 sample, that showed low spike recovery of copper and sodium cyanide cocktail (see below and Table 8c). Thus, it appears that most of the copper-cyanide is not recovered due to possible precipitation and removal of some of the copper cyanide complex upon zinc acetate addition followed by filtration and only sodium cyanide is recovered. This, however, suggest that there could still be a possibility of low recovery of WAD cyanides from samples that are dominated by weak metal-cyanide complexes using the proposed WAD procedure refinements. But this hypothesis should be further examined by subjecting the sample to both free cyanide and metal-cyanide complex analysis following addition of different amounts of zinc acetate.

Table 6. Refinement of WAD cyanide analytical method using groundwater sample, MW-9008.

Treatment	Total CN (mg/L) ^a	WAD CN (mg/L) ^a (no filtration)	Refined WAD CN (mg/L) (0.45 μm filtration)	Refined WAD CN (mg/L) (0.2 μm filtration)
	Mean (Std. Dev.)			
2 mL zinc acetate	11.4 (0.29) ^b	0.22 (0.004) ^b	0.23 (0.0056) ^b	0.16 (0.0038) ^b
4 mL zinc acetate	Not analyzed	0.11 (0.002) ^b	0.08 (0.0033) ^b	0.058 (0.0029) ^b
6 mL zinc acetate	Not analyzed	0.094 (0.006) ^b	0.061 (0.0031) ^b	0.035 (0.0012) ^b
8 mL zinc acetate	Not analyzed	0.096 ^c	0.058 ^c	0.042 ^c

^aConcentrations are different from corresponding concentrations in Table 5 due to different sample collection dates, which spanned over a month period; cyanide concentration in MW 9008 has been shown previously to vary over short periods of time; ^ball concentrations are average of triplicate analyses and reported as CN; ^csingle analysis results.

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Table 7. Application of refined WAD cyanide analytical method to reagent water matrix.^a

Spike levels	Total cyanide, mg/L	Available cyanide, mg/L	[Fe(CN) ₆] ⁴⁻³⁻ or [Cu(CN) ₃] ²⁻ by IC, mg/L	WAD-std, mg/L	WAD-2-0.45f, mg/L	WAD-6-0.2f, mg/L	Free cyanide by microdiffusion, mg/L
[Fe(CN) ₆] ⁴⁻ (5 mg/L)	5.54	0.008	4.84 ^b	0.028	0.011	0.007	0.01
4 mg/L [Cu(CN) ₃] ²⁻ + 5 mg/L NaCN	8.62	8.49	3.95 ^c	8.29	7.35	4.75	5.3

^aAll concentrations are average of triplicate analyses and are reported as CN; ^b[Fe(CN)₆]⁴⁻³⁻; ^c[Cu(CN)₃]²⁻.

Spiked field water samples. Table 8a provides the baseline analysis for all three field water samples prior to spiking with ferrocyanide and a cocktail comprised of copper and sodium cyanide, respectively. As shown in this table, both MW-9008 and MW-2 contain high concentrations of total cyanide, most of which is strongly com-

plexed with metals. On the contrary, Grab 001 contained a nondetectable amount of total cyanide.

Table 8b shows the result of the spiking study with 5 mg/L of ferrocyanide solution. As shown in this table, the "WAD-6-0.2f" method yielded WAD concentrations closest to the available cyanide concentrations for MW-

Table 8. Application of refined WAD cyanide analytical method; field water samples.^a

a. Baseline characterization

Unspiked samples	Total CN, mg/L	WAD-std, mg/L	WAD-2-0.45f, mg/L	WAD-6-0.2f, mg/L	Available CN, mg/L	Free (microdiffusion) CN, mg/L	[Fe(CN) ₆] ⁴⁻³⁻ analysis by IC, mg/L
MW 2	10.28	0.140	0.10	0.061	0.022	0.014	5.82
Grab 001	<QL	<QL	<QL	<QL	<QL	<QL	<QL
MW 9008	11.40	0.28	0.16	0.043	0.017	<QL	<QL

^aQL for Total, WAD and Free Cyanide in Field Matrix = 0.005 mg/L; QL for Available Cyanide = 0.002 mg/L; QL for [Fe(CN)₆]⁴⁻³⁻ = 0.1 mg/L.

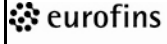
b. Spike studies with 5 mg/L ferrocyanide

[Fe(CN) ₆] ⁴⁻ (5 mg/L) spike	Total CN, mg/L	WAD-std, mg/L	WAD-2-0.45f, mg/L	WAD-6-0.2f, mg/L	Available CN, mg/L	Free (microdiffusion) CN, mg/L	[Fe(CN) ₆] ⁴⁻³⁻ analysis by IC, mg/L
MW 2	15.60	0.15	0.068	0.075	0.025	0.019	10.77
Grab 001	5.71	0.86	0.009	0.008	0.004	0.015	4.73
MW 9008	18.30	0.42	0.11	0.052	0.019	0.006	4.54

c. Spike studies with 4 mg/L [Cu(CN)₃]²⁻ and 5 mg/L NaCN mixture

4 mg/L [Cu(CN) ₃] ²⁻ + 5 mg/L NaCN spike	Total CN, mg/L	WAD-std, mg/L	WAD-2-0.45f, mg/L	WAD-6-0.2f, mg/L	Available CN, mg/L	Free (microdiffusion) CN, mg/L	[Fe(CN) ₆] ⁴⁻ analysis by IC, mg/L	[Cu(CN) ₃] ²⁻ analysis by IC, mg/L
MW 2	18.27	7.60	7.33	6.44	8.26	5.45	5.37	3.82
Grab 001	8.64	8.12	5.76	5.640	8.44	5.54	<0.10	3.87
MW 9008	19.93	9.33	8.61	8.00	8.30	5.67	<0.10	3.90

Note: All concentrations are average of triplicate analyses and reported as CN.

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9008 sample (0.052 vs. 0.019 mg/L). However, for the MW-2 sample and the Grab 001 sample, the "WAD-2-0.45f" method yielded WAD concentrations that were close to the available cyanide concentrations. Increasing the amount of zinc acetate to 6 mL and lowering the filter size to 0.2 μ m did not result in any further significant decrease in the WAD cyanide concentration.

Table 8c presents the result of the spiking study with a mixture comprised of 4 mg/L $[\text{Cu}(\text{CN})_3]^{2-}$ solution and 5 mg/L NaCN solution. As shown in this table, the "WAD-6-0.2f" method yielded WAD concentrations that were statistically similar to the available cyanide concentrations for the MW-9008 sample (8.0 vs. 8.3 mg/L), but both of these methods yielded WAD concentrations that were much less than that obtained using the "WAD-std" analytical method (9.3 mg/L) (ANOVA probability level = 0.005 and Duncan's Multiple-Comparison Test at $\alpha = 0.05$). For MW-2, where the $[\text{Fe}(\text{CN})_5\text{NHCH}_3]^{4-}$ complex became a minor component following spiking of the WAD complex and free cyanide, the "WAD-std" analytical method produced results closest to the available cyanide (7.6 vs. 8.26 mg/L). A similar result was also observed for the Grab-001 sample, where the bulk of the cyanide was due to the WAD complex and free cyanide in the sample spike.

DISCUSSIONS

WAD Cyanide analytical method refinement study

The results of the cyanide spiking study with reagent water shown in Fig. 3a and Table 1 both show the linear increase in the WAD cyanide concentration as determined by the "WAD-std" method with the increase in the ferri- and ferrocyanide spike levels. Theoretically, the WAD cyanide method should not detect any WAD cyanide in these spiked solutions, since iron-cyanide complexes are the only cyanide species in these samples. Note, although all distillations were performed under minimal light conditions, detection of minor amounts of free cyanide (<1%) from photodissociation of iron-cyanide complexes prior to precipitation could be expected based on some previous analysis due to minimal light intrusion. However, the linear increase in the WAD cyanide with the increase in spike level suggests that the iron-cyanide complexes can create interference in the "WAD-std" analytical method, especially at the lower spike levels. It should also be noted that WAD cyanide concentrations are generally higher when ferrocyanide was used as the spike compound, suggesting a difference in the response of the two iron-cyanide complexes to the WAD cyanide analytical method. Furthermore, the re-

sults of the increased zinc acetate addition, as shown in Table 1 and Fig. 3b, both suggest that the addition of more zinc acetate solution resulted in the precipitation of more iron-cyanide complexes from the solution. As before, a linear increase in the WAD cyanide concentration was observed with the increase in the spike concentrations up to 10 mg/L of total cyanide (Fig. 3b) and the ferrocyanide spikes produced higher WAD concentrations than were produced by the equivalent ferricyanide spikes. The results of filtration presented in Table 1 indicate the precipitate generated by the zinc acetate addition released cyanide during distillation of unfiltered samples. Also, this set of experiments further confirmed the observation that 2 mL of 100 g/L zinc acetate solution addition might be sufficient to precipitate ferri- and ferrocyanide complexes $[\text{Fe}(\text{CN})_6]^{3-/4-}$ from reagent water spiked solutions.


The WAD cyanide fraction data presented in Table 2 also suggests that environmental samples with low concentrations of iron-cyanide complexes (i.e., < 1 mg/L of $[\text{Fe}(\text{CN})_6]^{3-/4-}$ as total cyanide) would be more prone to false positive interferences when subjected to the original WAD cyanide analytical methodology.

Figure 3a-c show the slope and intercept values for the linear regressions. Note that the two principal requirements to optimize the WAD method using different trials with ferrocyanide and ferricyanide solutions are that the slope of the line for different concentrations should be close to zero to minimize any interference from iron-cyanide complexes, and that the intercept should be near zero. (This intercept is really not equal to zero, because of minor impurities in the reagent and the formation of minor amounts of free cyanide during the distillation step.) Based on these requirements, the "WAD-2-0.45f" method produces the best results for the samples dominated by ferro- and the ferricyanide complexes.

Finally, the results of the WAD method refinement study using MGP site groundwaters are presented in Tables 5 and 6. These sets of experiments suggest that $[\text{Fe}(\text{CN})_5\text{NHCH}_3]^{4-}$ has a different precipitation behavior than the ferricyanide and ferrocyanide complexes, particularly when precipitation is achieved using zinc acetate. Not only are higher amounts of zinc acetate needed to precipitate the $[\text{Fe}(\text{CN})_5\text{NHCH}_3]^{4-}$ but a smaller filter size is also required to remove the finer particles. Based on the refinement of the WAD cyanide analytical method using the MGP groundwater samples, the following conclusions were derived: (1) larger amounts of zinc acetate (6 mL instead of the 2 mL) are required to precipitate the $[\text{Fe}(\text{CN})_5\text{NHCH}_3]^{4-}$ complex; (2) the precipitate formed with the $[\text{Fe}(\text{CN})_5\text{NHCH}_3]^{4-}$ complex consists of finer particulates and requires a 0.2- μ m filter

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to remove it; (3) any groundwater with low concentrations of $[\text{Fe}(\text{CN})_5\text{NHCH}_3]^{4-}$ (e.g., MW-9009 with <2 mg/L of $[\text{Fe}(\text{CN})_5\text{NHCH}_3]^{4-}$) and any detectable concentration of $[\text{Fe}(\text{CN})_6]^{3-/4-}$ requires filtration by a $0.45\text{-}\mu\text{m}$ filter but no additional zinc acetate.

Application of refined WAD cyanide analytical method

Spiked reagent water. Table 7 presents the result of various cyanide analyses on reagent water samples spiked with ferrocyanide as well as a cocktail comprising of copper and sodium cyanide. The results from the ferrocyanide spike analyses confirm that "WAD-2-0.45F" yield the best WAD estimate for samples containing ferrocyanide complex. The "WAD-6-0.2F" method led to progressively lower recovery for the copper and sodium cyanide spiked cocktail. Furthermore, the results of this experiment supports the hypothesis that it is the incomplete precipitation of the iron-cyanide complexes (e.g., known $[\text{Fe}(\text{CN})_6]^{3-/4-}$ and/or $[\text{Fe}(\text{CN})_5\text{NHCH}_3]^{4-}$) that results in the overestimation of the WAD cyanide content in a sample if the original WAD cyanide analytical method is applied.

For samples spiked with weakly complexed and free cyanide (i.e., copper and sodium cyanide), the original WAD analytical method performed satisfactorily. Thus, it can be inferred from these data that it is only in presence of the iron-cyanide complexes ($[\text{Fe}(\text{CN})_6]^{3-/4-}$ and/or $[\text{Fe}(\text{CN})_5\text{NHCH}_3]^{4-}$) that the original WAD cyanide analytical method overestimates the amount of WAD cyanide in the sample.

Spiked field water samples. The baseline analysis of all the three groundwater samples presented in Table 8a indicate that the ferrocyanide complex is nonexistent in MW-9008 and Grab-001 samples. Table 8a also indicates that MW-9008 is dominated by a strong acid complex different from conventional ferrocyanide complex [i.e., 11.4 mg/L total cyanide using the APHA, 1996b, procedure and <0.10 mg/L of $[\text{Fe}(\text{CN})_6]^{3-/4-}$ by ion chromatography], while more than 50% of the total cyanide in the MW-2 sample is present as the $[\text{Fe}(\text{CN})_6]^{3-/4-}$ complex. As a perspective, a typical ion chromatogram of MW-9008 groundwater is shown in Fig. 4, where the only detectable peak is characterized to be of an iron-pentacyano complex, expressed as $[\text{Fe}(\text{CN})_5\text{NHCH}_3]^{4-}$ (Ghosh *et al.*, 2004; NGA, 2004). Note that it is also evident from this table that the "WAD-6-0.2F" method when applied to a sample dominated by the $[\text{Fe}(\text{CN})_5\text{NHCH}_3]^{4-}$ complex, yields WAD cyanide concentrations approximating the available cyanide concentrations (e.g., 0.061 vs. 0.022 mg/L for MW2).

The ferrocyanide spike studies presented in Table 8b show that for samples dominated by the ferrocyanide complex (MW-2 and Grab-001) following spiking, the "WAD-2-0.45F" is sufficient. For Grab 001, recovery of 0.86 mg/L of WAD cyanide from a field sample with 5 mg/L of spiked ferrocyanide and no previously detected cyanide further supports the hypothesis that the incomplete precipitation of $[\text{Fe}(\text{CN})_6]^{3-/4-}$ complexes result in the overestimation of the WAD cyanide content in a sample. However, for the MW-9008 sample, where the iron-pentacyano methylamino complex dominates the speciation even after spiking, the "WAD-6-0.2F" method

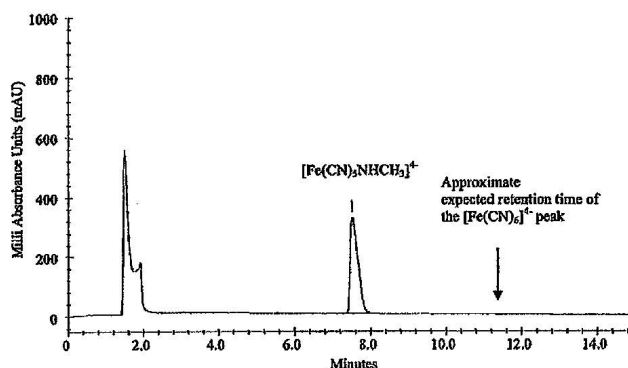
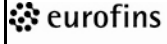


Figure 4. MW-9008 groundwater chromatogram.

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yielded WAD concentrations closest to the available cyanide concentrations for MW-9008 sample (0.052 vs. 0.019 mg/L).

The results of the groundwater spiking study with a cocktail mix of weak and free cyanide are presented in Table 8c. Of the three samples, only the MW-2 sample contained the $[\text{Fe}(\text{CN})_6]^{4-}$ complex; the other two samples reported nondetectable amounts of $[\text{Fe}(\text{CN})_6]^{4-}$. The $[\text{Fe}(\text{CN})_5\text{NHCH}_3]^{4-}$ complex dominated the cyanide speciation in the MW-9008 sample while less than 50% of the cyanide was present as the $[\text{Fe}(\text{CN})_5\text{NHCH}_3]^{4-}$ complex in MW-2. As expected, for samples MW-2 and Grab-001, where copper and sodium cyanide became the major components following spiking, the "WAD-std" method appeared to produce satisfactory results. On the contrary, for the MW-9008 sample, where $[\text{Fe}(\text{CN})_5\text{NHCH}_3]^{4-}$ was still the major component, the "Wad-6-0.2f" method was optimal.

For both the MW-2 sample and the Grab-001 sample, increasing the amount of zinc acetate resulted in a decrease in the WAD cyanide concentration, probably due to the precipitation of some of the weaker complexes. These results further confirm that the "WAD-std" analytical method is appropriate for samples dominated by weak cyanide complexes. However, for samples dominated by strong cyanide complexes, this method tends to overestimate the amount of WAD cyanide in the sample, especially, when low concentrations of iron-cyanide complexes (<1 mg/L) constitutes total cyanide. For such cases, addition of a filtration step prior to distillation and/or increasing the amount of zinc acetate followed by a filtration step yields a better estimation of the actual WAD cyanide concentration in the sample. Because of this inherent inconsistency of the current WAD method, it probably makes more sense to recommend the use of USEPA approved method OIA-1677 (U.S. EPA, 1999) for routine analysis of WAD cyanides in a sample instead of prescribing the different variations of the WAD cyanide analytical method. This is logical, since the available cyanide method OIA-1677 was used as a reference method in this study and apparently did not suffer from the interference issue cited in this study. In the absence of interference, the only significant difference in expected cyanide results would be from improved recovery of mercury cyanide species for available cyanide, and even this difference can be reduced by omitting the specific ligand exchange reagent for mercury cyanide complexes.

SUMMARY

In summary, the current WAD method requires modification before it could be applied for accurate characterization of water samples dominated by strong cyanide

complexes. Of particular relevance are the cyanide-impacted groundwaters and surface waters at former manufactured gas plant sites and aluminum production facilities. The results from the WAD method optimization study and the QA/QC data generated by reagent water and field water spike studies demonstrate that the current ASTM and APHA approved WAD cyanide method overestimates the WAD cyanide content of any sample when cyanide speciation is dominated by strong metal-cyanide complexes ($>50\%$ of the total cyanide content). In those cases, the WAD method modification includes addition of excess amounts of zinc acetate reagent (almost three times the current practice) and performing an intermediate filtration (0.45- or 0.2-micron filter) prior to carrying out the distillation step. The original WAD cyanide method as it currently stands, however, could be applied to any aqueous sample where weak metal-cyanide complexes and free cyanide dominate the cyanide speciation (i.e., WAD and free cyanide concentration $>50\%$ of the total cyanide content). Finally, because of this apparent inconsistency in the outcome of the original WAD procedure when applied to various cyanide matrices, it makes more sense to apply the reference analytical method, available cyanide by OIA-1677 (U.S. EPA, 1999), for routine analysis of WAD cyanide on field samples as it does not suffer from the interferences exhibited by the original WAD cyanide method.

ACKNOWLEDGMENTS


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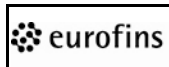
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Attachment 1 Continued

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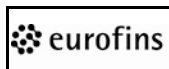
GHOSH ET AL.

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 Lancaster Laboratories Environmental	Document Title: Ammonia-Nitrogen for Waters (Titrimetric Distillation Procedure) by 4500-NH3 B/C (Modified)-1997, or EPA 350.2	Eurofins Document Reference: 1-P-QM-WI -9011636
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Eurofins Document Reference	1-P-QM-WI -9011636	Revision	12
Effective Date	Mar 23, 2015	Status	Effective
Historical/Local Document Number	Analysis 0221		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

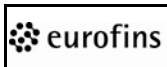
Prepared by	Michele Graham
Reviewed and Approved by	Erik Frederiksen;Review;Friday, March 6, 2015 9:50:19 AM EST Barbara Reedy;Approval;Monday, March 9, 2015 6:11:13 PM EDT

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Revision Log:

Revision: 12		Effective Date:	This version
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Throughout Document	Updated to current process	Updated temps from 4° ± 2°C to 0° to 6°C not frozen	
Reference 1.	Updated to current regulatory method	Added SM 22	
Cross Reference	Updated to current procedures	Added Analysis #12145, 12146, 12147, 12148, 12149, 12150, 12151, 12152, 12677, 12678, 12679 and 1-P-QM-QMA-9015389	
Calculation 2.	Clarification	Added refer to ManTech SOP for Calculation of analysis 2593	

Revision: 11		Effective Date:	Dec 27, 2012
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Throughout Document	Reflect re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers	
Title	New Requirement	Added methods and approval year for SM	
Reference 1	New Requirement	Added approval year of SM	
Personnel Training and Qualifications	Clarification	Reworded for clarification	
Reagents and Standards	Clarification	Reword for ease of use	

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Reference:

1. Standard Methods for the Examination of Water and Wastewater, 22nd Edition, 2012, Method 4500-NH3 B/C Modified -1997.
2. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 4500-NH3 B/C Modified -1997.
3. Method 350.2, Method for Chemical Analysis of Water and Wastes USEPA 600.
4. *Chemical Hygiene Plan*, current version.

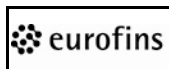
Cross Reference:

Document	Document Title
Analysis #12145, 12146, 12147, 12148, 12149, 12150, 12151, 12152, 12677, 12678, 12679	Analysis of Conductivity, Alkalinity, pH, Temperature of pH, Fluoride, Turbidity, Total Hardness, Carbonate, Bicarbonate, and Ammonia by Either Man-Tech Multi-Parameter System or Manual Technique
1-P-QM-PRO-9015530	Standardization of 0.02 and 0.1 Normal Sulfuric Acid
1-P-QM-PRO-9015535	Quality Control Data for Wet Chemistry
1-P-QM-QMA-9015389	Balance, Syringe, Pipette Verification
1-P-QM-QMA-9017309	Determining Method Detection Limits and Limits of Quantitation
1-P-QM-QMA-9017313	Establishing Control Limits
1-P-QM-QMA-9017328	Reagents and Standards

Scope:

The following method covers the determination of ammonia-nitrogen in drinking, surface, and saline waters, and domestic and industrial wastes. Samples from the states of New Hampshire, Wisconsin, and North Carolina must utilize this distillation method for the determination of ammonia nitrogen. The holding time for this analysis is 28 days. Samples are to be preserved in sulfuric acid. Refer to the LIMS for the current MDL and LOQ.

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Basic Principles:

The sample is buffered at a pH >9.5 with a borate buffer and is then distilled into a solution of boric acid. The ammonia in the distillate is determined titrimetrically with standard sulfuric acid with the use of a mixed indicator.

Reference Modification:

Samples are buffered at a pH of >9.5. and checked with pH range paper.

EPA 350.2 suggest that 300 mL of distillate be collected whereas standard method stipulates at least 200 mL.

Interferences:

Some sample matrices will cause interferences and would therefore need diluted prior to the distillation procedure. Residual chlorine must be removed by pretreatment of the sample with sodium thiosulfate, sodium sulfite, or ascorbic acid before distillation.

Safety Precautions and Waste Handling:

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

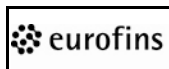
See *Chemical Hygiene Plan* for general information regarding employee safety, waste management and pollution prevention.

Always use caution when handling any chemicals, solvents, or reagents. Avoid inhalation and skin contact. Standard safe laboratory procedure must be followed.

Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of the SOP and a documented Demonstration of Capability.

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Analysts are considered proficient when they have successfully completed a Demonstration of Capability. Demonstration of Capability consists of four check samples that are carried through all steps of the analysis and meet the defined acceptance criteria.

Demonstration of Capability is performed annually and is maintained in the analyst's training records.

Sample Collection, Preservation, and Handling:

Sample is collected in a glass or plastic container preserved with concentrated sulfuric acid to a pH <2. Sample support removes any chlorine present in the sample, and checks the sample to ensure its preservation. Sample is stored at 0° - 6°C, not frozen.

Apparatus and Equipment:

Alternative weights and volumes may be used as long as the final concentrations remain the same.

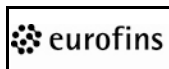
1. Analytical balance capable of weighing to 0.0001 g
2. An all-glass distillation apparatus with an 800-mL Kjeldahl flask
3. pH indicator strips
4. Microburets with reservoir

Reagents and Standards:

See 1-P-QM-QMA-9017328 for appropriate labeling and documentation of reagents and standards preparation.

1. Antifoam B, purchased; see label for expiration date. Store at room temperature.

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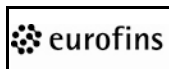
2. Sodium sulfite, Na_2SO_3 , purchased; see label for expiration date. Store at room temperature.

3. Borate buffer solution
 - a. In a 2-L glass volumetric flask containing approximately 1000 mL reagent water, dissolve 5.0 ± 0.1 g of $\text{Na}_2\text{B}_4\text{O}_7$ or 19.0 ± 0.1 g $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10 \text{H}_2\text{O}$.
 - b. Add 176.0 ± 1.0 mL of 0.1 N NaOH to the solution and dilute to 2 L with reagent water.
 - c. Store the solution at room temperature in a glass container.
 - d. Solution is stable for 6 months.

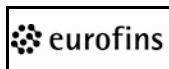
4. Mixed indicator solution
 - a. In a 250-mL glass beaker, dissolve 0.100 ± 0.005 g methyl red in 50.0 ± 0.5 mL of 95% ethanol.
 - b. In another 250-mL glass beaker, dissolve 0.050 ± 0.005 g methylene blue in 25.0 ± 0.5 mL of 95% ethanol.
 - c. Combine the two solutions into one container.
 - d. Store the solution at room temperature in a dark (amber) glass container.
 - e. Solution is stable for 30 days.

5. Boric acid solution
 - a. In a 2-L glass volumetric flask containing approximately 1000 mL reagent water, dissolve 40.0 ± 0.5 g boric acid (H_3BO_3).

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- b. Add 20.0 ± 0.5 mL of mixed indicator solution and dilute to 2 L.
 - c. Store solution at room temperature in a dark (amber) glass container.
 - d. Solution is stable for 30 days.
6. Standardized sulfuric acid, 0.1 N
 - a. Add 6 mL of concentrated sulfuric acid (H₂SO₄) to approximately 1900 mL of reagent water in a 2-L volumetric flask.
 - b. Dilute to volume with reagent water.
 - c. Standardize as per 1-P-QM-PRO-9015530, every 30 days.
 - d. Store at room temperature in a plastic container.
 - e. Solution is stable for one year.
7. Standardized sulfuric acid, 0.02 N
 - a. Add 200 mL of 0.1 N H₂SO₄ to approximately 500 mL of reagent water in a 1-L volumetric flask.
 - b. Dilute to volume with reagent water.
 - c. Standardize as per 1-P-QM-PRO-9015530 every 30 days.
 - d. Store at room temperature in a plastic container.
 - e. Solution is stable for one year.

 Lancaster Laboratories Environmental	Document Title: Ammonia-Nitrogen for Waters (Titrimetric Distillation Procedure) by 4500-NH ₃ B/C (Modified)-1997, or EPA 350.2	Eurofins Document Reference: 1-P-QM-WI -9011636
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8. Ammonia-nitrogen standard, 500 mg/L NH₃-N –

- a. In a 1-L volumetric flask, containing approximately 500 mL reagent water, dissolve 1.9095 ± 0.0002 g NH₄Cl (which has been dried at $105^{\circ} \pm 2^{\circ}\text{C}$ for approximately 2 hours).
- b. Dilute to 1 L using reagent water.
- c. Preserve the solution with concentrated sulfuric acid to a pH <2.
- d. Store the standard at $0^{\circ} - 6^{\circ}\text{C}$, not frozen, in a plastic or glass container.
- e. Solution is stable for 6 months.

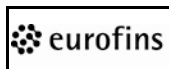
9. Sodium hydroxide, 5N

- a. In a 1-L volumetric flask containing approximately 800 mL reagent water, dissolve $200 \text{ g} \pm 0.5 \text{ g}$ NaOH Pellets.
- b. Cool and dilute to 1 L with reagent water.
- c. Store at room temperature in a plastic or glass container.
- d. Solution is stable for one year.

10. Sodium Hydroxide, 0.1 N NaOH

- a. In a 1-L glass volumetric flask, dissolve $4.0 \text{ g} \pm 0.1 \text{ g}$ of NaOH in approximately 500 mL reagent water.
- b. Bring to final volume of 1 L using reagent water once the NaOH has dissolved.

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- c. Store at room temperature in a plastic or glass container.
- d. Solution is stable for one year.

Calibration:

Balances must be calibrated daily per SOP 1-P-QM-QMA-9015389.

A Blank is prepared by measuring 500 mL of reagent water using a graduated cylinder and then following steps 4 – 9 under the procedure section listed in this method.

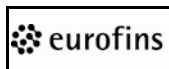
A 10 mg/L LCS is prepared by pipetting 10 mL of 500 mg/L into 490 mL of reagent water. The LCS is then carried through steps 3 – 8 listed under the procedure section in this method.

Procedure:

1. Rinse tubes with dilute HCl.
2. Add approximately 500 mL of reagent water to an 800-mL Kjeldahl flask and steam clean the distillation apparatus. Collect at least 100 mL.
3. Using a graduated cylinder, measure 500 mL of sample or an aliquot diluted to 500 mL with reagent water.
4. Adjust the pH of the blank, standard, or sample to >9.5 with 5 N NaOH. Add 25.0 ± 1 mL of borate buffer solution.
5. Transfer the solution to an 800-mL Kjeldahl flask; add a pinch of boiling chips and approximately 5 mL of Antifoam B to the blank, standard, or sample.

NOTE: Antifoam B may be diluted using reagent water on a 1:1 ratio.

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6. Distill the solution into a 600-mL beaker containing 50 mL of boric acid solution. Make sure the delivery tube is below the level of the boric acid solution (receiving solution).
7. Collect at least 220 mL of distillate and dilute with reagent water to 500 mL.
8. Titrate the distillate with standardized 0.1 N H₂SO₄ or 0.02 N H₂SO₄ to a purple endpoint. Sometimes this endpoint is very weak. Add H₂SO₄ until no further color change is observed. If more than 50 mL of titrant is used, repeat distillation with less sample. If less than 1.0 mL of the 0.1N H₂SO₄ is used in the titration process, repeat the distillation and use the 0.02N H₂SO₄ titrant.
9. If more samples are to be distilled, any tube that had a sample greater than the detection limit must be steam cleaned (See Step 1).

Calculations:

1.
$$mg / l NH_3 - N = N H_2 SO_4 \times \frac{14}{mL sample} \times mL titrant \times 1000$$
2. Refer to Analysis #12145, 12146, 12147, 12148, 12149, 12150, 12151, 12152, 12677, 12678, 12679 for calculation of Un-ionized Ammonia Analysis #2593

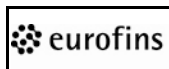
Statistical Information/Method Performance:

For statistical information refer to Method 350.2, Method for Chemical Analysis of Water and Wastes USEPA 600.

The method detection limit (MDL) is determined annually by following the procedure outlined in 1-P-QM-QMA-9017309.

The quality control acceptance windows are generated annually by following the procedure outlined in 1-P-QM-QMA-9017313.

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Quality Assurance/Quality Control:

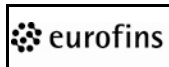
For each batch of 20 samples analyzed each day, a blank, LCS (10 mg/L), matrix spike, matrix spike duplicate, and a matrix duplicate must be also be analyzed.

Two duplicates must be analyzed when a batch contains samples from the state of South Carolina and contains 10 or more samples.

If there is not enough sample to analyze both a matrix spike and a matrix spike duplicate, then a LCSD (10 mg/L) must be analyzed.

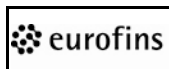
See LIMS for current quality control acceptance windows. Refer to 1-P-QM-PRO-9015535 if any of the QC samples do not meet required specifications.

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 Lancaster Laboratories Environmental	Document Title: Nitrate Nitrogen in Water and Wastewater (Colorimetric, Automated Cadmium Reduction)	Eurofins Document Reference: 1-P-QM-WI -9011635
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Eurofins Document Reference	1-P-QM-WI -9011635	Revision	13
Effective Date	May 26, 2015	Status	Effective
Historical/Local Document Number	Analysis 0220, 7882, 5992		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

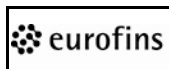
Prepared by	Nicole Veety
Reviewed and Approved by	Erik Frederiksen;Review;Wednesday, May 20, 2015 2:48:39 PM EDT Barbara Reedy;Approval;Thursday, May 21, 2015 3:15:15 PM EDT

 Lancaster Laboratories Environmental	Document Title: Nitrate Nitrogen in Water and Wastewater (Colorimetric, Automated Cadmium Reduction)	Eurofins Document Reference: 1-P-QM-WI -9011635
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Revision Log:

Revision: 13		Effective Date:	This version
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Scope	Method update	Clarified MCL limit of 10.0.	
Reagents and Standards A.7.	Method update	Clarification for requirement of LCS value versus MCL value.	

Revision: 12		Effective Date:	Dec 20, 2013
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Throughout Document	Reflect re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers	
	Method Update	Updated temperature to 0°to 6°C not frozen.	
Reagents and Standards A. and B.	Method Update	Added the preparation of the LCSW.	
Quality Control Standards	Method Update	Added the preparation of the LCSW.	
Table IV	Clarification	Changed the REDNO2 to the required REDNO3.	

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Reference:

1. Method 353.2, Methods for Chemical Analysis of Water and Wastes USEPA 600, Revision 2.0, 1993
2. Method 4500-NO₃-F, *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, 1998.
3. *Nitrate + Nitrite*, Astoria-Pacific International, A173, Rev. F, 9/2004.
4. Nitrate plus Nitrite Nitrogen and Nitrite Nitrogen, USEPA by FIA, OI Analytical, 2012.
5. *Chemical Hygiene Plan*, current version.

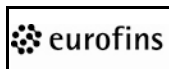
Cross Reference:

Document	Document Title
Analysis #0219, 5991	Nitrite Nitrogen in Water and Wastewater (Colorimetric, Automated)
1-P-QM-PRO-9015459	Quality Control for Auto-Analyzer Analyses Performed in Instrumental Water Quality
1-P-QM-QMA-9017309	Determining Method Detection Limits and Limits of Quantitation
1-P-QM-QMA-9017313	Establishing Control Limits
1-P-QM-QMA-9017328	Reagents and Standards

Scope:

This method pertains to the determination of nitrate nitrogen (NO₃-N) in surface and saline waters and domestic and industrial wastes. The limit of quantitation can be found in the analysis information file. For EW samples, a value of 10.00 or greater is an MCL violation and must be reported to the client within 1 hour of analysis. This must also be reported to the DEP within 24 hours of analysis. Use analysis #7882 when reporting a total nitrite/nitrate nitrogen value, and analysis #5992 for soils.

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 <div>Lancaster Laboratories Environmental</div>	Document Title: Nitrate Nitrogen in Water and Wastewater (Colorimetric, Automated Cadmium Reduction)	Eurofins Document Reference: 1-P-QM-WI -9011635
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Basic Principles:

A sample is passed through a coil, containing granulated copper-plated cadmium, to reduce nitrate to nitrite. The nitrite, that was originally present plus the now reduced nitrate, is determined spectrophotometrically by diazotization with sulfanilamide to yield a compound which couples with N-(1-naphthyl)-ethylenediamine dihydrochloride to form a soluble, highly-colored dye. This is measured colorimetrically at 540 nm. Nitrite must be determined by the nitrite method first. Nitrate is then calculated as the difference between the nitrate/nitrite and nitrite results.

Reference Modifications:

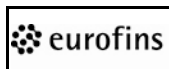
This method utilizes the parameters outlined in the autoanalyzer manufacturer's instruction manual for reagent and sample ratios and wavelength (540 nm is used instead of 520 nm). The concentration of the hydrochloric acid used to condition the cadmium column is 0.5N instead of 6N. The ammonium chloride buffer is adjusted to a pH of 8.5 instead of 9.1. These modifications are performance based and meet all requirements expressed in Method 353.2, Section 9.0, Quality Control.

Interferences:

Interferences include sample turbidity, sample color that absorbs in the 540 nm range, and high concentration of metal ions. High concentrations of chlorine or such reducing substances as sulfite or sulfide will adversely affect the cadmium coil operation. Turbid samples must be filtered prior to analysis. Some ions will form colored complexes in the 540 nm range giving high results, while others will lower the reduction efficiency of the coil giving low results. EDTA is added to the ammonium chloride reagent to eliminate this interference.

The correction of samples for color will be discussed in the procedure section of this method.

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If not already done during the nitrite procedure, samples must be checked for residual chlorine, which will oxidize the cadmium in the coil. This is done by adding 1 drop of ortho-tolidine to approximately 1.0 mL of sample. If the sample turns yellow, add a few drops of 0.2 N sodium thiosulfate to the sample vial to correct for this problem. Also, if not already done during the nitrite procedure, the pH of the samples must be checked using pH paper. If the pH is not between 5 and 9, adjust with concentrated H₂SO₄ or concentrated NH₄OH. Document the pH adjustment on the channel report.

Safety Precautions and Waste Handling:

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

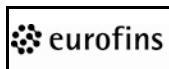
Follow routine laboratory safety steps. Discard or send for repair any glassware that is chipped, flawed, or broken. Discard any acid waste in acid waste containers.

Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability (DOC).

Analysts are considered proficient when they have successfully completed DOC for the analysis. A DOC consists of four laboratory control samples that are carried through all steps of the analysis and that meet the acceptance criteria for the LCS. Documentation for these studies is in each individual's training records.

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Sample Collection, Preservation, and Handling:

Samples are collected in either glass or plastic containers. The samples must be stored at 0°to 6°C not frozen. The analysis is to be performed within 48 hours of the collection time unless the sample is preserved with sulfuric acid (2 mL concentrated H₂SO₄). If the sample is preserved, the holding time is 28 days from the time of sample collection. Samples are treated for chlorine at the time of nitrite analysis (see analysis 0219), or upon receipt at the laboratory.

Apparatus and Equipment:

An automated flow analyzer is required for this method. The flow analyzer consists of the following parts:

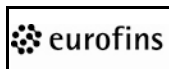
A. Alpken Instrumentation

1. An automated flow analyzer is required for this method. The flow analyzer consists of the following parts: Astoria – Pacific automatic sampler (Model 301A) or equivalent
2. Alpkem proportioning pump (Model 502) or equivalent
3. Pump tubes and pump tube harnesses
4. Astoria-Pacific Model 315 detector with 10-mm flowcell, or equivalent
5. Astoria-Pacific Nitrate + Nitrite Cartridge
6. PC with Astoria-Pacific FASPAC software or equivalent

B OI Instrumentation

A flow injection analyzer is required for this method. The flow analyzer consists of the following parts:

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1. OI automatic sampler (Model 3090) or equivalent
2. OI multichannel dispenser (Model ISM938E) or equivalent
3. OI Nitrate/Nitrite cartridge and pump tubing (Part # 323657)
4. OI UV detector (Model FS3100)
5. PC with OI Analytical WinFlow TM software

Reagents and Standards:

NOTE: All chemicals used must be ACS reagent grade unless otherwise noted.

See 1-P-QM-QMA-9017328, for the appropriate labeling and documentation of reagent and standard preparation.

Different volumes or weights may be used in the preparation of reagents or standards, as long as the ratios remain equivalent.

A. Alpken Instrumentation

1. Color reagent

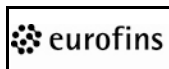
Sulfanilamide ($C_6H_8N_2O_2S$) 20.0 ± 0.1 g

Concentrated phosphoric acid (H_3PO_4) 50 mL

N-1-naphthylethylenediamine dihydrochloride ($C_{12}H_{14}N_2 \cdot 2HCl$) 1.0 ± 0.01 g

- a. Add 50 mL of concentrated phosphoric acid and 20 ± 0.1 g of sulfanilamide to approximately 400 mL of reagent water in a 500-mL volumetric flask and dissolve completely (heat if necessary).
- b. Add 1.0 ± 0.01 g of N-(1-naphthyl)-ethylenediamine dihydrochloride and dissolve.

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- c. Dilute to 500 mL with reagent water.
- d. Store in an amber bottle and keep in the dark at room temperature when not in use.
- e. Stable for 60 days.

2. Ammonium chloride reagent

Ammonium chloride (NH ₄ Cl)	170.0 ± 2.0 g
Disodium ethylenediamine tetracetate (EDTA)	0.2 ± 0.02 g
Brij-35, 30% solution	.05 mL
Concentrated ammonium hydroxide (NH ₄ OH)	

- a. Dissolve 170.0 ± 2.0 g of ammonium chloride and 0.2 ± 0.02 g of EDTA in approximately 1800 mL of reagent water in a 2000-mL volumetric flask and dilute to volume with reagent water.
- b. Adjust the pH to 8.5 with concentrated ammonium hydroxide (NH₄OH). Add .05 mL of Brij-35, 30% solution.
- c. This reagent is stable for 6 months at 0° to 6°C not frozen when not in use.

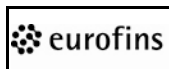
NOTE: The amount of Brij solution to add is an estimated amount and may be adjusted for optimum performance.

3. 0.5 N hydrochloric acid

Hydrochloric acid (HCl)	41.5 mL
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- a. Carefully add 41.5 mL of concentrated hydrochloric acid to approximately 900 mL of reagent water in a 1000-mL volumetric flask.

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- b. Dilute to 1000 mL with reagent water.
- c. This solution is used to clean the cadmium in the coil during the activation procedure.
- d. Stable for 6 months at room temperature.

4. Copper sulfate solution, 2%

Copper sulfate ($\text{CuSO}_4 \times 5\text{H}_2\text{O}$) 20 g \pm 0.5 g

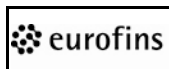
- a. Dissolve 20 \pm 0.5 g of copper sulfate in approximately 500 mL of reagent water.
- b. Dilute to 1 L.
- c. Store in a glass bottle at room temperature.
- d. This solution is stable for 6 months.

5. Stock solution for calibration, 100 mg/L $\text{NO}_3\text{-N}$

Potassium nitrate (KNO_3) 0.7218 \pm 0.0003 g
(Dried at approximately 105°C for 2 hours)

Chloroform (CHCl_3) 2 mL

- a. Dissolve 0.7218 \pm .0003 g of potassium nitrate in reagent water and dilute to 1 L.
- b. Add 2 mL of chloroform as a preservative.
- c. Store in a dark bottle at 0° to 6°C not frozen.
- d. This solution is stable for 6 months.

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6. Stock solution for quality control, 100 mg/L NO₃-N: Same procedure as for stock solution for calibration using potassium nitrate from a different source.
7. Purchased Nitrate Standard. See certificate of analysis for true value. Prepare per instructions provided. Store at 0°to 6°C not frozen. See vendor instructions for expiration date.

NOTE: An LCS can also be prepared using the 100 mg/L NO₃-N QC Stock standard by diluting 1.25 ml of the 100 mg/L NO₃-N Stock standard to 50 ml of reagent water. The LCS true value for the prepared standard must be below the MCL value of 10.0.

8. 0.2 N sodium thiosulfate, purchased. See label for expiration date. Store at room temperature.

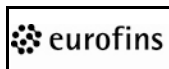
B. OI Instrumentation

1. Color reagent

Sulfanilamide (C ₆ H ₈ N ₂ O ₂ S)	5.0 ± 0.025 g
Concentrated phosphoric acid (H ₃ PO ₄)	50 mL
N-1-naphthylethylenediamine dihydrochloride (C ₁₂ H ₁₄ N ₂ •2HCl)	0.5 ± 0.005 g

- a. Add 50 mL of concentrated phosphoric acid and 5.0 ± 0.025 g of sulfanilamide to approximately 400 mL of reagent water in a 500-mL volumetric flask and dissolve completely (heat if necessary).
- b. Add 0.5 ± 0.005 g of N-1-naphthylethylenediamine dihydrochloride and dissolve.
- c. Dilute to 500 mL with reagent water.
- d. Store in an amber bottle and keep in the dark at room temperature when not in use.

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e. Stable for 2 months.

2. Ammonium chloride reagent

Ammonium chloride (NH_4Cl) 170.0 \pm 2.0 g

Disodium ethylenediamine tetracetate (EDTA) 0.2 \pm 0.02 g

Brij-35, 30% solution .05 mL

Concentrated ammonium hydroxide (NH_4OH)

a. Dissolve 170.0 \pm 2.0 g of ammonium chloride and 0.2 \pm 0.02 g of EDTA in approximately 1800 mL of reagent water in a 2000-mL volumetric flask and dilute to volume with reagent water.

b. Adjust the pH to 8.5 with concentrated ammonium hydroxide (NH_4OH).

c. Add .05 mL of Brij-35, 30% solution.

d. Store at 0°to 6°C not frozen.

e. Stable for 6 months

NOTE: The amount of Brij solution to add is an estimated amount and may be adjusted for optimum performance.

3. Stock solution for calibration, 100 mg/L $\text{NO}_3\text{-N}$

Potassium nitrate (KNO_3) 0.7218 \pm 0.0003 g

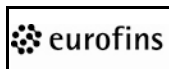
(Dried at approximately 105°C for 2 hours)

Chloroform (CHCl_3) 2 mL

a. Dissolve 0.7218 \pm .0003 g of potassium nitrate in reagent water and dilute to 1 L.

b. Add 2 mL of chloroform as a preservative.

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- c. Store in a dark bottle at 0°to 6°C not frozen.
 - e. This solution is stable for 6 months.
4. Stock solution for quality control, 100 mg/L NO₃-N: Same procedure as for stock solution for calibration using potassium nitrate from a different source.
 5. Purchased Nitrate Standard. See certificate of analysis for true value. Prepare per instructions provided. Store at 0°to 6°C not frozen. See vendor instructions for expiration date.

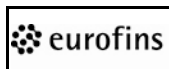
NOTE: An LCS can also be prepared using the 100 mg/L NO₃-N QC Stock standard by diluting 1.25 ml of the 100 mg/L NO₃-N Stock standard to 50 ml of reagent water.

6. 0.2 N sodium thiosulfate, purchased. See label for expiration date. Store at room temperature.

Calibration:

1. Working Standard A, 20 mg/L – Pipette 20 mL of the stock calibration standard into a 100-mL volumetric flask and dilute to volume (prepare every 48 hours as necessary, store at 0°to 6°C not frozen).
2. Using the Working Standard A, prepare the following calibration standards in 100-mL volumetric flasks (prepare every 48 hours as necessary, store at 0°to 6°C not frozen).

<u>mL Working Standard A Solution</u>	4.0	<u>mg/L NO₃-N</u>
20.0		
15.0		3.0
5.0		1.0
2.5		0.5
1.0		0.2
0.5		0.1

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Quality Control Standards:

1. Working Standard B, 20 mg/L – Pipette 20 mL of the stock quality control standard into a 100-mL volumetric flask and dilute to volume (prepare every 48 hours as necessary, store at 0°to 6°C not frozen).
2. Using the Working Standard B, prepare the following calibration standards in 100-mL volumetric flasks (prepare every 48 hours as necessary, store at 0°to 6°C not frozen).

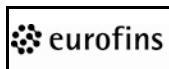
<u>Standard</u> ICV,CCV2	<u>mL Working Standard B Solution</u> 12.5	<u>mg/L NO₃-N</u> 2.5
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3. Nitrite standard, 2.0 mg/L – Pipette 2.0 mL of the stock NO₂ quality control standard into a 100-mL volumetric flask and dilute to volume (see the method for analysis 0219 for the preparation instructions of the stock NO₂ quality control standard). This standard is used as the 2.0 NO₂ reduction efficiency standard (prepare every 48 hours as necessary, store at 0°to 6°C not frozen).
4. Nitrate standard, 2.0 mg/L – Pipette 2.0 mL of the stock NO₃ quality control standard into a 100-mL volumetric flask and dilute to volume. This standard is used as the 2.0 NO₃ reduction efficiency standard (prepare every 48 hours as necessary, store at 0°to 6°C not frozen).
5. Laboratory Control Standard (LCS) – Pipette 1.25 mL of the stock NO₃ quality control standard into a 50-mL volumetric flask and dilute to volume (prepare every 48 hours as necessary, store at 0°to 6°C not frozen).

Open Tubular Cadmium Reactor Coil Activation:

The cadmium reduction coil is a purchased 24" long coil containing granulated copper-plated cadmium, which serves to reduce nitrate to nitrite. The column is activated as follows:

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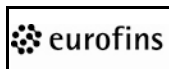
1. Unscrew one ¼-28" nut from the union.
2. Flush the coil, using the following solutions in the following order with the aid of a 50-cc plastic syringe, being sure not to let any air into the coil during the process:
 - a. Reagent water
 - b. 0.5 N hydrochloric acid – Perform this flush quickly with only approximately 25 mL of acid and immediately go to step c.
 - c. Reagent water
 - d. 2% copper sulfate – Perform this flush slowly with approximately two 50-mL aliquots of copper sulfate. Precipitated copper must be seen leaving the coil.
 - e. Reagent water – Wash coil thoroughly at this time to ensure that all the precipitated copper is removed from the coil.
 - f. Ammonium chloride/EDTA buffer – Flush the reagent water from the coil with the buffer and store, making sure no air is trapped in the coil.

Procedure:

A. Alphen Instrumentation

1. Configure the flow analyzer with the nitrate/nitrite cartridge and pump tubes according to Figure 1. However, do not install the open tubular cadmium reactor coil at this time.
2. Using Table I as a guide, set up the pump, the detector, the sampler, and data system (this is the same as the nitrite nitrogen procedure).

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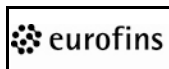
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NOTE: The pump speed and/or range may be adjusted to compensate for any changes in the system.

3. Place all of the sample and reagent lines in reagent water. Turn ON the pump and adjust the tension on the pump tube harnesses to obtain a flow through each tube.
4. Wash the system with reagent water for at least 5 minutes.
5. Place all reagents on-line and pump at least 5 minutes. Insert the open tubular cadmium reactor coil and pump for another 5 minutes. If the coil is being used for the first time, run one of the higher range standards through the system for 10 minutes to condition the coil. Subsequently, wash the coil for 10 minutes with the reagents.
6. Load the nitrate nitrogen template. This template is shown in Table II and lists the order in which the calibration standards, blanks, and quality control standards must be analyzed to calibrate and verify that the analytical system is in control. Sample names can be added to this list and analyzed after Position 18, if calibration and QC criteria have been met. Save the nitrate nitrogen template using the following numbering system:

e.g., 03 090 NA
 ↓ ↓
 Year Julian day

7. Filter any sample that has a high amount of suspended matter. Whenever samples must be filtered, the PBW and LCSW for that batch must also be filtered.
8. Load the sample tray with calibrants, blanks, samples, and QC samples in the order in which they were entered into the template.

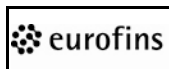
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9. Start the autosampler and begin acquiring data. The data system will recognize the “Sync” peak and activate data collection. A standard with a concentration $> \frac{1}{2}$ the highest calibration standard is used in the Sync position. Once the calibration standards have been run, check the linearity of the calibration. The coefficient must be > 0.995 for the curve to be acceptable. Also, calculate the reduction efficiency of the coil $[(2.0 \text{ mg/L NO}_3\text{-N result} / 2.0 \text{ mg/L NO}_2\text{-N result}) \times 100]$. The reduction efficiency must be 85% to 115% for all samples.

The calculated values of both standards must also fall within the statistically derived range of 1.73 mg/L to 2.22 mg/L. If this criteria is not met, recondition the coil being used or attach a new coil, condition it, and repeat the above steps.

10. Once the calibration and reduction efficiency is acceptable, continue to run samples with the appropriate laboratory control standard (LCS) and preparation blank (PB). Analyze a calibration verification standard (CCV) and calibration blank (W) between every ten injections.
11. If the sample is colored, this color may add to the color change reaction and give a high result. To correct for this, run the sample as described above, and then run the sample a second time at the end of the run with the color reagent line in reagent water. Subtract the second value from the first to correct for sample color.
12. Any sample that falls above the highest standard of the full-scale calibration must be diluted with reagent water and reanalyzed. The raw result of the diluted sample must have a value of at least 10% of the highest calibration standard.
13. Shutdown process – End the run with a calibration verification standard, calibration blank, and a reduction efficiency check. Turn OFF the autosampler. Remove the coil and reconnect the union between the two ports. Flush the coil with 10 cc of NH_4Cl reagent and store making sure no air is trapped in the coil. Place all lines in reagent water and pump for at least 15 minutes. Turn OFF the system.

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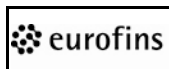
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B. OI Instrumentation

1. Configure the Instrument with the nitrate/nitrite cartridge and pump tubes according to Figure 2.
2. Using Table II as a guide for the Model FS3100 detector set up the pump, the detector, the sampler, and data system.
3. Place the sample and color reagent line in reagent water and the buffer line in the Brij-35 wash solution. Turn ON the pump and adjust the tension on the pump tube harnesses to obtain a flow through each tube. Wash the system with reagent for at least 10 minutes.
4. Place all reagents on-line and pump at least 10 minutes. Insert the open tubular cadmium reactor coil and pump for another 5 minutes. If the coil is being used for the first time, run one of the higher range standards through the system for 10 minutes to condition the coil. Subsequently, wash the coil for 10 minutes with the reagents.
5. Open the WinFlow™ software. In the sample table section load the nitrate nitrogen table. Table IV shows the order in which the calibration standards, blanks, and quality control standards must be analyzed to calibrate and verify that the analytical system is in control. Add all samples and QC to the table, save and exit.
6. Enter the Collect Data section and select the NO3 table and method. Save the file using a two digit year followed by the Julian day and the NO3 designation.

e.g., 03 090 NO3
 ↑ ↑
 Year Julian day

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7. Click the run button and allow for the system to stabilize the baseline. Once a stable baseline is observed click the stop button, wait for the sample probe to reset and click the rewind button. Once again click the run button until a baseline is observed and then click the forward button to begin collecting data.

8. Filter any sample that has a high amount of suspended matter.

NOTE: Any sample that must be filtered also needs a PBW and LCSW filtered for that batch.

9. Start the auto sampler and begin acquiring data. The data system will recognize the “Sync” peak and activate data collection. A standard with a concentration $> \frac{1}{2}$ the highest calibration standard is used in the Sync position.

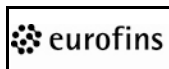
10. Once the calibration standards have been analyzed, check the linearity of the calibration. The coefficient must be > 0.995 for the curve to be acceptable.

11. Once the calibration is acceptable, continue to analyze samples with the appropriate laboratory control standard (LCS) and preparation blank (PB). Analyze a calibration verification standard (CCV) and calibration blank (W) between every **ten** injections.

12. If the sample is colored, this color may add to the color change reaction and give a high result. To correct for this, run the sample as described above, and then run the sample a second time at the end of the run with the color reagent line in reagent water. Subtract the second value from the first to correct for sample color. Alternately, the sample may be diluted to eliminate color, and the reporting limit adjusted accordingly.

13. Any sample that falls above the highest standard of the full-scale calibration must be diluted with reagent water and reanalyzed. The raw result of the diluted sample must have a value of at least 10% of the highest calibration standard.

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14. Shutdown process – End the run with a calibration verification standard, calibration blank, and a reduction efficiency check. Turn OFF the autosampler. Remove the coil and reconnect the union between the two ports. Flush the coil with 10 cc of NH₄Cl reagent and store making sure no air is trapped in the coil. Place all lines in reagent water and pump for at least 15 minutes. Turn OFF the system.

Calculations:

The data system automatically prepares a standard curve (first order-linear) by plotting peak heights of standards against their concentrations. The concentration of nitrate nitrogen in the samples is calculated by comparing the peak height to the standard curve. Apply any dilution factors used against the raw result and subtract the predetermined nitrite nitrogen result to get the final nitrate nitrogen result as seen in the following equation (calculated automatically by the software and the LIMS system).

$$mg/L \text{ NO}_3 - N = [(Conc. \text{ from curve}) \times (DF)] - [NO_2 - N \text{ result (mg/L)}]$$

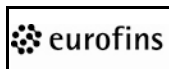
Statistical Information/Method Performance:

1. The method detection limit (MDL) must be determined every 6 months by following the procedure outlined in 1-P-QM-QMA-9017309.
2. The quality control acceptance windows are generated annually by following the procedure outlined in 1-P-QM-QMA-9017313.

Quality Assurance/Quality Control:

1. A calibration curve of six standards ranging from 0.10 to 4.0 mg/L nitrate nitrogen and a blank will be run at the beginning of every run. The correlation coefficient of the curve must be >0.995. If this is not met, the calibration is unacceptable and must be rerun. The blank intercept for the curve (or W) cannot be greater than the method detection limit (MDL) or less than the negative of the LOQ.

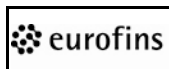
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2. The reduction efficiency of the cadmium coil must be determined by analyzing and comparing a 2.0 mg/L NO₂-N and a 2.0 mg/L NO₃-N standard $[(2.0 \text{ mg/L NO}_3\text{-N result} / 2.0 \text{ mg/L NO}_2\text{-N result}) \times 100]$. The reduction efficiency must be between 85% and 115% for all samples. The calculated values of each standard must fall within the statistically derived range of 87% to 111% of the true value (1.73 mg/L to 2.22 mg/L). A reduction efficiency is run at the beginning of the run immediately following the 6-point calibration curve, directly before the ICV and calibration blank (W), and also at the very end of the run (after the final CCV and W).

Reduction efficiencies may also be run between batches in the middle of the run. (In order for nitrate nitrogen results to be valid, they must fall between two acceptable reduction efficiencies). If a set of reduction efficiency standards is outside the acceptable range, it may be repeated one time. If it is within specification the second time, the data may be reported. If it is not within specifications, affected samples in the block must be repeated.

3. An initial calibration verification standard (ICV) (2.5 mg/L NO₃) must be run immediately after every calibration. The acceptable range is $\pm 10\%$ of the true value. If the ICV does not meet this acceptance criterion, see 1-P-QM-PRO-9015459, for handling outliers and the appropriate corrective action must be taken.
4. An initial calibration blank (W or ICB) must be run after the ICV. The acceptable result is less than the MDL. If the calibration blank does not meet this requirement, see 1-P-QM-PRO-9015459 for handling outliers and the appropriate corrective action must be taken.
5. A batch must contain no more than 20 field samples plus associated QC samples (LCS, PB, duplicate, spike).

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6. A laboratory control standard (LCS) must be prepared and analyzed with every batch of samples prepared. The acceptable range of the LCS is 90% to 110% of the true value stated by the manufacturer or the manufacturer's specifications if they are better than the required control limits of 90% to 110%. If the LCS does not meet these acceptance criterion, see 1-P-QM-PRO-9015459 for handling outliers and the appropriate corrective action must be taken.

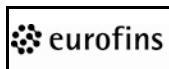
7. Based upon client requirements, when appropriate, a laboratory control standard duplicate (LCSD) must also be prepared and analyzed under the same conditions as the LCS. The relative percent deviation between the LCS and LCSD is noted in the LIMS. The acceptable range of the LCSD is the same as the LCS. If the LCSD does not meet this acceptance criterion, see 1-P-QM-PRO-9015459 for handling outliers and the appropriate corrective action must be taken. If the RPD between the LCS and LCSD is greater than the statistical criteria, see your coordinator or group leader to determine if reanalysis is needed.

8. A preparation blank (PBW), consisting of reagent water, must be prepared and analyzed with every batch of samples prepared. The acceptable result is less than the MDL. If the batch blank does not meet this criterion, see 1-P-QM-PRO-9015459 for handling outliers and the appropriate corrective action must be taken.

9. A duplicate must be prepared and analyzed for every ten samples. See the LIMS for current RPD acceptance criteria. If one or both are $<5\times$ the LOQ, the difference between the results cannot exceed the LOQ. If the acceptance criterion is not met, see 1-P-QM-PRO-9015459 for handling outliers and the appropriate corrective action must be taken.

10. A spiked sample must be prepared and analyzed for every ten samples (samples must be spiked in a frequency of at least 10%). The acceptance range is 90% to 110%. If a spike recovery does not meet the acceptance criterion, see 1-P-QM-PRO-9015459 for handling outliers and the appropriate corrective action must be taken.

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11. Based upon client requirements, a matrix spike duplicate may also be prepared and analyzed under identical conditions as the matrix spike. If a spike recovery does not meet the acceptance criterion, see 1-P-QM-PRO-9015459 for handling outliers and the appropriate corrective action must be taken. The RPD between the MS and MSD is statistical and can be found in the LIMS. If the RPD is outside the control limit, see your group leader or manager to determine if reanalysis is needed.

12. A continuing calibration standard (CCV) and a continuing calibration blank (W) must be run every ten injections. The acceptable range for the CCV is $\pm 10\%$ of the true value. An acceptable calibration blank result is less than the MDL. If this criterion is not met, see 1-P-QM-PRO-9015459 for handling outliers and the appropriate corrective action must be taken.

13. The linearity of the calibration must be determined every 6 months by analyzing a blank and three standards. If any verification data exceeds the initial values by $\pm 10\%$, linearity must be reestablished. The values of the three standards are taken from the calculated values of the standards used for the calibration curve.

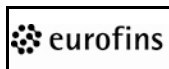
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Table I
Autoanalyzer Setup Parameters

Nitrate Nitrogen

R a n g e		0.10 to 4 mg/L
P u m p		
Speed	Percent	60
Tubes	Buffer	yel/blu
	Nitrogen	orn/yel
	Sample	orn/grn
	Color Reagent	orn/yel
	Pull-off	red/red
	Wash Solution	grn/grn
D e t e c t o r		
315	Wavelength	540 nm
	Rise time	10 sec.
	Range	1.0 AUFS
	Heater	None
S a m p l e r		
	Rate	48/hr.
	Sample time	35 sec.
	Wash time	40 sec.
	Pecking	OFF
	Wash solution	DI water

NOTE: The pump tube sizes listed for the wash solution and pull-off lines are minimum requirements. Larger sized tubes may replace the minimum tube size listed. The range, wash time and sample time are merely guidelines and may be adjusted to achieve maximum instrument performance.

Table II
Setup Parameters for FS3100 Detector

Nitrate Nitrogen

R a n g e		0.05-1.0 mg/L
P u m p		
Speed	Percent	40
Tubes	Buffer	yel/yel
	Nitrogen	blk/blk
	Sample	grn/grn
	Color Reagent	blk/blk
	Debubbler	wht/wht
	Wash Solution	blk/blk
D e t e c t o r		
FS3100	Wavelength	540 nm
N O 2 M e t h o d		
	Load	0.00 sec
	Inject	50 sec.
	Wash solution	reagent water

NOTE: The pump tubing requirements for Debubbler is only a minimum requirement. Larger sized tubes may be used. The inject time is merely a guideline and may be adjusted to ensure the sample loop is completely loaded with only the sample before injecting.

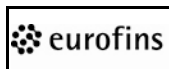
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Table III

Setup Parameters
Table Name: Nitrate Nitrogen

<u>Cup #</u>	<u>Sample ID</u>	<u>Dil.</u>	<u>Wt.</u>	<u>Cup #</u>	<u>Sample ID</u>	<u>Dil.</u>	<u>Wt.</u>
1	SYNC	1	1	2	rinse	1	1
3	W	1	1	4	S1	1	1
5	S2	1	1	6	S3	1	1
7	S4	1	1	8	S5	1	1
9	S6	1	1	10	rinse	1	1
11	W	1	1	12	REDNO ₂	1	1
13	rinse	1	1	14	REDNO ₃	1	1
15	rinse	1	1	16	W	1	1
17	ICV	1	1	18	W	1	1

Table IV

Table Parameters
Table Name: NO3

<u>Cup</u>	<u>Name</u>	<u>Type</u>	<u>R</u>	<u>Dil</u>
106	SYNC	SYNC	1	1
900	Carryover	CO	1	1
900	Blank	RB	1	1
900	Cal 0.00 ppm	C	1	1
100	Cal 0.05 ppm	C	1	1
101	Cal 0.10 ppm	C	1	1
102	Cal 0.20 ppm	C	1	1
103	Cal 0.40 ppm	C	1	1
104	Cal 0.80 ppm	C	1	1
105	Cal 1.00 ppm	C	1	1
900	Carryover	CO	1	1
900	Blank	RB	1	1
113	REDNO2	U	1	1
900	BLANK	RB	1	1
114	REDNO3	U	1	1
115	ICV	ICV	1	1
900	ICB	ICB	1	1

Table V

Standards Table

Units	mg/L
S1	4.0
S2	3.0
S3	1.0
S4	0.5
S5	0.2
S6	0.1

Figure 2

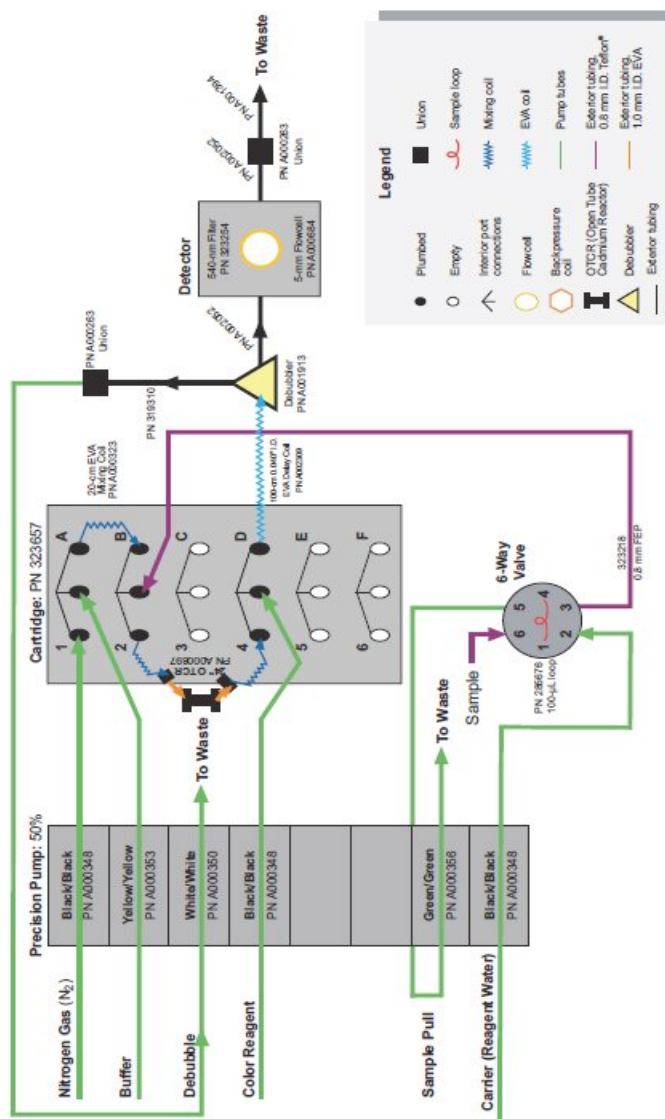
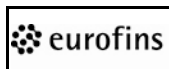


Figure 1. Detailed flow diagram for Nitrate plus Nitrite Nitrogen and Nitrite Nitrogen Cartridge

NOTE: This schematic is intended for use as a flow diagram only. Refer to the method for specific requirements.

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Appendix I

Nitrate Nitrogen + Nitrite Nitrogen in Drinking and Surface Waters, Domestic and Industrial Wastes

Reference:

1. Method 353.2, *EPA Methods for Chemical Analysis of Water and Wastes*, USEPA 600, Revision 2.0, 1993.
2. *AQ2 Discrete Multi-Chemistry Analyzer Operator Handbook*, SEAL Analytical Inc., Rev. 2, March 2006.
3. *AQ2 Series Software Guide*, SEAL Analytical, Inc., Version 4, 2005.
4. *Chemical Hygiene Plan*, current version.

Cross Reference:

Identical to attached analytical method.

Scope:

Identical to attached analytical method.

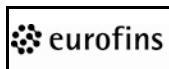
Reference Modifications:

Identical to attached analytical method.

Basic Principles:

Identical to attached analytical method.

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Interferences:

Identical to attached analytical method.

Personnel Training and Qualifications:

Identical to attached analytical method.

Sample Preservation and Storage:

Identical to attached analytical method.

Apparatus and Equipment:

SEAL AQ2 Discrete Analyzer

Reagents and Standards:

1. Triton® X-100, 10 % (w/v)

Triton® X-100 25.0 g

Weigh 25.0 g of Triton® X-100 into a beaker. While stirring vigorously, slowly add 250 mL of reagent water. This will thicken initially, but will dissolve with continued stirring. Stable for one year at room temperature.

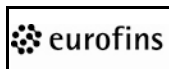
2. Copper Sulfate, identical to attached method
3. Stock ammonium chloride buffer, pH 8.5

Ammonium chloride(NH₄Cl) 134.2 g ±0.04g

Ethylenediaminetetraacetic acid, disodium salt dihydrate
(EDTA) 1.2 g ±0.04 g

Concentrated ammonium hydroxide pH to 8.5

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Dissolve 134.2 ± 0.04 g of ammonium chloride and 1.2 ± 0.04 g of EDTA in approximately 800 mL of reagent water. Adjust the pH to 8.5 using concentrated ammonium hydroxide and dilute to 1000 mL. This reagent is stable for 6 months at 2° to 4°C.

4. Working buffer

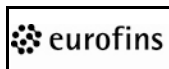
Stock ammonium chloride buffer	100 mL
10 % (w/v) Triton® X-100 solution	0.2 mL

Add 0.2 mL 10 % (w/v) Triton® X-100 solution to 100 mL stock ammonium chloride buffer and mix well. This reagent is stable for 6 months at 2° to 4°C.

5. Sulfanilamide-NEDD reagent

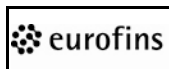
Concentrated phosphoric acid	19 mL
Sulfanilamide	$7.5 \text{ g} \pm 0.04 \text{ g}$
N-(1-naphthyl)-ethylenediamine dihydrochloride	$0.375 \text{ g} \pm 0.04 \text{ g}$
Working buffer	156 mL

Carefully add 19 mL concentrated phosphoric acid to approximately 300 mL reagent water. Add $7.5 \text{ g} \pm 0.04 \text{ g}$ sulfanilamide and $0.375 \text{ g} \pm 0.04 \text{ g}$ N-(1-naphthyl)-ethylenediamine dihydrochloride and dissolve with constant stirring. Add 156 mL working buffer. Caution, before adding the buffer, test a small volume to ensure that addition of buffer does not cause a pink color to develop. Dilute to 500 mL with reagent water. This reagent is stable for 30 days when stored in an amber bottle at 2° to 4°C. Discard if reagent possesses or develops a significant pink color.

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Test Parameters:

PARAMETERS	AQ2 SETTING
Test name	Nitrate 4.5
Units	mg N/L
Decimals	4
Test type	Cadmium reduction
Sample volume (µL)	300
Water volume (µL)	90
Number of mixes	2
Cuvette primes	1
Cuvette washes	2
Reduction time (seconds)	25
Cadmium flush volume	300 (subject to adjustment)
Reaction time (seconds)	420
Wavelength (nm)	520
Polynomial order	1
Number of reagents	2
1. NOx Ammonium chloride buffer (µL)	390
2. NOx Sulfanilamide –NEDD (µL)	350
Advanced Test Parameters	<input checked="" type="checkbox"/> Eliminate Air from Test Transfer <input checked="" type="checkbox"/> Extra Debubbling Action

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Standards:

Standards for calibration are prepared by the AQ2 using the high (4.0) curve point standard. Record this preparation in the *Instrumental Water Quality Reagents and Standards* logbook. The reduction efficiency standards are prepared in the same manner as the attached method as are the initial and continuing calibration standards (ICV/CCV).

Sample Handling and Preservation:

Identical to attached analytical method.

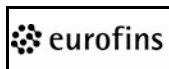
Safety Precautions, Waste Handling, Pollution Prevention:

Identical to attached analytical method.

Procedure:

1. Log into the SEAL AQ2 software.
2. Switch on reagent cooling (small auxiliary switch). **NOTE:** This must be done before switching on the main power switch.
3. Power on the analyzer with the main switch (larger on right side) at rear of instrument.
4. Empty and refill wash bottle with reagent water.
5. Ensure waste container is empty and waste tubing is not below the surface of the waste liquid.
6. Ensure clean segments are loaded into the reaction wheel and the well count is zeroed.
7. Replenish any necessary reagents.

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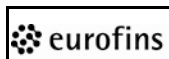
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8. Perform Daily Start-up routine. This is initiated by selecting *Settings* and *Daily Start-up* from the menu bar. NOTE: This does not need to be completed on a daily basis, either as needed or at the start of each week.
9. The cadmium coil rejuvenation is performed by the AQ2 by entering the *Maintenance* screen and clicking on the cadmium coil symbol at the bottom of the menu bar. The AQ2 will pull in Copper Sulfate, the 20 ppm Nitrate standard, and Reagent water to fully flush the coil for analysis.
10. Double click on the *Scheduling* icon and select an empty tray.
11. Enter the appropriate calibration, if applicable, and sample IDs. Using the *sample type* column to enter either unknown values (U1, U2, U3, etc.) or check standards (ICV, CCV, CCB).

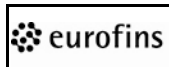
Leave the first line empty if an auto standardization is planned for the analysis. The instrument will automatically populate a curve and auto prepares the calibration for only selected analyses.

If a manually prepared calibration is being analyzed, you must hand enter the standards into the *type* column as follows: S1, S2, S3, S4 S5, S6, S7, S8, with the S1 and S8 being blank values analyzed by the instrument.

12. Once samples and standards are loaded and the tray is complete, click on File and Save the new data.
13. Double click on the *Run* tab and select the correct file name for the tray. When this is complete a box will pop-up with the following options: *Set Tube Counter to Zero*, which resets the reaction segments back to sample at number 1, *Perform Water baselines*, this step is performed during the daily start-up, and *Auto Standardize*, this option must only be checked when the instrument is performing the calibration.

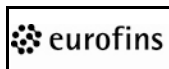
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14. After this step has been performed, the instrument will automatically start up and will begin to check reagent volumes. The current state of the analyzer will be displayed on the status window, letting you know which sample is being analyzed and how long the current analysis will run.

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Eurofins Document Reference	1-P-QM-WI -9022845	Revision	3
Effective Date	Oct 16, 2014	Status	Effective
Historical/Local Document Number	Analysis 2392, 6171, 6176, 7320, 7578, 7579, 8389, 8390 OH VAP		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

Prepared by	Chad Wettig
Reviewed and Approved by	Dana Kauffman;Review;Monday, September 29, 2014 9:33:37 AM EDT Kathryn Brungard;Approval;Thursday, October 2, 2014 7:43:15 AM EDT

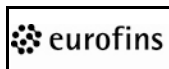
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Revision Log:

Revision: 3		Effective Date:	This version
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Procedure A.3.d.	Clarification	Added relevant LIMS scan numbers	
Procedure A.3.e.	Correction	Added to store vials used for analysis 7578 and 8390 at -10° to -15°C.	
Procedure A.4.	Removed based on the change of the storage conditions.	Removed the statement concerning hold time for vials prepared with surrogate solution	

Revision: 2		Effective Date:	May 16, 2014
Section	Justification	Changes	
Document Title	Enhancement	Change to include encores and field preserved. Preparation of Solid Samples by SW-846 Method 5035A (Field Preserved and EnCores™) for OH VAP	
Historical/Local Document Number	Correction	Removed scans not related to 8260B as the final analytical method. Added relevant scans for procedure. (2392, 6171, 6176, 7320, 7578, 7579, 8389, 8390 OH VAP)	
Through Document	Enhancement	Included language for field preserved samples. Previously this document only contained information on samples collected by a coring device	
Reference	Referenced method associated with the LIMS scans	Added Method 5035A	
Cross Reference	Correction to the referenced scans for the procedure	Changed document analysis numbers associated with the analytical SOP	
	No longer referenced within document	Removed documents	
Scope	Correction	Removed reference to deactivated scans (10949, 10950)	
Definitions	Enhancement	Added relevant definitions (i.e. comment, preservation blank, reagent water)	
Personnel Training and Qualifications	Enhancement	Wording added to better explain training process	
Sample Collection, Preservation and Storage	Unnecessary for this procedure	Removed discussion of number of coring devices requested for collection	
	Reflects change in industry standard	Updated refrigeration conditions from 4° ± 2°C	
Apparatus and Equipment	Moved to definition section	Removed VOA Prep Application	
Reagent and Standards	Clarity	Rearranged reagent section	
	Enhancement	Added the standards used within the procedure	
Procedure A.4.	Not relevant to final analysis by 8260B	Removed reference to high level analysis 6117 and 6130.	
Quality Assurance/Quality Control	Reflects current procedure	Added information on preservation blanks	

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Reference:

1. *Test Methods for Evaluating Solid Wastes*, SW-846, Method 5035A, July 2002.
2. *Chemical Hygiene Plan*, current version.

Cross Reference:

Document	Document Title
Analysis #10237, 10335 OH VAP	Volatile Compounds in Aqueous and Solid Samples by SW-846 8260B for OH VAP
1-P-QM-FOR-9009110	Standardized Report and Case Narrative Comments

Purpose:

The purpose of this Standard Operating Procedure (SOP) is to describe the proper preparation of non-aqueous samples by SW-846 Method 5035A, submitted in a coring device or field preserved vials, for low and high concentration volatile analysis by SW-846 Method 8260B for the Ohio Voluntary Action Program (OH VAP).

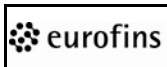
Scope:

This method is used for preparation of volatile solid samples collected by various techniques outlined in SW-846 Method 5035A (coring device collection such as EnCore™ or field preserved vial collection) for analysis using GC/MS purge and trap techniques. The compounds for analysis are listed in the LIMS under scan 10237 (solids).

Basic Principles:

Samples are collected in either an airtight coring device, (EnCore™) or in a pre-preserved tared vial that is filled in the field using a coring tool. The weight of the container, preservative, and soil is captured and the net weight of the sample is calculated and captured in the Volatile Preparation program in LIMS.

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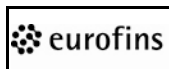
Reference Modifications:

Not applicable to this procedure.

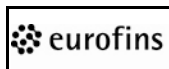
Definitions:

1. Comment – standard text that has been typed, formatted and assigned a comment number through the LIMS. Comments are added by the analyst or verifier and included on the analytical reports. The comment may include narration or potential bias if required by OH VAP as noted in 1-P-QM-FOR-9009100.
2. ELLE Sample ID – unique 7-digit number assigned to a client sample by the Eurofins Lancaster Laboratory Environmental
3. Headspace – defined as a significant amount of space between the sample level and the top of the jar. Some sample settling is acceptable. However, a significant amount of headspace exists when more than a 1/4 of the volume in the container is missing.
4. LIMS – Laboratory Information Management Systems
5. MeOH – Methanol
6. Matrix spike/matrix spike duplicate (MS/MSD) – A sample created by fortifying a second aliquot of an aqueous or solid sample with some or all of the analytes of interest. The concentration added is known and compared to the amount recovered to determine percent recovery. Matrix spike recoveries provide information about the accuracy of the method in light of the matrix analyzed. A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test.
7. OH VAP – Ohio Voluntary Action Program

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8. OH VAP CP – Ohio Voluntary Action Program Certified Professional. Third party OH VAP approved person responsible for verifying properties are cleaned up to the levels required by the program rules.
9. Preparation – Refers to the preservation steps that are performed at the lab, not an extraction step.
10. QC – Quality Control Samples, includes method blank, MS/MSD and LCS/ LCSD.
11. Reagent water – Used as a rinse during the pipette dispenser cleaning process. The deionized water supplied at the taps in the laboratory meets criteria.
12. Reporting Limit – varies from project to project, may be the MDL, LOQ or client specified.
13. Surrogates – Organic compounds which are similar to the analytes of interest but are not naturally occurring in environmental samples. Surrogates are spiked into all standards and every field and QC sample prior to extraction and analysis to provide information regarding the effects of the sample matrix.
14. SOP – Standard Operating Procedure
15. US – unspiked sample
16. VOA Prep Summary and VOA Prep Summary by SDG – Reports that reside on the LIMS database. Using the Volatile Prep application and moisture results pulled from Parallax, the report is populated and the calculations are performed to achieve a Final Extraction Volume to be used when necessary by the GC/MS group.

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Interferences:

Sample preparation must be performed in a volatile free environment to avoid contamination. Therefore, this process must be performed in one of the designated volatile free laboratories. It is possible for samples to become contaminated by diffusion of volatiles through the sample vial septum; a trip blank carried through sampling, storage and handling acts as a check for such contamination.

Safety Precautions and Waste Handling:

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

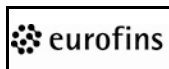
Methanol (MeOH) is flammable. Containers of this solvent must be kept away from any sources of open flames or sparks. Due to the potentially toxic nature of samples received from clients for analysis, safety precautions must be observed when handling samples. Safety glasses, lab coats, and gloves are required as personal protective equipment. Samples must be weighed in a hood.

The solvents utilized in this procedure are disposed of in a solvent waste container. Expired standards in methanol are disposed of as hazardous waste. Other wastes generated by the laboratory are disposed of via incineration at EPA licensed facilities.

Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP.

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The initial training consists of observing the procedure being carried out by an experienced analyst/technician. Next, the trainee performs the procedure while the experienced person watches, answers questions, and gives feedback. Following the initial training, experienced individuals are available as a resource until no longer required. Analysts are considered proficient when the procedure can be carried out independently.

Sample Collection, Preservation, and Handling:

Samples are collected in either an airtight coring device (EnCore™) or in pre-preserved tared vials that are filled in the field using a coring tool.

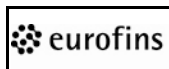
Samples are collected and transported to the laboratory immediately after collection under refrigeration at 0° to 6°C.

Once received at the laboratory: Samples in either EnCore sampling devices or jars used for the effervescence check must be refrigerated upon receipt at the laboratory. (Jars used for collection must be glass with a PTFE-lined lid.). Within 48 hours of the collection time, samples in EnCores must be either preserved with Sodium Bisulfate or Methanol with Surrogate and refrigerated at 0° to 6°C, or extruded into a vial with reagent water and stored in a freezer at -10° to -15°C.

Field preserved samples must be refrigerated upon receipt at the laboratory. Within 48 hours of the collection time field preserved samples in DI must be frozen at -10° to -15° C. Field Samples collected in methanol or sodium bisulfate are considered preserved when the sample is taken in the field and are kept stored under refrigeration at 0° to 6°C.

When samples do not meet the criteria above, the client is notified to confirm that the laboratory should proceed with analysis. If the sample is analyzed a comment is added to the analytical report to document that the requirement was not met. Refer to form 1-P-QM-FOR-9009110 for designated pre-formatted comments.

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Apparatus and Equipment:

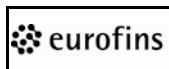
NOTE: The Apparatus and Equipment may be subject to change.

1. 40-mL vials with stir bars, Teflon™-lined low-bleed septa, and screw caps. SciSpec Catalog #376740-MB or equivalent.
2. EnCore™ sampler, or equivalent.
3. Calibrated pipette dispenser capable of dispensing up to 25 ±0.25 mL, or equivalent
4. Calibrated top-loading balance capable of weighing ±0.01 g
5. Preprinted labels with vial ID code.
6. Extruder tool for EnCore™ sampler.
7. Glassware – funnels, and volumetric flasks, Class A

Reagents and Standards:

- A. Standard/ spiking concentration and reagent vendors are subject to change without notification.
- B. A rinse using reagent water followed by methanol must be performed on the pipette dispensers before adding a new lot of solution or standards. A clean funnel is used to transfer the new solution into the pipette dispenser.

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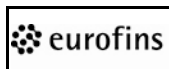
C. Reagents

1. Initial lot checks are performed prior to releasing the reagents for use in this procedure. If compounds are detected above the method detection limit (MDL), prepare another vial and repeat the analysis. If compounds are still detected above the MDL, a new lot must be tested and released before the reagent is used.
2. Methanol – Purge and trap grade, store at room temperature and re-analyze yearly.
3. Sodium hydrogen sulfate anhydrous powder, Fluka, Catalog #2316657 or equivalent. Store at room temperature and re-analyze yearly.
4. Sodium Bisulfate Solution – prepared by diluting 200 ± 0.5 g of the sodium hydrogen sulfate anhydrous into 1000 mL of reagent water in 1000-mL volumetric flask. Cap and invert at least 10 times to mix. Store at room temperature and re-analyze every six months if supply remains.
5. Reagent water – water in which target analytes are not detected at or above the reporting limit for parameters of interest. In general, the deionized water supplied at the taps in the laboratory meets criteria. If the reagent water does not meet the requirements, see your supervisor for further instructions.

D. Standards

1. Store ampulated standards at -10° to -15°C until the expiration date indicated by the vendor or for 1 year if no expiration date is provided. Replace stock standards prepared in house every 6 months.
2. Store all working and secondary standard solutions in Teflon®-lined screw-capped GC vials or mininert vials at -10° to -15°C . Replace all working calibration and spike standards monthly. Replace secondary dilution standards every 6 months.

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3. 8260 surrogate standard spike (8260 SS Spike) – purchase from Restek, Cat.#55671, or equivalent.
4. 8260 Surrogate Standard Solution for Sample Support (25ppm) (8260 SS Solution) – Methanol with surrogate prepared by personnel in the GC/MS Volatiles lab per Analysis #10237, 10335 OHVAP. Stored in an amber jar.

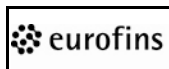
Calibration:

Not applicable to this procedure

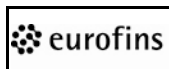
Procedure:

NOTE: See Analysis #10237, 10335 OH VAP for all QC preparation.

- A. Vial preparation – (vials are prepared and stored to be sent to clients for field preservation of volatile soil samples or used in-house once EnCores™ are returned to the laboratory)
 1. Sodium bisulfate solution vials used in preparation for low concentration analysis 2392 (field preserved) and 8389 (EnCore™).
 - a. Add 5 mL of sodium bisulfate solution to a clean 40-mL vial with a magnetic stir bar.
 - b. Seal the vial with a screw cap and septum seal. (low bleed septum recommended).
 - c. Label the vial with a tracking number. Use the Volatile Prep application to capture the weight (to the nearest 0.01g) of the vial weighed on a tared balance and the vial tracking number.
 - d. Store at room temperature until sample preparation occurs.

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2. Reagent water vials used for low level concentration analyses 6176 (field collection) and when effervescence occurs during preparation for 7320 (EnCore™).
 - a. Add 5 mL of reagent water to a clean 40-mL vial with a magnetic stir bar.
 - b. Seal the vial with a screw cap and septum seal. (low bleed septum recommended).
 - c. Label the vial with a tracking number. Use the Volatile Prep application to capture the weight (to the nearest 0.01g) of the vial weighed on a tared balance and the vial tracking number.
 - d. Store at room temperature until sample preparation occurs.
3. Methanol vials used in preparation for high concentration analysis 6171 and 7579 (field preserved), 7578 and 8390 (EnCore™)
 - a. Add 5 mL of the 8260 SS Solution or methanol to a clean 40-mL vial.
 - (1) Analysis 6171 and 7579 – 5 mL methanol added
 - (2) Analysis 7578 and 8390 – 5 mL 8260 SS solution added
 - b. Seal the vial with a screw cap and septum seal.
 - c. Label the vial with a tracking number. Use the Volatile Prep application to capture the weight (to the nearest 0.01g) of the vial weighed on a tared balance, the vial tracking number and the methanol lot or 8260 SS solution lot number..
 - d. Store vials used for analysis 6171 and 7579 under refrigeration at 0° to 6°C.

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e. Store vials used for analysis 7578 and 8390 at -10° to -15°C.

4. All prepared vials must be discarded if not used within 6 months of preparation.

B. Samples submitted in EnCore™ samplers

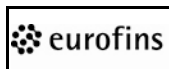
1. Samples are removed from the refrigerator (within 48 hours of collection) for preparation in small numbers to ensure that they remain cold.

NOTE: Typically, EnCores are shipped with a separate jar of the sample. Take a representative sample from the jar (not an EnCore™ sampler) and place it in a vial containing sodium bisulfate solution. Check for effervescence and pH and record results. If the pH is ≥ 2 , add enough sodium bisulfate to bring the pH < 2 . If effervescence is noted by a rapid or vigorous reaction, prepare the EnCore™ collections into vials that contain a stir bar and 5 mL reagent water and then freeze at -10° to -15°C.

2. Samples for low concentration analysis require three replicate collections (two sample replicates are prepared into sodium bisulfate solution and one sample replicate is prepared into 8260 SS solution as a back up in case we need to change to high level) and samples for high concentration analysis requires one collection prepared into 8260 SS solution.

Note: For low level analysis, the vial with 8260 SS solution must be prepared prior to the sodium bisulfate or DI vials to ensure at least one vial is available for each required preservation.

3. For both high and low level concentration analysis:
 - a. Extrude the sample from the sampling device into the appropriate prepared vial based on the LIMS number and immediately recap the vial.

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- b. Use the Volatile Prep application to capture the weight (to the nearest 0.01g) of the vial weighed on a tared balance and the vial tracking number.
- c. Record any unusual observations about the sample. Note in the comment section if the EnCore™ sampling device is not properly sealed or if the device is not full causing a low weight.
- d. Adhere the supplied laboratory sample ID label onto the sample vial and scan into the Volatile Prep application (this links all the tracking label information to the sample). Upload to LIMS.

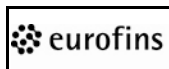
C. Samples submitted in field preserved vials

1. Methanol field preserved vials used for Analysis 6171 and 7579

- a. Use the Volatile Prep application to capture the weight (to the nearest 0.01g) of the vial (which contains the sample) weighed on a tared balance and the vial tracking number.
- b. Spike with 5 µl of 8260 SS spike.
- c. Record any unusual observations about the sample and note in the comment section.
- d. Adhere the supplied laboratory sample ID label onto the sample vial and scan into the Volatile Prep application (this links all the tracking label information to the sample). Upload to LIMS.

2. Sodium bisulfate field preserved vials used for Analysis 2392

- a. Use the Volatile Prep application to capture the weight (to the nearest 0.01g) of the vial (which contains the sample) weighed on a tared balance and the vial tracking number.

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- b. Record any unusual observations about the sample and note in the comment section.
- c. Adhere the supplied laboratory sample ID label onto the sample vial and scan into the Volatile Prep application (this links all the tracking label information to the sample). Upload to LIMS.

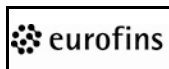
3. DI field preserved vials used for Analysis 6176

- a. Samples are removed from the storage refrigerator within 48 hours of collection
- b. Use the Volatile Prep application to capture the weight (to the nearest 0.01g) of the vial (which contains the sample) weighed on a tared balance and the vial tracking number.
- c. Record any unusual observations about the sample and note in the comment section.
- d. Adhere the supplied laboratory sample ID label onto the sample vial and scan into the Volatile Prep application (this links all the tracking label information to the sample). Upload to LIMS.

D. Scan and deliver the samples to the volatile laboratory (Dept. 4021) designated storage location.

1. Samples prepared in sodium bisulfate are stored under refrigeration until analysis.
2. Samples in reagent water are stored frozen until analysis.
3. Samples prepared in methanol are stored under refrigeration until analysis.

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- E. The sample preservation time is either recorded as the time in which the sample was placed into methanol or sodium bisulfate or in the case of DI water, the time in which the sample is scanned to the freezer.

Calculations:

The weight of the soil is determined by a calculation performed by the volatile prep program based on subtracting the weight of the prepped vial from the weight of the vial with soil.

$$\text{Calculation of sample weight : } W_n = W_s - W_f$$

Where:

W_f = weight of container + solution (first weight)

W_s = weight of container + solution + soil (second weight)

W_n = net weight of soil sample

Note in the comment section if the sampling device or vials are not properly sealed or if the sampling device is not full. Both of these scenarios could cause a low sample weight. The volatile prep application generates an e-mail and sends it to the appropriate client service representative.

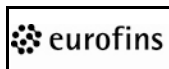
Statistical Information/Method Performance:

Not applicable to this procedure

Quality Assurance/Quality Control:

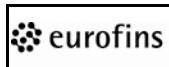
See Analysis #10237, 10335 OH VAP for QC preparation, analysis, and corrective action.

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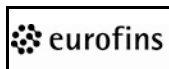
Eurofins Document Reference	1-P-QM-WI -9025371	Revision	1
Effective Date	Jun 12, 2014	Status	Effective
Historical/Local Document Number	Analysis 13218		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

Prepared by	Robert Vincent
Reviewed and Approved by	Susan Goshert;Review;Monday, June 9, 2014 2:46:29 PM EDT Richard Karam;Review;Thursday, June 12, 2014 9:54:26 AM EDT Kathryn Brungard;Approval;Thursday, June 12, 2014 11:13:40 AM EDT

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Revision Log:

Revision: 1		Effective Date: This version
Section	Justification	Changes
		New

 Lancaster Laboratories Environmental	Document Title: Microextraction of EDB, DBCP, and TCP in Solids by Method 8011	Eurofins Document Reference: 1-P-QM-WI -9025371
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Reference:

1. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 8011, Revision 0, July 1992.
2. *Chemical Hygiene Plan*, current version.

Cross Reference:

Document	Document Title
Analysis #13214	EDB, DBCP and TCP by Method 8011 in Solids using Microextraction and GC-ECD
1-P-QM-PRO-9015490	Organic Extraction Standards Storage and Handling

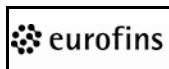
Scope:

This analysis applies to the determination of 1,2-Dibromoethane (EDB), 1,2-Dibromo-3-chloropropane (DBCP), and 1,2,3-Trichloropropane (TCP). These are the List 2 Unregulated VOCs from the National Primary Drinking Water Regulations established in July 1987. These are also recognized as Group SOC1 by PA DEP.

Basic Principles:

A 10 g aliquot of sample is extracted in a 40 ml vial with 10 mL hexane (micro-extraction). Surrogate standards are added to each sample to monitor recovery. The samples are tumbled and centrifuged. The solvent layer is drawn off and ready for analysis (Analysis #13214).

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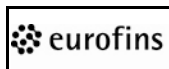
Definition:

1. Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) – A sample of known composition analyzed with each batch of samples to demonstrate laboratory accuracy. The samples either naturally contain the analytes of interest or are clean samples fortified with known concentrations. Used to demonstrate laboratory accuracy. A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test.
2. Matrix spike/matrix spike duplicate (MS/MSD) – A sample created by fortifying a second aliquot of a water or soil sample with some or all of the analytes of interest. The concentration added is known and compared to the amount recovered to determine percent recovery. Matrix spike recoveries provide information about the accuracy of the method in light of the matrix analyzed. A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test.
3. Method Detection Limit (MDL) Check Standard – An aliquot of reagent water to which known quantities of method analytes are added in the laboratory. The MDL check sample is treated exactly as a sample. The MDL check is used to determine whether the laboratory is capable of making accurate and precise measurements at or near the required method detection limit.
4. Surrogates – Organic compounds which are similar to the analytes of interest but are not naturally occurring in environmental samples. Surrogates are spiked into all standards and every field and QC sample prior to extraction and analysis to provide information regarding the effects of the sample matrix.

Interferences:

Method interferences may be caused by impurities in solvents, reagents, glassware, or other hardware used in sample processing. A method blank is performed with each batch of samples to demonstrate that the extraction system is free of contaminants.

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Safety Precautions and Waste Handling:

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

All laboratory waste is accumulated, managed and disposed of in accordance with all federal, state, and local laws and regulations.

The toxicity of all compounds used in this method has not been established. Each compound must be treated as a potential health hazard. Care must be taken when handling the neat analyte standards. Gloves must be worn and the reagents must be prepared in a hood to avoid skin or respiratory contact. EDB and DBCP have been tentatively classified as known or suspected carcinogens. Avoid skin contact with methanol as it is absorbed through the skin. Safety Data Sheets (SDS) are available from the Safety Officer.

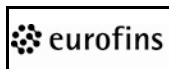
All solvent waste generated from this preparation must be collected in designated containers. These will then be transferred to the lab-wide disposal facility. Any solid waste material (disposable pipettes, broken glassware) is disposed of in the normal solid waste collection containers.

Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the technicians training records.

Initially, each technician performing the extraction must work with an experienced employee for a period of time until they can independently perform the extraction. Proficiency is measured through a documented Initial Demonstration of Capability (IDOC).

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The IDOC and the DOC consists of four laboratory control samples (or alternatively, one blind sample for the DOC) that is carried through all steps of the extraction and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation.

Sample Collection, Preservation and Handling:

Samples are collected in wide-mouth jar equipped with Teflon-lined silicone septa with no headspace. All samples are stored at 0° to 6°C, not frozen. Samples must be extracted within 14 days of collection. Extracts are stored at -10° to -15°C.

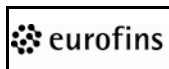
Apparatus and Equipment:

1. 40-mL glass vials with screw-on tops containing Teflon inserts
2. Syringe Pump – Hamilton ML625-CNT syringe pump or equivalent
3. Glass syringes in various volumes
4. Disposable Pasteur pipettes and bulbs
5. Analytical balance capable of weighing to 0.01 g
6. GC autosampler vials

Reagents and Standards:

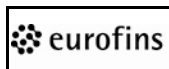
1. Hexane – Resi-Analyzed grade or equivalent. Store at room temperature for up to 1 year.
2. Methanol – Resi-Analyzed grade or equivalent. Store at room temperature for up to 1 year.

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3. Sodium sulfate – Reagent grade crystal or equivalent, baked at 400°C for a minimum of 4 hours in a shallow pan prior to use to remove organic contaminants. Store in a glass jar for up to 1 year after baking.
4. 1, 1, 2, 2- Tetrachloroethane – Accustandard M-502-44, or equivalent. Follow manufacturer’s storage conditions and expiration dates.
5. 504.1 Calibration mix – Accustandard M-504.1- CS or equivalent. Follow manufacturer’s storage conditions and expiration dates.
6. 1, 2, 3- Trichloropropane – Ultra scientific PPS-250 or equivalent. Follow manufacturer’s storage conditions and expiration dates.
7. 504.1 QC stock – Ultra scientific DWM-514 or equivalent. Follow manufacturer’s storage conditions and expiration dates.
8. All QC standards added during extraction process are prepared by Organic Extractions using instructions generated by the standards database.
9. Standards Preparation:
 - a. Prepare a 504.1 calibration intermediate by combining the following the following in methanol and bring to final volume of 10.0 mL:
 - (1) 0.125 mL of 1, 1, 2, 2-tetrachloroethane (200 ppm)
 - (2) 0.25 mL of 504.1 calibration mix (200 ppm)
 - (3) 0.092 mL of 1, 2, 3-trichloropropane (100 ppm)
 - (4) This solution is stored in the freezer (-10 to -15°C) and is stable for 1 month.

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- b. Prepare the 504.1 calibration High Spike by diluting 0.5 mL of 504.1 calibration intermediate into 10.0 mL with methanol. This solution is stored in the freezer (-10 to -15°C) and is stable for 1 month.
- c. Prepare the 504.1 calibration Low Spike by diluting 0.1 mL of 504.1 calibration intermediate into 10.0 mL with methanol. This solution is stored in the freezer (-10 to -15°C) and is stable for 1 month.
- d. Prepare the EDB surrogate by diluting 0.0125 mL of 1, 1, 2, 2-tetrachloroethane into 100.0 mL with methanol. This solution is stored in the freezer (-10 to -15°C) and is stable for 1 month.
- e. Prepare the 504.1 matrix spike by diluting 0.015 mL of 504.1 QC stock into 25.0 mL with methanol. This solution is stored in the freezer (-10 to -15°C) and is stable for 1 month.

Calibration:

Not applicable to this procedure.

Procedure:

A. Calibration standards prep (weekly)

1. Calibration standards are prepped in seven 40-mL vials.
2. Add 10 g of sodium sulfate to each vial.
3. Add the appropriate calibration standard to each vial as follows:

NOTE: Be sure to use a syringe size that is close to the amount being measured.

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<u>Vial</u>	<u>Amount Used (µL)</u>	<u>Standard Used</u>
Level 6	250	504.1 Calib High
Level 5	175	504.1 Calib High
Level 4	100	504.1 Calib High
Level 3	250	504.1 Calib Low
Level 2	125	504.1 Calib Low
Level 1	70	504.1 Calib Low
MDL	70	504.1 Calib Low

4. Add 10 mL hexane to each vial. Cap the vials and tumble for 15 minutes.
5. Set vials aside and allow sample and hexane to separate.
6. The hexane layer is removed with a disposable Pasteur pipette and is divided into three clear GC vials and securely capped.
 - a. Each vial is marked with the appropriate vial number.
 - b. The extracts are stored in a freezer (-10 to -15°C) until ready to analyze.
 - c. The second vial is for confirmation, and the third vial is to be used as a continuing calibration standard.

B. QC sample prep

1. Each QC sample is prepped in three 40-mL vials (Blank, LCS, LCSD, MS, MSD, DUP).
 - a. If sufficient sample is sent by the client or the client designates QC, a sample is used to prepare an MS/MSD.
 - b. If samples are expected to contain target analytes of concern, then you may use an MS and a DUP of an unspiked field sample as an alternative to the MS/MSD.

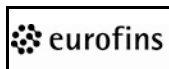
- c. If there is limited sample that prevents the preparation of the MS/MSD then, an LCS and an LCSD is performed.
2. Add 10 g of sodium sulfate to each vial of the QC.
3. Add the appropriate standard to each vial as follows:

NOTE: Be sure to use a syringe size that is close to the amount being measured.

<u>QC Type</u>	<u>Amount Used (µL)</u>	<u>Standard Used</u>
LCS	700	EDB/DBCP/TCP Matrix Spike
LCSD	700	EDB/DBCP/TCP Matrix Spike
MS	700	EDB/DBCP/TCP Matrix Spike
MSD	700	EDB/DBCP/TCP Matrix Spike
Blank	None	None
Duplicate	None	None

See 1-P-QM-PRO-9015490 (SOP-OE-017) for storage and handling of spikes.

4. Add 0.5 mL of EDB surrogate to each QC sample.
5. Add 0.7mL of 504.1 Matrix Spike to the LCS/LCSD and MS/MSD, as applicable.
6. Add 10 mL of hexane, cap the vials, and tumble them for 15 minutes.
7. The vials are then centrifuged to separate the sample and extract.
8. The hexane layer is removed with a disposable Pasteur pipette and is divided into two clear GC vials and securely capped.
 - a. Each vial is marked with the appropriate QC name.

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- b. The extracts are stored in a freezer (-10 to -15°C) until ready to analyze.
- c. The second vial is for confirmation.

C. Sample prep

1. Weigh 10 g of each sample into a labeled 40 mL vial. Record the weight on the batch log.
2. Add 0.5 mL of the EDB surrogate to each sample.
3. Add 10 mL of hexane to the vial. Cap and tumble for at least 15 minutes.
4. The vials are then centrifuged to separate the sample and extract.
5. The hexane layer is removed with a disposable Pasteur pipette and is divided into two clear GC vials and securely capped.
 - a. Each vial is marked with the appropriate sample number.
 - b. The extracts are stored in a freezer (-10 to -15°C) until ready to analyze.
 - c. The second vial is for confirmation.

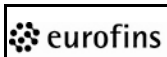
Calculations:

Not applicable.

Statistical Information/Method Performance:

See analytical method.

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Quality Assurance/Quality Control:

A batch is defined as the samples to be extracted on any given day but not to exceed 20 field samples. If more than 20 samples are prepared in a day, an additional batch must be prepared.

For each batch of samples extracted, a blank, LCS, and an MS, and MSD must be extracted. If there is limited sample which prevents the preparation of the MS/MSD then prepare an LCS/LCSD. If the batch contains only field or equipment blank samples, an LCS/LCSD QC pairing is used.

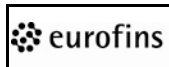
All samples and QC are spiked with a surrogate.

If samples are expected to contain target analytes of concern, then you may use an MS and a DUP of an unspiked field sample as an alternative to the MS/MSD.

If any client, agency, or state has more stringent QC or batch requirements, these must be followed instead. See the GC analysis method for specifics on compounds in the spiking solution.

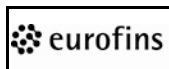
An MDL determination must be done on a weekly basis.

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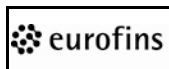
Eurofins Document Reference	1-P-QM-WI -9025366	Revision	1
Effective Date	Jun 12, 2014	Status	Effective
Historical/Local Document Number	Analysis 13214		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

Prepared by	Rick Shober
Reviewed and Approved by	Susan Goshert;Review;Wednesday, June 11, 2014 5:22:29 PM EDT Kathryn Brungard;Approval;Thursday, June 12, 2014 11:16:20 AM EDT

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Revision Log:

Revision: 01		Effective Date: This version
Section	Justification	Changes
		New

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Reference:

1. *Test Methods for Evaluating Solid Wastes*, SW846 Method 8011, Revision 0, July 1992.
2. *Chemical Hygiene Plan*, current version.

Cross Reference:

Document	Document Title
Analysis #13218	Microextraction of EDB, DBCP, and TCP in Solids by Method 8011
1-P-QM-PRO-9015493	QC Data Acceptability and Corrective Action
1-P-QM-PRO-9015496	Monitoring QC Data Acceptance Limits
1-P-QM-QMA-9015390	Demonstrations of Capability
1-P-QM-QMA-9017309	Determining Method Detection Limits and Limits of Quantitation

Scope:

This method is used for identifying and quantitating 1,2-Dibromoethane (EDB), 1,2-Dibromo-3-chloropropane (DBCP), and 1,2,3-Trichloropropane (TCP) in soils, sediments, and solids:

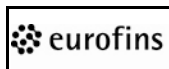
Compound	LOQ (µg/kg)	Analysis	Prep Analysis
EDB	0.5	13214	13218
DBCP	0.5	13214	13218
TCP	4	13214	13218

LOQs are based on annual statistical evaluation of laboratory data and are subject to change. The current LOQs are maintained in the LIMS.

Basic Principles:

The analytes are extracted using a microextraction technique with hexane, injected into a gas chromatograph equipped with a capillary column, and detected using an electron capture detector (GC-ECD). Standards are extracted from sodium sulfate in the same manner. All positive results are confirmed on a second capillary column.

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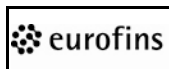
Definitions:

1. DOC – Demonstration of Capability
2. IDOC – Initial Demonstration of Capability
3. LCS/LCSD – Laboratory Control Sample/Laboratory Control Sample Duplicate
4. LOQ – Limit of Quantitation
5. MCL - Maximum Contaminant Level
6. MDL – Method detection limit
7. MS/MSD – Matrix Spike/Matrix Spike Duplicate

Interferences:

1. Samples that contain other VOCs may contain interferences. EDB at low concentrations may be masked by very high concentrations of DBCM, a common chlorinated drinking water contaminant. The retention time of DBCM can be identified on both columns, and separation must occur on at least one column to ensure proper identification and quantitation of EDB.
2. Unresolvable peaks can be introduced into the chromatogram by various interferences.
 - a. An ECD is very sensitive to compounds that contain halogens and will also respond to many other compounds and materials including oxygenated organics, unsaturated organics, and elemental sulfur.
 - b. Avoid contact with any plastic material during the extraction and analysis procedures to minimize interferences from phthalate esters.

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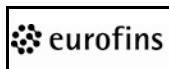
 <div>Lancaster Laboratories Environmental</div>	<div>Document Title:</div> <div>EDB, DBCP and TCP by Method 8011 in Solids using Microextraction and GC-ECD</div>	<div>Eurofins Document Reference:</div> <div>1-P-QM-WI -9025366</div>
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- c. Scrupulously clean all glassware to minimize interferences caused by laboratory contaminants.

Safety Precautions and Waste Handling:

1. See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.
2. All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local laws and regulations.
3. The toxicity of all compounds used in this method has not been established. Each compound must be treated as a potential health hazard. Care must be taken when handling the neat analyte standards. Gloves must be worn and the reagents must be prepared in a hood to avoid any skin or respiratory contact.
 - a. EDB and DBCP have been tentatively classified as known or suspected human or mammalian carcinogens.
 - b. Avoid skin contact with methanol because it is absorbed through the skin.
 - c. Information concerning the toxicity, properties, or special handling precautions for any compound can be found in the material safety data sheets available from the safety officer.
4. Safety glasses must be worn around the GC and in areas where solvents or extracts are present.
5. All solvent waste is collected in approved solvent waste containers in the laboratory and subsequently emptied by personnel trained in hazardous waste disposal into the lab-wide disposal facility.

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6. GC vials are disposed of in the lab container for waste vials, and subsequently lab packed.

Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each analyst performing instrumental analysis must work with an experienced analyst for a period of time until they can independently calibrate the instrument, use the chromatography data system to set up sequences, perform the calculations, interpret chromatograms, perform instrument maintenance, and enter data into the LIMS. Proficiency is measured through documented audits of the tasks listed and over checking of data as well as an Initial Demonstration of Capability (IDOC).

The IDOC consists of four LCSs that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. The IDOC criteria for Method 8011 is 60 to 140% using the average concentration of the MDLs. Various options are available for a DOC and can include four laboratory control samples or one blind sample. Refer to 1-P-QM-QMA-9015390 (LOM-SOP-ES-238) for more guidance on these options.

Sample Collection, Preservation, and Handling:

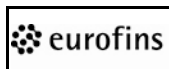
Samples are collected in glass jars with Teflon-lined lids. All samples are stored at 0° to 6°C, not frozen. Samples must be extracted within 14 days of collection. Extracts are stored at -10° to -15°C. Samples must be analyzed within 40 days of extraction.

NOTE: Samples from South Carolina must be analyzed within 14 days of extraction.

Apparatus and Equipment:

1. Agilent 7890 Gas Chromatograph or equivalent with ECD, autosampler, and automated splitless capillary injector

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2. Column A – ZB-MR1 30 m × 0.32 mm × 0.5 µm or equivalent
3. Column B – ZB-MR2 I 30 m × 0.32 mm × 0.25 µm or equivalent
4. Integrating system such as Chrom Perfect® by Justice Laboratory Software, or equivalent.

Reagents and Standards:

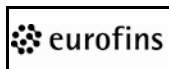
A. Reagents

1. Hexane – Optima grade, Fisher Scientific or equivalent. Store at room temperature.
2. UPC (ultra pure carrier) helium or hydrogen or equivalent for carrier gas.
3. UPC nitrogen or equivalent for detector make-up gas.

B. Standards

1. Unopened ampules are stored according to the manufacturer's instructions and are stable until the expiration date provided by the manufacturer.
2. 1,1,2,2-Tetrachlorethane stock - Accustandard catalog #M-502-44, or equivalent at a concentration of 196.70 ppm in methanol.
3. 1,1,2,2-Tetrachlorethane intermediate solution – Make a 100 fold dilution of the 1,1,2,2-Tetrachlorethane stock in hexane. This is stable for 6 months and must be stored in the freezer -10 to -15C.
4. EDB Instrument blank (EIBLK) – Prepare by placing 0.06 mL of 1,1,2,2-Tetrachlorethane intermediate solution into a 100-mL volumetric and bring to volume with hexane. This is stable for 6 months and must be stored in the freezer -10 to -15C.

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5. See extraction procedure, Analysis #13218, for calibration and QC standards.

Extraction:

See Analysis #13218

Gas Chromatographic Conditions:

The gas chromatographic system is set to the conditions similar to those stated below:

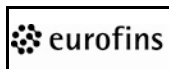
Detector:	ECD
Detector Temp:	300°C
Column Temp:	45°C, hold 1 min, 12°C/min to 120°C, 40C/min to280C
Carrier:	H ₂
Flow:	3.8 mL/min constant flow
Makeup Gas:	N ₂ at 100 mL/min
Injection Size:	1 µL splitless
Injection Temp:	225°C

The conditions listed are usually the optimum operating conditions, but may vary to improve the sensitivity, linearity, and overall chromatography or shorten run times on each GC system.

Calibration:

1. The GC analysis is performed using a dual column set up.
 - a. One injection of a sample or standard is split onto two analytical columns, a primary and confirmation column.
 - b. This approach allows the simultaneous generation of chromatograms from both columns.
 - c. Full calibration and calibration verifications are performed on both columns and the data is evaluated for compliance on both columns.

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2. Prior to starting a new calibration:

Fill the autosampler rinse vials with clean solvent or replace vials which appear dirty.

3. Prepare a sequence using the following suggested order of injections:

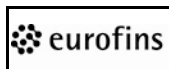
1. Conditioner (optional)
2. Instrument blank
3. STD Level 1
4. STD Level 2
5. STD Level 3
6. STD Level 4
7. STD Level 5
8. STD Level 6
9. MDL

4. Inject conditioner to prime the system (optional).

- a. Conditioner is best utilized when the GC has not been running and there is a gap in time prior to starting a set of injections.
- b. The conditioner is typically a standard or sample that has already been injected.
- c. The instrument blank is analyzed to check the cleanliness of the system prior to calibration.

5. Initial calibration (ICAL) – set up the calibration files in Chromperfect and evaluate as follows:

- a. An initial calibration is performed and this can be used as long as calibration checks remain within the 85% - 115% recovery criteria.
- b. Use at least five levels of calibration standards (concentrations of 0.35 µg/kg through 6.25 µg/kg are typically used).

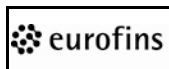
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- c. The average response factor can be used if the % RSD between the levels is $\leq 10\%$.
- d. Alternatively, a linear calibration curve can be used and must meet a correlation coefficient of 0.99 to be valid. The zero is set to ignore.
- e. However, if the correlation coefficient is <0.99 , a quadratic fit is tried.
 - (1) A 6-point calibration must be run to use quadratic.
 - (2) Prepare a sixth point somewhere within the established calibration range listed in the standards preparation section.
 - (3) The zero is set to ignore.
6. Ensure all peaks of interest are labeled and that the scaling is set such that peaks at the MDL are about 2 to 3 mm in height.
7. The retention time (RT) windows for the target analytes are established as $3\times$ the standard deviation determined over a 72-hour period of time, but not less than a minimum of 0.03 minutes applied to the initial calibration standard.

Procedure:

1. Prepare a sequence using the following suggested order of injections:
 1. STD Level 3, 4 or 5 rotated throughout the run
 2. Instrument blank
 3. Blank
 4. LCS (second source to validate the ICAL)
 5. LCSD
 - 6.-12. Continue running seven samples, including BKG, MS, MSD
 13. STD Level 3, 4 or 5
 14. Instrument blank
 - 15.-24. Continue with ten samples
 25. STD Level 3, 4, or 5
 26. Instrument blank

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2. Continue running sets of ten injections (samples, QC, blanks etc) followed by a continuing calibration verification standard (CCV) and an instrument blank.
3. CCV standards are run at the start of each day to verify the system is still in calibration, and every ten injections throughout a sequence.

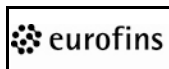
The response for each component must be within $\pm 15\%$ difference from the nominal concentration.

4. Any samples not bracketed by compliant check standards must be rerun after a new calibration has been performed.

Exception: If the response for a CCV is outside the criteria, high, and the associated samples do not have a detection for the analytes of interest, those samples do not need to be rerun.

5. All presumptive peaks on the primary column are confirmed on the second column. Both values are quantitated.
6. Results are typically reported from the ZB-MR1 column, which has been designated the quantitation (primary) column. A positive result is reported if the peak has confirmed on the ZB-MR2 column.
7. There may however be situations where it is more accurate to report a result for the ZB-MR2 column. These include:
 - a. A peak for a target analyte is detected in the expected retention time window on the ZB-MR1 column, but no peak is detected in the retention time window for that same compound on the ZB-MR2 column.
 - (1) In this case the confirmation column has ruled out the presence of the target analyte, and the data is reported as “non-detect” based on the ZB-MR2 column.

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- (2) The check standards must pass the recovery criteria for the analyte in question to be reported from the ZB-MR2 column.

- b. A peak for a target analyte is detected in the expected retention time window on the ZB-MR1 column, and is also detected in the retention time window for that same compound on the ZB-MR2 column. However, the calibration verification standard(s) is outside the recovery criteria on the ZB-MR1 column.
 - (1) In this case, if the ZB-MR2 column meets the calibration verification criteria (as well as initial calibration criteria); the data is reported from the RTX-CLP II column.
 - (2) Conversely, if no peak is detected on either the ZB-MR1 column or the ZB-MR2 column, but calibration verification standard(s) is outside the recovery criteria on the ZB-MR1 column but within the recovery criteria on the ZB-MR2 column, then a “non-detect” can be reported based on the ZB-MR2.

- c. In order to support these reporting scenarios, all batch QC must be evaluated on both columns if any data is to be reported from the confirmation column. All IDCs, DOCs, and MDLs must be maintained and evaluated per column. If significant interference is present, dilute the extract.

8. If negative peaks are present, baselines may need to be drawn manually. A hard copy printout of the changed baseline must be placed with the original chromatogram for documentation and review. Every effort must be made to set the integration events and parameters so that the majority of baselines are drawn correctly by the data acquisition system.

Calculations:

An external standard 6-point calibration curve is established using peak height. The concentrations are entered into the calibration table in µg/L. The data system uses the following equation to calculate the concentration in the extract:

1. Using average response factor (AVGRF):

$$X = \text{Sample Height} / \text{AVGRF}$$

Where:

X = Extract concentration

2. Using linear curve fit:

$$Y = MX + B \text{ which becomes } \dots X = \frac{(Y - B)}{M}$$

Where:

Y = Sample peak height

M = Slope of the calibration curve

B = Y-intercept

X = Extract concentration

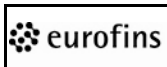
3. To calculate results in the as-received sample:

$$\text{Extract Concentration (X)} \times \frac{10 \text{ mL}}{\text{IW}} \times \text{DF} = \mu\text{g/kg in sample}$$

Where:

IW = Initial weight (g)

DF = Dilution factor if subsequent dilutions are made

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Statistical Information/Method Performance:

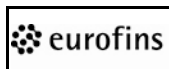
Generate method detection limits (MDLs) and limits of quantitation (LOQs) according to 1-P-QM-QMA-9017309 (LOM-SOP-ES-203). Perform an MDL study initially on each instrument used for the analysis. Determine the MDL by taking seven spiked replicates through the entire extraction and analysis procedure. Compare and pool results to determine the final reporting MDL. NELAC allows for an annual verification of the MDL in lieu of an EPA MDL study each year. The department supervisor maintains annual study data. Updates to the LIMS are made as needed by the QA department and only as directed by the technical management. The department database is updated via a download from the LIMS.

QC Acceptance limits are established as statistical limits. See 1-P-QM-PRO-9015496 (SOP-PP-025) for further information on monitoring and establishing limits.

Quality Assurance/Quality Control:

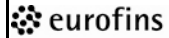
1. A reagent blank must be analyzed per batch (all samples extracted within a 24-hour period) or for every 20 samples, whichever is more frequent.
 - a. The blank must not contain the analytes of interest above the reported limit.
 - b. If reportable levels of any analytes are present, the source of the contamination must be determined. Samples must be re-extracted.
2. An LCS must be extracted for each group of twenty or fewer samples.
 - a. Acceptance limits are 60% to 140%.
 - b. If an analyte falls outside the acceptance range, reinject the LCS.
 - (1) If it is within the range, sample analysis may continue.

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- (2) If it is still outside the range, the samples associated with that LCS/LCSD must be re-extracted.
3. If sufficient sample is available, an MS/MSD must be analyzed per batch or for every 20 samples, whichever is more frequent.
 - a. Recovery must be between 60% and 140%.
 - b. If either analyte falls outside the acceptance range, but the LCS is within specifications, the data may be reported.
 - c. If the analyte is outside the range in both the LCS and the MS/MSD, then the source of the problem must be located and all samples must be re-extracted.
 - d. If samples are expected to contain target analytes of concern, then you may use an MS and a DUP of an unspiked field sample as an alternative to the MS/MSD.
 - e. If there is limited sample that prevents the preparation of the MS/MSD then, an LCS and an LCSD is performed.
4. All samples and QC are spiked with a surrogate (1,1,2,2-tetrachloroethane) to monitor extraction efficiency and the operation of the autosampler. Acceptance limits are derived statistically using three standard deviations.
5. See 1-P-QM-PRO-9015493 (SOP-PP-002 for QC) acceptance criteria and corrective action.

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Eurofins Document Reference	1-P-QM-WI -9018443	Revision	6
Effective Date	Jan 15, 2015	Status	Effective
Historical/Local Document Number	Analysis 6142, 6123, 6125, 10801, 6126, 6127, 6129, 6128, 6132, 6131, 6133, 6134, 6140, 6136, 6137, 6138, 6143, 6139, 6135, 6124, 6141, 6146, 6144, 6147, 6145, ...		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
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Reviewed and Approved by	Robert Strocko;Review;Wednesday, January 14, 2015 12:32:13 PM EST Barbara Reedy;Approval;Thursday, January 15, 2015 7:54:29 AM EST

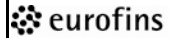
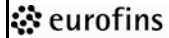
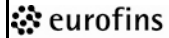
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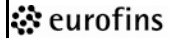
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Revision Log:

Revision: 6		Effective Date:	This version
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Throughout Document	Reflects re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers	
	No longer used	Removed CLP references.	
	New requirement	Added Uranium	
Definitions	Clarification	Added that the CCV is prepared from the same source as the calibration standards.	
Calculations	Clarification	Included information for 1-point MSA.	

Revision: 5		Effective Date:	Apr 11, 2014
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Definitions	Clarification	Updated Linear Range definition.	
Procedure	Clarification	Updated references for LR.	
Tables	Clarification	Updated LR, LLC and Prep Blank requirements.	

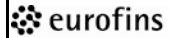
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Reference:

1. Method 200.8 (rev 5.4), Determination of Metals and Trace Metals in Water and Wastes by Inductively Coupled Plasma-Mass Spectrometry, USEPA 600/R-94/111 May 1994.
2. Test Methods for Evaluating Solid Wastes, SW-846 Method 6020, September 1994.
3. Test Methods for Evaluating Solid Wastes, SW-846 Method 6020A, February 2007.
4. Agilent 7500 Series ICP-MS ChemStation (G1834B) Operator's Manual.
5. Agilent 7500 Series ICP-MS Hardware Manual.
6. Agilent 7500 Series ICP-MS Tuning & Application Handbook.
7. Agilent 7500 Series ICP-MS Maintenance Video (DVD).
8. ESI SC Manual.
9. Perkin Elmer Elan 9000 Hardware Guide, 2001 & 2003.
10. Perkin-Elmer Elan Version 2.4 Software Guide, 2001.
11. Perkin-Elmer Elan Version 3.0 Software Guide, 2003.
12. *Chemical Hygiene Plan*, current version.
13. Agilent 7700 Series ICP-MS MassHunter Workstation Guide
14. Agilent 7700 Series ICP-MS Hardware Maintenance Manual

Cross Reference:

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Document	Document Title
1-P-QM-FOR-9007858	Nonconformance Form
1-P-QM-FOR-9009076	Working Instructions for Preparation of ICP-MS Solutions and Standards
1-P-QM-PRO-9015511	Liquid Sample Preservation
1-P-QM-QMA-9017309	Determining Method Detection Limits and Limits of Quantitation
1-P-QM-QMA-9017313	Establishing Control Limits
1-P-QM-QMA-9017325	Instrument and Equipment Maintenance and Calibration

Purpose:

The purpose of this SOP is to describe the proper analysis of aqueous and solid samples for metals by ICP-MS. This SOP also outlines the proper operation and maintenance of the ICP-MS instrumentation and provides consistent guidelines for the evaluation of ICP-MS data.

Scope:

This procedure applies to analyses performed in Environmental Sciences using ICP-MS for identification and quantitation of metallic constituents.


LOQs are based on annual statistical evaluation of laboratory data and are subject to change. The current MDLs and LOQs are maintained in the LIMS.

Limits of Quantitation are subject to change without notification.

Routine Methods:

Elements routinely analyzed on the Agilent 7500 and 7700 Series ICP-MS and/or the Perkin Elmer Elan 9000 ICP-MS include Eurofins Lancaster Laboratories Environmental analyses:

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Analyte	Mass	Soil Analysis #	Water Analysis #
Li	7	10803	10804
Be	9	6127	6027
B	11	10801	10802
Na	23	6143	6043
Mg	24	6136	6036
Al	27	6123	6023
P	31	10805	10806
K	39	6140	6040
Ca	44	6129	6029
Ti	47	6147	6047
V	51	6148	6048
Cr	52	6131	6031
Mn	55	6137	6037
Fe	57	6134	6034
Co	59	6132	6032
Ni	60	6139	6039
Cu	63	6133	6033
Zn	66	6149	6049
As	75	6125	6025
Se*	78	6141	6041
Se**	82	6141	6041
Rb	85	13172	13171
Sr	88	6144	6044
Zr	90	10807	10808
Mo	98	6138	6038
Ag	107	6142	6042
Cd	111	6128	6028
Sn	120	6146	6046
Sb	121	6124	6024
Ba	137	6126	6026
Tl	203	6145	6045
Pb 206	206	6135	6035
Pb 207	207	6135	6035
Pb 208***	208	6135	6035
U	238	13502	13501

*Se 78 is the mass reported from collision cell ICPMS only

**Se 82 is the mass reported from non-collision cell ICPMS only

***For Pb masses 206, 207 and 208 are summed for calibration and analysis

NOTE: All elements are available for analysis by any method. Precision and accuracy data is available upon request.

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Basic Principles:

ICP-MS is an analytical instrument that uses the energy of an inductively coupled plasma to generate ions to be analyzed in the mass spectrometer. Several different means are utilized for sample introduction.

The Perkin-Elmer Elan 9000 uses a computer controlled peristaltic pump that delivers the sample from the autosampler into a cross flow nebulizer attached to a Scott spray chamber.

The Agilent 7500 and 7700 use a discrete sampling system that first loads the sample into a Teflon sample loop. The sample is then pushed by a carrier solution using a computer controlled peristaltic pump that delivers the sample from the loop into the nebulizer attached to an electronically cooled cyclonic spray chamber.


The Agilent 7500 and 7700 can analyze samples in 3 different modes of operation:

Mode 1 – no gas. This mode does not use a collision or reaction gas. Elements with a low atomic mass or that have no interferences can be analyzed using the “no gas” mode.

Mode 2 – Helium (He) mode. This mode uses He as a collision gas for reliable, predictable removal of unknown matrix interferences. No new interferences are formed in the cell, and no analytes are lost by a reaction.

Mode 3 – Hydrogen (H₂) mode. This mode uses H₂ as a reaction gas, since it reacts quickly and efficiently with the Argon-based interfering species, but reacts slowly or not at all with the analyte of interest. In this mode, interferences can be reduced to the level of baseline noise, allowing lower detection limits to be achieved for some difficult elements.


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Definitions:

Batch and instrument QC


1. Analytical Batch – A group of field samples that are digested and analyzed together. A batch consists of no more than 10 samples for EPA 600 methods or no more than 20 samples for other methods.
2. Analytical Samples – Analytical sample is defined as any solution introduced into an instrument on which an analysis is performed, excluding instrument calibration, ICV, ICB, CCV, CCB, and tunes. Analytical samples include undiluted and diluted samples, matrix spike samples, duplicate samples, serial dilution samples, analytical spike samples, post-digestion spike samples, ICSs, LLCs, PBs, LCSs, and PEs.
3. Background Sample (U) – The original sample from which the batch QC is derived. The background sample is either site specific or randomly selected.
4. Continuing Calibration Blank (CCB) – A reagent blank run immediately after every CCV. This is used to monitor the stability of the low end of the calibration.
5. Continuing Calibration Verification (CCV) – A mid-range standard run at a frequency of 10% (every ten samples) throughout the run. It is prepared from the same source as the calibration standards and used to monitor instrument drift.
6. Duplicate Sample (D) – A replicate of the original sample processed in parallel. This sample is used to provide a measure of the in-lab repeatability (precision) of the analytical process. The duplicate sample is either site specific or randomly selected.

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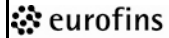
7. Initial Calibration Verification (ICV) – This is a standard near the middle of the calibration range prepared from a different source than the calibration standards. It is used to prove that the instrument is calibrated correctly at the start of the run.
8. Initial Calibration Blank (ICB) – This is a standard reagent blank used to prove that the low end of the calibration is acceptable. It must be run immediately after the ICV.
9. Interelement Correction Standard-A (ICSA) – A standard containing high concentrations of commonly interfering elements. It is used to assess the interferences due to matrix elements that are normally expected to be found in a sample.
10. Interelement Correction Standard-AB (ICSAB) – A standard containing both interfering elements and target analytes, run immediately after the ICSA. It is used to demonstrate the effectiveness of the correction factors in use.
11. Instrument detection limit (IDL)

EPA SW846 and EPA 600 Analyses – A value determined for the purpose of evaluating the ICB/CCBs for data package samples. It is determined by analyzing 7 standard solutions at a concentration 3× to 5× the anticipated IDL. This value must be obtained quarterly for each element analyzed on an instrument.

12. Laboratory Control Sample (LCS) – This is a matrix-matched synthetic sample of known composition. It is used to judge efficiency of the digestion procedure, as measured by the % recovery of the analytes.
13. Laboratory Control Sample Duplicate (LCSD) – This is a duplicate of the LCS. It is used to judge efficiency of the digestion procedure, as measured by the % recovery of the analytes. It is also used as a measure of the precision of the analytical process.

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14. Limit of Quantitation (LOQ) – The level above which quantitative results are obtained with a specified degree of confidence. It is based on a value 3× to 5× the MDL.
15. Linear Range (LR) – This is the highest sample concentration that can be analyzed by the method with criteria of +/- 10% of the true value. Sample results must be <90% of the true value of the linear range. Linear Ranges are analyzed quarterly.
16. Low Level Check Standard (LLC) – A low-level standard used to monitor the performance of the instrument near the detection limit.
17. Matrix Spike Sample (R) – A replicate of the original sample spiked with a known amount of analyte. This sample is used to determine if there are any matrix effects influencing analyte recovery during the digestion procedure. The matrix spike sample is either site specific or randomly selected.
18. Matrix Spike Duplicate (MSD) – A duplicate of the Matrix Spike Sample (R). This sample is used to determine if there are any matrix effects influencing analyte recovery during the digestion procedure. It is also used as a measure of the precision of the analytical process. The matrix spike duplicate sample is either site specific or randomly selected.
19. Method Detection Limit (MDL) – The minimum concentration of a substance that is reportable with 99% confidence that the analyte concentration is greater than 0. It is determined by analyzing 7 digested standards at an estimated concentration 2.5× to 5× the signal/noise ratio. MDLs are performed on all instruments used to determine each analyte. The MDLs are available in the LIMS system since they change frequently.
20. Post Digestion Spike (PDS) – This sample is a spike of the Background Sample prepared after digestion, at the time of analysis. It is used to determine if low spike recoveries are due to problems in the digestion or are matrix related.

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21. Preparation Blank (PB) – This is a reagent blank carried through the entire digestion procedure. It is used to determine if contamination has occurred during the digestion procedure.
22. Serial Dilution (SD) – This sample is a 1:4 (5×) dilution of the Background Sample, prepared after the digestion. It is used to indicate the presence of any matrix effects causing a nonlinear response at the instrument.
23. Analytical Value – Analytical reading obtained by the average of three instrument replicates.

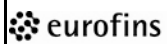
NOTE: A single point calibration, consisting of a blank and one standard, is the minimum number of points that is required for analysis. For samples that require a multi-point calibration, the calibration consists of a blank and three standards (see 1-P-QM-FOR-9009076 for prep of the multipoint standards). A single point calibration is used, except for samples requiring a multipoint calibration. These values are listed in the instrument method that is printed with each run.

Interferences:

ICP-MS interferences include isobaric elemental interferences and polyatomic ion interferences derived from the plasma gas, reagents, and/or sample matrix. The Agilent 7500 and 7700 utilize helium as an inert collision gas to reduce or eliminate many types of polyatomic ion interferences.

Physical interferences caused by the change in sample matrix affecting sample transport and/or nebulization must be compensated for using internal standardization.

Memory interference is the contribution of analyte signal from a previous sample onto the next sample analysis. Adequate rinse time of the sample introduction system overcomes any memory interference.

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Safety Precautions and Waste Handling:

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Preparing samples for inorganic analysis involves working with concentrated acids and other chemicals which are dangerous if not handled carefully:

Hydrochloric acid (HCl) – This acid can cause skin burns. Never mix HCl with concentrated H₂SO₄ to avoid a violent reaction. Always use in a fume hood.

Hydrofluoric acid (HF) – This acid is very toxic and absorbs through the skin without pain. Wear double nitrile gloves and handle the solution in a fume hood with assistance from your supervisor. If you spill any HF on your skin IMMEDIATELY FLUSH the affected area with water and dial 1-1-1 immediately. The initial rinse must last for 5 minutes, followed by a liberal application of calcium gluconate gel.


Double nitrile gloves must be worn while the gel is applied and massaged into the affected area. EMERGENCY CARE TREATMENT IS REQUIRED FOR ALL HF EXPOSURES. SEEK MEDICAL ATTENTION IMMEDIATELY (DIAL 9-1-1 OR GO TO THE NEAREST EMERGENCY ROOM.)

Hydrogen Peroxide 30% (H₂O₂) - This oxidizer can cause skin burns. Always use in a fume hood.

Nitric acid (HNO₃) – This acid can cause skin burns. Add nitric acid to samples in a hood to avoid exposure to toxic fumes.

When diluting strong acids, never add water to acid; always add acid to water.

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Store concentrated acids in the prep room acid lockers. Only acids are to be stored in these lockers. (Store solvents in the flammable liquid storage cabinet.) Some concentrated acids are kept in the acid reagent bottles on prep room counters. Fill reagent bottles in an operating fume hood using caution to avoid spills.

Use spill pillows to absorb large acid spills (small spills are cleaned with wet paper towels.) Use SPILL-X-A , soda ash or equivalent, to neutralize any remaining acid and then rinse the area thoroughly with water. Spill pillows and SPILL-X-A are stored on the prep room shelf. Soda ash is located in the stairwell adjacent to the prep room.

For small HF spills (a few drops) on the counter top or floor, dilute with water to reduce fumes given off, dust the spill with boric acid powder, and then follow up with copious water rinse. Boric acid powder is stored on the prep room shelf. **For all other HF spills, immediately evacuate the area and dial 1-1-1; full protective equipment is required to treat large HF spills.**

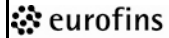
Dispose of acid waste properly. Collect all acid digestions, waste solutions, and expired reagent solutions in waste containers. When the acid waste containers are full, a designated acid waste handler transfers the waste to the acid neutralization tank.

Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability (DOC).

Initially, each analyst performing the instrumental analysis must work with an experienced analyst for a period of time until they can independently calibrate the instrument, use the sequence editor to set up the run, perform calculations, interpret raw data, and enter data into the LIMS. Proficiency is measured through documented audits of the tasks listed and over checking of data as well as an Initial Demonstration of Capability (IDOC).

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The IDOC and the DOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation.

Sample Collection, Preservation, and Handling:

- A. Aqueous samples - Aqueous samples are collected in plastic or glass containers with the exception of Drinking Water samples which are collected in 1-L plastic or glass containers. Aqueous samples are preserved with nitric acid and stored at 0° to 6°C not frozen. Samples must be digested within 180 days of collection for all Methods.
- B. Solid samples - Solid samples are collected in glass containers and stored at 0° to 6°C not frozen. Samples must be digested within 180 days of collection.
- C. pH Adjustment
 1. Upon receipt at the laboratory, Sample Storage personnel check the pH of water samples. If the pH is greater than 2, the pH of the sample is adjusted to a pH less than 2 following the protocol outlined in 1-P-QM-PRO-9015511.
 2. Samples requiring pH check immediately before digestion and analysis must be tested and if pH is greater than 2, the client service representative is notified. The client service representative must notify the client for direction on how to proceed with the sample (i.e. proceed as is or add more acid.)
 3. Dissolved Metals: Samples to be analyzed for metals requiring filtration at the lab must be submitted unpreserved. The sample is run through a 0.45 micron filter within 5 days of receipt and then for aqueous samples, samples are collected in plastic containers and preserved to a pH of <2 with HNO₃.
 4. Solid samples require no chemical preservation.
- D. Storage - Store sample digestates in plastic bottles at room temperature. Store standards and digestates separately.

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- E. Sample Discard - The general practice in the metals group is to discard the digestions after all the required metals from a batch of samples have been analyzed and verified in the LIMS. Samples which require the digestate to be held for long term storage are periodically evaluated for discard.

Apparatus and Equipment:

- A. The following is a list of the hardware used in the Agilent 7500, Agilent 7700 and Perkin-Elmer Elan 9000 ICP-MS systems.

1. Spectrometer

- a. The Agilent 7500ce is an inductively coupled plasma mass spectrometer. The sample introduction system consists of an ESI FAST discrete sampling system, Teflon nebulizer and electronically cooled spray chamber attached to a concentric quartz tube plasma torch.
- b. The Perkin-Elmer Elan 9000 is an inductively coupled plasma mass spectrometer. The sample introduction system consists of a Ryton crossflow nebulizer on a Scott spraychamber attached to a concentric quartz tube plasma torch.
- c. The Agilent 7700x is an inductively coupled plasma mass spectrometer. The sample introduction system consists of an ESI FAST discrete sampling system, glass concentric or Teflon nebulizer and electronically cooled spray chamber attached to a concentric quartz tube plasma torch.

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2. Autosampler


- a. The Agilent 7500 and 7700 systems use an ESI SC-8 FAST autosampler. The autosampler parameters for each automated run are entered into the Edit Sample Log Table interface editor in the ChemStation software (7500) or in the Sample List in MassHunter software (7700).
- b. The Perkin-Elmer AS-93*plus* autosampler has capacity for 149 samples and 8 standards. The autosampler parameters for each automated run are entered into the sample window of the Elan software.

3. Coolflow

- a. The Agilent 7500's G3292A Recirculating Chiller is set up to deliver cooling liquid to the ICP-MS at a regulated pressure of 60 psi.
- b. The Perkin-Elmer's Polyscience cooling system is set up to deliver cooling liquid to the ICP-MS at a regulated pressure of 50 psi.
- c. The Agilent 7700's G1879B Heat Exchanger is set up to deliver cooling liquid to the ICP-MS at a regulated pressure of 30 psi.

4. Computer

- a. The Agilent 7500ce is controlled by a Windows-based IBM compatible PC with ICP-MS ChemStation software installed.
- b. The Perkin-Elmer Elan 9000 is controlled by a Windows-based IBM compatible PC with Elan Version 2.4 or Version 3.0 ICP-MS software installed.
- c. The Agilent 7700x is controlled by a Windows-based IBM compatible PC with MassHunter software installed.

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5. Vacuum Pumps

- a. The Agilent 7500ce and 7700x both have a 3-stage vacuum system. A rotary pump evacuates the interface chamber; a turbomolecular pump evacuates the ion lens chamber; and a turbomolecular pump evacuates the analyzer chamber.
- b. The Perkin-Elmer has a rotary vane vacuum pump hooked up to the region between the sampler and skimmer cones. This pump maintains the interface region at approximately 4 torr of vacuum. In the quadrapole region, there is a dual inlet turbo molecular pump. This pump maintains the ion optic region at a vacuum of approximately 8×10^{-4} torr, and the mass filter region at a vacuum of approximately 1×10^{-5} torr.

6. Ultrasonic bath


7. Polishing paper (#400 and #1200)

8. Alumina powder

B. The following is a list of the apparatus necessary for the setup of an ICP-MS run for analysis:

1. ICP-MS run cover sheets. Cover sheets are generated using the IDAT Sequence Editor program in Parallax.
2. Test tube racks
3. 17×100 -mm polystyrene tubes
4. Graduated 15-mL polypropylene tubes and caps
5. 50-mL polypropylene screw cap tubes

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6. FilterMate 2 µm filters and plungers
7. 1 × 100 10-mL sterile disposable syringes
8. 25-mm syringe filters, PTFE, 0.45 µm
9. 30-mL polypropylene medicine cups
10. Adjustable electronic hand-held pipettes (10 - 5000 µL) - Fisherbrand® or equivalent.

NOTE: For routine operation, calibration, and maintenance of adjustable electronic hand-held pipettes, see 1-P-QM-QMA-9017325.

11. Fixed volume hand-held pipettes (25 – 2000 µL) - Eppendorf or equivalent.

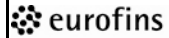
NOTE: For routine operation, calibration, and maintenance of fixed volume hand-held pipettes, see 1-P-QM-QMA-9017325

Reagents and Standards:

Refer to Form 1-P-QM-FOR-9009076 for reagent and standard information and the preparation of the following standard and solutions.

- A. ICP MS Standards
- B. ICP MS Initial and Continuing Calibration
- C. ICP MS LOQ Check Standard Solution (LLC)
- D. Interference Check Solutions
- E. Rinse/Carrier, Tuning and Calibration Solutions
- F. Internal Standard Solution

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G. PDS Solutions

H. Matrix Matched Standards

I. General Acids and Chemicals

Calibration:

A. Initial Calibration.

1. For the preparation and concentrations of calibration blanks and calibration standards see 1-P-QM-FOR-9009076.
2. For the frequency, acceptance criteria and corrective action see tables I, and II.

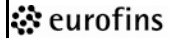
B. Initial Calibration Verification (ICV).

1. For the preparation and concentrations of ICV standard see Form 1-P-QM-FOR-9009076.
2. For the frequency, acceptance criteria and corrective action see tables I, and II.

C. Continuing Calibration Verification (CCV).

1. For the preparation and concentrations of CCV standard see Form 1-P-QM-FOR-9009076.
2. For the frequency, acceptance criteria and corrective action see tables I, and II.

D. Low Level Check Standards (LLC)

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1. For the preparation and concentrations of LLC standards see Form 1-P-QM-FOR-9009076
2. For the frequency, acceptance criteria and corrective action see tables I, and II.

E. ICSA/ICSAB

1. For the preparation and concentrations of ICSA/ICSAB standards see Form 1-P-QM-FOR-9009076
2. For the frequency, acceptance criteria and corrective action see tables I, and II.
3. As of 10/10/2012 due to the high total dissolved solids in these interference check solutions a rinse sample is analyzed after each ICSA/ICSAB pair for 6020A update 4.

Procedure:

A. Setting up an ICP-MS run

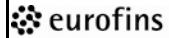
The procedure is the same for both the Perkin Elmer Elan 9000, Agilent 7500ce and Agilent 7700x instruments.

1. Determine the batches to be analyzed and determine any special requirements by viewing lab notes and/or project notes that are with the batch paperwork .

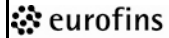
NOTE: An ICP-MS run typically contains no more than 60 tubes; however, it is acceptable to use more tubes than this, especially for clean matrix samples (i.e., undigested drinking water samples).

2. Open the Sequence Editor program from the IDAT menu in Parallax.

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3. Select “ICP-MS” in the Instrument Method drop down list.
4. Select the appropriate digest type and load the list of batches.
5. Select the appropriate template and batch and add the batch to the template.
6. The following information is added automatically by the Sequence Editor program.
 - a. Sample names include:
 - (1) PBW – Prep blank (water)
 - (2) LCSW – Laboratory control sample (water)
 - (3) LCSDW – Laboratory control sample duplicate (water)
 - (4) PBS – Prep blank (solid)
 - (5) LCSS – Laboratory control sample (solid)
 - (6) LCSDS – Laboratory control sample duplicate (solid)
 - (7) Lancaster Laboratories’ sample number
 - (8) CCV – Continuing calibration verification
 - (9) CCB – Continuing calibration blank
 - (10) LLC – Low level check
 - (11) ICSA – Interference check standard – A
 - (12) ICSAB – Interference check standard - AB

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(13) S0 – Calibration blank

(14) S1 – Calibration standard 1

(15) CCS – Carryover Control Standard

NOTE: A single point calibration, consisting of a blank (S0) and one standard (S1), is used for all analysis except samples requiring a multipoint calibration. When a single point calibration is used, the upper standard is at 100 ppb for all analytes reported by the method. For multipoint samples, a multi-point calibration is used consisting of a blank, 25 ppb, 50 ppb and 100 ppb standards.

- b. Initial volume (IV) – The sample aliquot digested. IV is not included on the cover sheet but is pulled from Parallax during import.
- c. Final volume (FV) – The final sample volume after digestion. FV is not included on the cover sheet but is pulled from Parallax during import.
- d. Dilution factor (DF) – The dilution factor of the sample prepared at the time of analysis, needed to bring the sample into the linear range of the instrument, to negate a matrix effect, or for serial dilutions. If dilutions other than the default dilution are required the analyst must change the DF for affected tubes prior to saving the sequence.
- e. Batch No. – The batch number of the sample. The Sequence Editor Program automatically inserts the batch number.

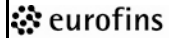
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- f. Protocol – The protocol used to review the data for specific method requirements in the IDAT database. Each template in Sequence Editor has a default protocol. If samples require a different protocol it must be changed for the appropriate tubes prior to saving the sequence.
 - g. SDG – Sample delivery group number for data package samples. SDG is not included on the run cover sheets.
 - h. Comments – Any description of the sample (from prep logs), status of the sample (i.e., RUSH, Promised) and due date are recorded here. The list of elements needed for the run is automatically inserted on the cover sheet by the Sequence Editor Program.
 - i. Lot numbers – Lot numbers must be recorded by the analyst at the start of the analytical run.
7. When setting up a run using the Sequence Editor Program, Batch QC (i.e., PB, LCS, background, duplicate, matrix spike, matrix spike duplicate, post-digest spike, and serial dilution) are automatically placed in a block of ten or fewer samples. If there is an LCS and LCSD, they are automatically placed one after the other.
- a. ICV/ICB must be analyzed immediately after the calibration curve.
 - b. CCV/CCB must be run after every ten analytical samples.
 - c. LLC, ICSA, ICSAB, CCV, CCB immediately follow the ICV/ICB and must conclude each run.

NOTE: As of 10/11/2012 for all DOD protocols, it is not necessary to analyze the ending ICSA/ICSAB and LLC check samples. This is for DOD only!

- d. Any deviations from protocol must be noted in the Comments Section of the cover page.

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- e. Verify that all information has been entered correctly.
- f. Save the file, this automatically generates the cover sheet.
- g. Add batch location and any comments to the cover sheet.
- h. Print the cover sheet.

B. Pouring an ICP-MS run

The procedure is the same for the Perkin Elmer Elan 9000, Agilent 7500ce and Agilent 7700x instruments.

It is important to minimize any chance of contamination, to both yourself and the samples. Keep your hands and the work area clean at all times. Wear appropriate PPE at all times.


NOTE: See Form 1-P-QM-FOR-9009076 for standards and solutions used during the analytical run.

1. Choose the appropriate run sheet. Record the following on the first page of the ICP-MS run sheet: initials, employee number, and the date.

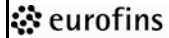
NOTE: When retrieving the batch from the shelf for the first time, record the batch location on the cap of the prep blank in black sharpie. This saves time when returning the batch to the proper location after analysis. To prevent more than one batch being assigned to the same location a card system is used – when no batch is assigned to a location the card is placed on the shelf with “OPEN” facing up; when a batch is assigned a location on the shelf the card is placed on the shelf with “IN USE” facing up. Leave the card on the shelf whenever the batch is removed for pouring or analysis. When samples are discarded the corresponding card is flipped to “OPEN”.

2. Batches prepared in hotblocks (50-mL digestion cups only)

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- a. The only tubes that need to be poured for the initial run are the PDS (UP) and serial dilution (UL).
 - b. All other samples remain in the 50-mL digestion cups for analysis.
3. Samples that need to be poured into test tubes.
 - a. Obtain the appropriate number of tubes.
 - b. Number each tube with the sample number, dilution factor and batch location.
 - c. Place them in test tube racks.
 - d. The analyst must ensure that tubes are labeled correctly, that dilutions are performed accurately, and that the dilutions are recorded on the run cover sheet.
4. Post-digest spike (PDS)
 - a. PDS is required for each batch (sample volume permitting).
 - b. A PDS is prepared by placing 0.2 mL of the appropriate PDS solution into a 14 mL graduated test tube and bringing to a volume of 10 mL with the background sample.
 - c. Record the volume and lot number of PDS solution used as well as the final volume in the comments column of the ICP-MS run sheet.


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5. Serial dilution (SD)

- a. Prepare the SD by diluting the background sample at a dilution that is equal to 5× the dilution factor of the background sample (i.e. if Bkg = DF1, SD must = DF5; if Bkg = DF5, SD must = DF25).
- b. Document the volume of background sample used as well as the final volume in the comment section.

6. Filtering samples

- a. Samples that are cloudy or have particulate suspended in solution must be filtered prior to analysis to prevent clogging of the sample introduction system, which causes run failures and instrument down time to correct the problem.
- b. Samples that are digested using the 50 mL hotblock tubes need to be filtered using the FilterMate filtration devices and plunger.
- c. Attach a filtration device to the plunger and very carefully insert the filter into the hotblock tube until the filter reaches the bottom of the digestion tube.
- d. Remove and discard the plunger.
- e. An alternative for samples in any type of vessel is to filter using a 10-mL sterile disposable syringe fitted with a 0.45 µm PTFE syringe filter.
- f. If any samples are filtered, the prep blank must also be filtered.
- g. Document all filtrations on the run cover sheet.

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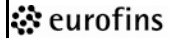
NOTE: It is not necessary to filter all samples (in hotblock tubes only) that contain particulate, as long as all of the particulate is settled to the bottom of the tube below the 5 mL mark in 50 mL digestion vessels. The sampling depth of the autosampler probe is set such that the tip of the probe is approximately 1 cm above the bottom of the digestion tube.

7. Verify that all samples in the hotblock tray are in the correct position and/or pour each sample (or sample filtrate) into the appropriate tube. Usually, the order of the batch QC is PB, LCS, (LCSD), Bkg, PDS, DUP, MS, (MSD), and SD. Most importantly, the actual positions of the samples in the tray must match the autosampler table used for analysis.

NOTE: Immediately prior to beginning analysis, the analyst must visually verify that each sample is in the position indicated in the autosampler table used for the run.

8. If not being analyzed immediately, cover any poured tubes with plastic wrap to prevent contamination of the samples (hotblock tubes and dilutions prepared in graduated test tubes must be capped tightly except during pouring and/or analysis).
9. Return samples to sample storage, being sure to place the batch back into the location recorded on the batch sheet.
10. NOTES:
 - a. A PDS and a SD are performed on one sample in each digestion batch. Typically, the background sample is chosen. If the batch QC is split between two samples, the PDS is performed on the background sample accompanied by a matrix spike; the SD is performed on the background sample accompanied by a matrix duplicate. If sample volume is limited, it is acceptable to use the duplicate for the PDS and SD.
 - b. Batches with only field blanks or equipment blanks do not need a PDS or a SD.

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- c. Air filter batches need only a SD on one sample in the batch (a PDS is not required).
- d. “As Received” samples are analyzed with a blank and LCS, LCSD (prepared by the analyst). These “batches” are assigned a batch number by the analyst and recorded into the departmental LLENS system and is uploaded to parallax.
- e. Documentation is of utmost importance. Verify all entries.


Instrument Operations:

A. Startup, Shutdown and Status of the Agilent 7500ce ICP-MS

NOTE: When referring to menus in the procedure below “ChemStation menu” refers to the pull down menus at the top of the ChemStation software window. Other menus are referred to by the name that appears in the title bar of any window that opens within the ChemStation software.


NOTE: ChemStation limits file and folder names to a maximum of 8 characters. Any time the user is prompted by this procedure to save a file or folder while using ChemStation the file or folder name must not exceed 8 characters. Refer also to pages 4-78 in the ChemStation Operator’s Manual for a list of special characters that must not be used when naming files and folders within ChemStation.

1. To open the ChemStation software:
 - a. If not already active, double-click on the “ICP-MS Top” icon on the computer desktop to start the software. Alternatively, single click on the “ICP-MS Top” icon in the Quick Launch bar.
 - b. Activate the Instrument Control window by selecting the appropriate icon at the top of the screen or by selecting *Instrument >> Instrument Control* from the ChemStation menu.

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2. Startup of the Agilent 7500ce ICP-MS:


- a. There are three states from which the Agilent 7500ce is started: unplugged (i.e. cold), shutdown mode, and standby mode. The current mode is displayed in the title bar of the Instrument Control window. See Chapter 3 of the ChemStation Operator's Manual for more detailed instructions.
- b. Check that the waste drain vessel is not full, and has adequate space remaining to complete the automated run without overflowing.
- c. Check that the sample, internal standard, and drain lines are attached to the peristaltic pump and that all tubing is connected properly.
- d. Check to see that there is adequate internal standard solution to complete the entire automated run.
- e. Check to see that the autosampler rinse vessel has sufficient rinse for duration of the automated run. If not, refill with the appropriate rinse solution. The carrier solution probe and the internal standard probe are placed in a bottle containing reagent water.
- f. If a cold startup is required refer to p. 3-3 in the ChemStation Operator's Manual. Continue to the next step only after confirming that the instrument is in Shutdown mode.
- g. To start the instrument from Shutdown mode select *Vacuum >> Vacuum On* in the Instrument Control window. Select "Yes" to confirm this action. Once the vacuum chamber reaches the correct pressure of approximately 5×10^{-4} Pa the instrument goes into Standby Mode.

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- h. To start the instrument from Standby Mode, first verify that the instrument coolflow is on. *Select Plasma >> Plasma On* in the Instrument Control window. Once the interface vacuum has reached approximately 4.5×10^{-2} Pa and the plasma is lit, the instrument switches to Analysis mode.
- i. Allow the instrument to warm up for at least 15 minutes if the plasma has been off for 15 minutes or less. Allow at least 30 minutes of warm up time if the plasma has been off for more than 15 minutes.

B. Agilent Tuning and set up of the ChemStation software

1. Open the ChemStation software if not already open.
2. Analyzing the Daily EPA Tune sample
 - a. Tuning must only be done after the instrument has been allowed to warm up as described above in Instrument Operations, section A.2.i. In the ESI software “FAST Control Enabled” must be unchecked during analysis of the EPA Tune sample.
 - b. Place the carrier probe into the EPA Tuning Solution (10 ppb Ba, Cd, Ce, Cu, In, Mg, Pb, Rh and U). The internal standard line must remain in the reagent water bottle, and the analyst must ensure that there are no air bubbles in either line during analysis of the tuning solution.
 - c. Select *Sequence >> Load and Run Sequence* from the ChemStation menu. Choose “EPA_Tune.S” from the file list and click “OK”.

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- d. In the Start Sequence window, type in your user ID (i.e., abc01234) as the operator name. Note that the default Data Batch Directory path is "C:\ICPCHEM\1\DATA\[NAME].B\", where [NAME] is the folder name assigned by the Agilent software. Change the directory path to "D:\ICPCHEM\1\DATA\YYDDD##.B\", where "YY" is the two digit year, "DDD" is the Julian day, and "##" is the tune number. Once these changes have been made, click "Run Sequence".
- e. Once the analysis of the Tuning sample is complete, a Tune Report prints. Verify that the Tune Result is "Pass" and use the Offline Data Analysis to generate a data file for import into Parallax. This file must then be imported using the IDAT ICPMS Tune Data program in Parallax prior to importing sample runs for that day. Keep the passing Tune Report for reference and recycle any previous Tune report(s).


NOTE: If the Tune Result is "Fail," repeat steps c. and d. above. If a second Tune failure is encountered, evaluate whether maintenance or optimization are required.

- f. Once the Tune data file is imported the Tune Report is automatically appended to the run report for any additional runs.


NOTE: The EPA Tune sample is analyzed once at the beginning of each day **OR** after any maintenance, before starting any analytical runs (even if the EPA Tune sample has been analyzed earlier on the same day).

- g. Tuning and optimization of the Agilent 7500ce ICP-MS

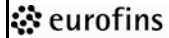
NOTE: The manuals and software refer to the various instrument optimization parameters as "Tuning". This differs from the EPA Tuning described in this section.

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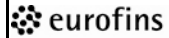
- (1) Tuning and optimization are performed on an as needed basis, either as corrective actions for poor instrument performance or as required steps following instrument maintenance.
 - (2) Refer to the Agilent 7500 Tuning Manual for complete details on instrument tuning procedures.
3. After analysis of the EPA Tune sample is complete, place the internal standard line into the internal standard solution. The carrier probe must now be placed in the Carrier Solution bottle. Before commencing sample analysis "FAST Control Enabled" must be checked in the ESI software.
4. Load the method to be used for analysis by selecting *Methods >> Load* from the ChemStation menu. Double-click the method that you wish to use in the Select Method File window that appears. In the Select Calibration File window, verify that the selected calibration file has the same name as the method you selected; then click "OK".
5. Next load, edit, save and print the sample sequence. Procedure 5.a. describes how to do this using the online Edit Sample Log Table interface in the ChemStation software. Procedure 5.b. describes how to enter sequences using the Offline version of the Edit Sample Log Table and how to utilize the Chained Sequence.
 - a. How to enter a sequence using the online Edit Sample Log Table interface:
 - (1) Open a sequence for editing by first selecting *Sequence >> Load* from the ChemStation menu.
 - (2) Choose an appropriate file from the list; then click "OK".
 - (3) If it is a new sequence you must rename the file.

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- (4) Select *Sequence >> Save* from the ChemStation menu and enter an 8 digit file name using the Julian day, digest, and last digit from the batch number.
- (5) Next select *Sequence >> Edit Sample Log Table* from the ChemStation menu.
- (6) Double-click on the “1” in the first row in the column on the far left of the Edit Sample Log Table window.
- (7) Right click anywhere in the sequence and select “Load list from CSV file”.
- (8) Navigate to the IDAT Sequences folder and select the appropriate batch number and click Open.
- (9) If you need to change the method choose a method by double-clicking on the first row in the “Method” column.
- (10) Choose a method from the list; then click “OK”.
- (11) Select all the cells in the “Method” column starting with the cell in the first row down to the cell in the last row of the sequence.
- (12) Right-click on the selection; then select “Fill down” to copy the method from the first cell into the rest of the selection.
- (13) Note that the correct sample positions for the SC-8 autosampler are not currently populated by the Sequence Editor program.
- (14) Select an appropriate template from the “Default Positions for SC-8” folder in the taskbar and copy and paste the positions into the sequence.

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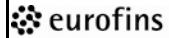
- (15) Select the S0 through the last sample in your run, press Ctrl-C, and then switch to the Edit Sample Log Table window, select the cell that corresponds to the calib blank in the Vial column, and press Ctrl-V.
 - (16) Add any additional rinse or conditioning tubes to the beginning of the sequence as needed.
 - (17) Once you have verified that all information has been entered correctly, click "Print" in the lower right corner of the Edit Sample Log Table interface.
 - (18) Click "OK" to return to the main ChemStation window.
 - (19) Then select *Sequence >> Save* from the ChemStation menu. When prompted as to whether you wish to overwrite the existing file select "Yes" (the file name already corresponds to the batch number on the cover sheet).
 - (20) After double checking the entries on the printed Sample Log Table, initial the top of the printout.
- b. How to enter a sequence using the offline Edit Sample Log Table interface and using the Chained Sequence in ChemStation:
- (1) The Chained Sequence function in ChemStation allows the analyst to add a sequence to a queue while a run is in progress. This allows the next run to commence as soon as the current run completes minimizing gap times between runs. It is also used to allow for unattended analysis during an off shift taking full advantage of the multibatch capacity of the SC-8 autosampler.
 - (2) Setup your first run using the instructions above in part a, steps (1) through (20).

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- (3) Commence analysis by selecting “Chained Sequence” then “Edit and Run” from the ChemStation menu.
- (4) Add the appropriate sequence, and edit the Data Batch and Tune file fields.
- (5) Once you have loaded the autosampler, click “Run” on the Edit Chained Sequence window to begin analysis. The autosampler immediately moves to the first vial in your sequence.
- (6) While analysis of the first run continues, setup additional sequences using the offline version of the Edit Sample Log Table and add them to the Chained Sequence by editing the Sequence File, Data Batch and Tune file fields as needed.
- (7) To open the offline Edit Sample Log Table chose “ICPMS Offline ChemStation” and “Edit Sample Log Table” from the Programs folder in the Start menu.
- (8) Click the “Load” button at the bottom of the screen.
- (9) Follow the “Shortcut to Sequence on D” to get to the folder where ChemStation sequences are stored and open an appropriate sequence. If the batch is being analyzed for the first time the file must be immediately renamed; click the “Save” button at the bottom of the Edit Sample Table window and enter an 8 digit file name that corresponds to the batch number on the cover sheet. Do not overwrite any sequence that has already been added to the chained sequence.
- (10) Double-click on the “1” in the first row in the column on the far left of the Edit Sample Log Table window. Continue to edit and print the file as outlined in steps (7) through (14) in procedure 5a above.

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- (11) Save the sequence by clicking the “Save” button at the bottom of the window. When prompted as to whether you wish to overwrite the existing file select “Yes” (the file name already corresponds to the batch number on the cover sheet).
 - (12) Click “Exit” at the bottom of the window to exit the offline Edit Sample Log Table.
 - (13) Add the sequence to the Chained Sequence and load the autosampler for the newly added sequence. Be sure to use the next blank line in the Chained Sequence window each time you add a new sequence.
 - (14) After double-checking the entries on the printed Sample Log Table, initial the top of the printout.
6. Before beginning analysis, the analyst must visually verify that all sample numbers and vial positions on the printed Sample Log Table correspond to the samples and standards as loaded on the autosampler prior to initialing the top of the printout. If changes are needed during the run sequence the analyst must print the modified Sample Log Table, and confirm that the changes on the printout match what is on the autosampler. Keep the original and any modified Sample Log Table printouts with the run until verification is complete.
 7. Verify that the appropriate Sequence is loaded by viewing the selections shown in the drop down menus across the top of the ChemStation software. Access the drop-down menus to quickly select the appropriate files if they are incorrect. Alternatively verify the correct sequence(s) is loaded in the Chained Sequence window.
 8. Place the standards and samples in the appropriate locations on the FAST SC-8 autosampler.

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- a. The autosampler positions ("Vial" column in the Sequence) are defined as follows:

Standard ID	Vial	Sequence #	Tube type
S0 (Blank)	2101	1	17 × 100-mm Tubes
S1 (Standard 1)	2102	2	17 × 100-mm Tubes
ICV	1101	3	50-mL Screw Cap Tubes
ICB/CCB	1102	4/9	50-mL Screw Cap Tubes
LLC or CRI	1103	5	50-mL Screw Cap Tubes
ICSA	1104	6	50-mL Screw Cap Tubes
ICSAB	1105	7	50-mL Screw Cap Tubes
CCV	1106	8	50-mL Screw Cap Tubes
Samples	Racks 3, 4, & 5*	10+	50-mL Screw Cap Tubes
Samples	Rack 2*	10+	17 × 100-mm Tubes

*The Vial positions in each Rack are defined by a four digit number: the first digit is the Rack number, the second digit is the column number, and the last two digits are the row number. For example, the first tube in column 1 of Rack 1 is 1101; the first tube in column 1 of Rack 4 is 4101; etc. Rack 1 contains the run QC standards in 50-mL Screw Cap Tubes and the Vial positions are 1101-1107 (matrix D standards); 1201-1207(matrix H standards); & 1301-1307 (matrix F standards). Rack 2 is used for calibration standards, PDS, serial dilution, dilutions, and any other samples using 17 × 100-mm Tubes and Vial positions are 2101-2112; 2201-2212; 2301-2312; 2401-2412; & 2501-2512. Racks 3, 4 and 5 are used for samples in 50-mL digestion vessels in the Grey Foam Trays. Rack 3 uses Vial positions 3101-3105; 3201-3205; 3301-3305, 3401-3405 & 3501-3505. Rack 4 uses Vial positions 4101-4105; 4201-4205; 4301-4305, 4401-4405 & 4501-4505. Rack 5 uses Vial positions 5101-5105; 5201-5205; 5301-5305, 5401-5405 & 5501-5505. There are also 10 Vial positions along the back of the autosampler that are designed for 50-mL Screw Cap Tubes, and these Vial positions are 1 through 10.

- b. S0 and S1 must be poured fresh immediately prior to starting each analytical run. The check standards in Rack 1 are refilled as needed and must be kept capped when not in use.

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- c. Samples in the gray foam hotblock trays are placed directly on the autosampler using racks 3, 4, or 5.
- d. For solid batches (10637, 5708) requiring dilution, samples must be poured into 17 × 100-mm Tubes and placed in Rack 2.
- e. The sample log table used for analysis must be printed prior to commencing analysis. As each sample is placed on the autosampler, verify that the autosampler position on the table matches the placement of the tube.

NOTE: Any poured tubes must be labeled using the sample number, dilution factor and batch location; the pourer is responsible for making sure the samples are poured in the correct tubes and placed in the correct autosampler position.

9. Verify that all standards are the correct matrix and are in the correct autosampler tray position; they must not expire before they are analyzed in the run sequence.
10. Select *Sequence >> Run* from the ChemStation menu.
 - a. In the Start Sequence window type in your user ID (i.e., abc01234) as the operator name. Note that the default Data Batch Directory path is "C:\ICPCHEM\1\DATA\[NAME].B\\"", where [NAME] is the folder name assigned by the Agilent software.
 - b. The directory path must be changed to D:\ICPCHEM\1\DATA\[NAME].B\\"",. Verify that the data folder selected is unique from any previous runs.
 - c. Once these changes have been made, click "Run Sequence".

NOTE: To minimize downtime between analytical runs, it is acceptable to start the analytical run prior to pouring any of the samples. Setup the

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run as described above in Section D, pour the S0 and S1 and start the analytical run. Place the appropriate check standard cups in the autosampler, then proceed to pour the run using the printed autosampler table as a guide (record the appropriate information on the run cover sheet as you setup the standards and pour the run).


C. Operation of the Perkin-Elmer Elan 9000

1. To operate Elan software:


If not already active, double click on the Elan icon on the computer desktop to start the software.

2. Warm start-up of the Perkin-Elmer Elan 9000 ICP-MS:

- a. Open the Instrument window and select the Front Panel tab.
- b. Verify that the System Status is “Ready”. If the System Status is “Not Ready”, click on the Diagnostics tab to find which parts of the system are not operating within specs. (See Section 14 of the Elan Version 2.4 Software Guide for further use of the diagnostics.)
- c. Check that the waste drain vessel is not full, and has adequate space remaining to complete the automated run without overflowing.
- d. Check that the sample, internal standard, and drain lines are attached to the peristaltic pump and that all tubing is connected properly.
- e. Check to see that there is adequate internal standard solution to complete the entire automated run.
- f. Check to see that the autosampler rinse vessel has sufficient rinse for duration of the automated run. If not, refill with the appropriate rinse solution.

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- g Both the sample and internal standard sipper probes must be placed in the 2-L bottle filled with reagent water.
 - h. Open the Instrument window and select the Front Panel tab. Check that the vacuum pressure reads between 1×10^{-6} Torr and 2×10^{-6} Torr. Pressure significantly lower or higher indicates a potential instrument hardware problem.
 - i Click on the “PLASMA START” button on the Front Panel tab. The plasma ignites within 20 seconds.
 - j After the plasma has ignited, open the Devices window and set the peristaltic pump speed to -24 rpm. If plasma fails to ignite, refer to Elan Software Guide section 2 “What to Do if Ignition Is Unsuccessful.”
 - k. Allow plasma to warm up for 10 to 15 minutes if system has been down for 15 minutes or less. Allow at least 30 minutes of warm up time if system had been down for more than 15 minutes.
3. Cold start-up of the Perkin-Elmer Elan 9000 ICP-MS
- a. This procedure is used when the system has been down for an extended time period and the vacuum pumps have not been running.
 - b. Check oil levels in both vacuum pumps before proceeding.
 - c. Refer to Section 2 to 3 of the Elan Software manual for detailed instructions for starting up the instrument.

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D. Perkin-Elmer Tuning and set up of Elan software


1. Open the Elan software if not already open.

NOTE: When the Elan software is first started, the analyst must always check to see that the tubing saver mode is disabled in the Devices window. The analyst must also verify that the correct sample details are entered in the Manual tab of the Sample window.

2. Daily Tuning.

- a. After the instrument has been allowed to warm up, choose “Open Workspace” from the “File” menu and open “Daily Tuning.wrk.”
- b. Aspirate the Elan 6100 Setup/Stab/Masscal Solution (10 ppb Mg, Cu, Rh, Cd, In, Ba, Ce, Pb, and U; before use each new bottle is also spiked with 0.2 mL of 1000 ppm Li for a concentration of 200 ppb Li). Be sure that both the sample probe and internal standard probe are placed into the solution. Allow the solution to flush until all air bubbles have traveled through both sample and internal standard lines. Cu, Ba, and Cd are not used in the evaluation of the instrument tuning.
- c. Select the method and change the report filename using the 2 digit year, Julian Day, Tune number format (i.e., 0612301.TN#, where # is the instrument designation). Make sure the “Send to File” checkbox is checked; then save the method.
- d. Select the Tuning window. Make sure the “Peak Width Only” box is checked, and click “TUNE MASS SPEC.” Five replicates of the Tuning solution are analyzed. Widths read back ≥ 0.64 and ≤ 0.66 amu. Verify that the Measured Mass is within ± 0.1 amu of the Exact Mass. Check the Summary section and verify that the RSD is less than 5 for masses 6, 24, 103, 115, 140, 208, and 238. The Daily Tuning check is considered acceptable only when the Peak Width, Measured Mass, and RSD meet the specified criteria.

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NOTE: RSD is calculated using 5 replicates.


NOTE: The Measured Mass values only change when a Mass Calibration is performed (i.e., tuning is performed with the “Peak Width Only” box unchecked), usually as part of optimization procedures. Thus, the Measured Mass values are usually already within the specified range. If not, perform a Mass Calibration (refer to the Elan version 2.4 Software Guide, p. 3-16). A Mass Calibration is only performed after any instrument maintenance issues have been addressed.

- e. If peak widths fall outside of the specified range, they are adjusted by changing the RDAC Value. To lower the measured peak width by 0.01, raise the RDAC Value by 3 and vice versa. The new RDAC values are also determined by using the Excel spreadsheet “Tuning Calculator” located in K:\SHRDATA\ICP-MS. Separate spreadsheets are designated for each of the ICP-MS instruments in use.

Enter the Measured Peak Width values from the Tuning window into the “Measured Peak Width” column in the Excel spreadsheet. Enter the values from the “New DAC Value” column (in the Excel spreadsheet) into the appropriate RDAC Value cell in the Tuning window. After changing the appropriate RDAC values, save the tuning file (select “File”→“Save”) and click “TUNE MASS SPEC.” Repeat this process until all widths read back between 0.64 and 0.66 amu. Always save the tuning file before proceeding to Daily Performance.

NOTE: See Figure 1 for acceptance criteria.

NOTE: This check is performed once at the beginning of each day **OR** if maintenance is performed this check must be done after maintenance, before starting any analytical runs (even if Tuning has been done earlier on the same day).

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- Once daily Tuning passes criteria, choose “Open Workspace” and open “Daily Performance.wrk.” Continue to aspirate the Elan 6100 Setup/Stab/Masscal Solution. Type “Daily Performance” in the Sample Name field and click “ANALYZE SAMPLE.”

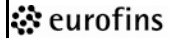
NOTE: This check is performed once at the beginning of each day OR if maintenance is performed this check must be done after maintenance, before starting any analytical runs (even if Daily Performance has been checked earlier on the same day). The criteria listed in Attachment I are posted as guidelines regarding general instrument performance. Achieving these criteria is not a prerequisite for sample analysis; however, they serve as indicators of the need for instrument maintenance and optimization. Run and batch QC are used to verify that the instrument performance is acceptable for each analytical run.

- After Tuning and Daily Performance checks are complete select the Sampling tab in the Method. Click the “PROBE” button. The “Autosampler Probe Control” window appears. Click the “GO TO RINSE” button, then click “OK.” This returns the autosampler arm to the rinse station. Verify that the pump for the instrument rinse is turned on. Place the internal standard probe in the internal standard solution and place the sample probe into the rinse station (through the autosampler arm). If an acceptable Tuning is not achieved refer to the appropriate Elan Software Guide and/or the Elan 9000 Hardware Guide for troubleshooting the problem.
- Before each analytical run begins, print a copy of the most recent Daily Performance Report for that day. A copy of the Tuning report automatically prints with each run when the run is imported.

NOTE: The Tuning data file must be imported to the IDAT database in Parallax prior to importing data for the first analytical run.

To reprint the Daily Performance Report open “Daily Performance.wrk”, select the Dataset window, highlight the last row of data, and click the “Reprocess” button.

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6. Chose “Open Workspace” from the “File” menu and open the appropriate workspace. Typically “~Main 1.wrk” is used for the first run of the day; “~Main 2.wrk” is used for the second run of the day; etc.
 - a. Select the Method window and open an appropriate method.
 - b. Select the Sampling tab and change the rinse times to an appropriate value.
 - c. Click the Report tab on the right hand side of the Method window.
 - d. Under the section titled “Report to File”, change the Report Filename to the appropriate IDAT run # (i.e., c:\import\0612301.E01). The file name must end in “.E0#”, where # is the instrument designation.
 - e. Select “Append” then save the Method using “File”→“Save”.
 - f. Print the method file using the “MethodReport.rop” report options file.
7. Select the Sample window.
 - a. Open the appropriate sequence from the IDAT Sequences folder. All necessary fields are pre-filled by the Sequence Editor program at the time the sequence is created in Parallax.
 - b. “Wash (sec)” (i.e. rinse time) are adjusted depending on the sample matrix, but is the same throughout the entire run. A rinse time of 60 seconds is usually sufficient for most samples. If the run ends during your shift set “Wash Speed” value to -24 for the last tube in the run sequence. Optionally, a wash speed of -1 is used for the last tube in the run to reduce waste when the instrument is unattended.
 - c. When all information is verified in the Sample window save the file using “File”→“Save”. Print the Sample file and double check all entries.

8. The autosampler positions (A/S) are defined as follows:

Standard ID	A/S	Sequence #	Tube type
S0 (Blank)	9	1	17 × 100-mm Tubes
S1 (Standard 1)	10	2	17 × 100-mm Tubes
CCS	2	4	50-mL Screw Cap Tubes
ICV	3	5	50-mL Screw Cap Tubes
ICB/CCB	4	6/11	50-mL Screw Cap Tubes
LLC or CRI	5	7	50-mL Screw Cap Tubes
ICSA	6	8	50-mL Screw Cap Tubes
ICSAB	7	9	50-mL Screw Cap Tubes
CCV	8	10	50-mL Screw Cap Tubes
Samples	11-157	12+	17 × 100-mm Tubes
Samples	158-182	12+	50-mL Screw Cap Tubes

- S0 and S1 must be poured fresh immediately prior to starting each analytical run. The check standards in A/S 1-8 are refilled as needed and must be kept capped when not in use.
- Samples begin at Sequence #12 and utilize A/S positions 158 to 182 when analyzed in the gray foam hotblock trays (containing up to 25 x 50mL digestion cups).
- A/S positions 11 to 37 are used for any dilutions or PDSs (poured into 17 × 100-mm Tubes) when a hotblock tray is used.
- For sample batches not using the hotblock trays, samples are poured into 17 × 100-mm Tubes and placed in positions 38 to 157.
- The autosampler table used for analysis must always be printed prior to placing the samples on the autosampler. As each sample is placed, verify that the autosampler position on the table matches the placement of the tube in the sample racks (the numbered autosampler trays are used whenever possible).

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9. Verify that all standards are the correct matrix, are in the correct autosampler tray position and have sufficient time until expiration to complete the run.
 - a. Open the Calibration View window and open a new calibration file using "File"→"New." If prompted to save the calibration file select "No." If prompted to clear blank and remove calibration information, always select "Yes."
 - b. Select the "Sample" window, save the sample file, and then save the workspace.
 - c. Highlight all samples to be run, and click "Analyze Batch." The system runs the Blank and calibration standard, then check standards and samples.
 - d. If prompted to clear QC data and/or all existing Blank/Calibration data, always select "Yes."

NOTE: To minimize downtime between analytical runs, it is acceptable to start the analytical run prior to placing any of the samples. Setup the run as described above in Section D, pour the S0 and S1 and start the analytical run. Place the appropriate check standard cups in the autosampler, then proceed to load the autosampler using the printed autosampler table as a guide (record the appropriate information on the run cover sheet as you setup the standards and pour the run).

NOTE: The instrument methods used for sample analysis are configured to take the average of three replicate readings of each standard and sample at the time of analysis. This average is calculated by the instrument software. The average result is used to calculate the final samples results.

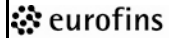
NOTE: The instrument methods used for sample analysis are configured to use the "Linear Thru Zero" curve type. The Elan 3.0 software guide definition of "Linear Thru Zero" curve type is: "Uses linear regression with a forced zero"; i.e. the curve includes a point at the origin of the calibration graph.

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E. Import, QC Review and Upload of the sample data using IDAT


1. After the analysis is complete the analyst must run a macro to create a CSV file and place it in the "D:\IDAT\Import\" directory. The file name matches the data directory for each run.
 - a. In the Offline Data Analysis program open the appropriate data file, method and calibration for the run you are importing. Verify in the drop down menus that the data directory matches the raw data printout.
 - b. Select "DoList" from the "Tools" menu. Verify that "Macro" is the only option checked in the "Select a Report Option" window, then click "Go".
 - c. Chose "a_a_Data.mac" from the list of macro files and click "OK".
 - d. Select the calibration blank through the last CCB in the list of files, click "Add" to move them to the right, and then click "Process". The screen flashes as the macro processes the data. "File list processed" appears in the lower left corner when the macro is finished.
2. Open Parallax and Login. Select *IDAT >> Import*.
3. Double-click on the CSV file that corresponds to the run you are importing.
4. Verify that all information is correct. Report any missing or incorrect prep data to your supervisor and make a note in the comments section of the batch sheet.
5. Enter the employee number for the analyst listed as Analyst at the top of the run cover sheet. DO NOT use your own employee number unless you are the Analyst for the run.
6. Enter the rinse time; then click "Save".

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7. Once import completes, verify that the run log is filled out correctly. Click OK to exit the import program.
8. Select *IDAT >> QC Review*. Select the appropriate run number from the list then click “Review”.
9. Once the review is complete, press the “Print QC” button to get a copy of the QC review. This is not necessary if you have “Print QC Report” checked.
10. View the list of samples that did not pass by selecting the radio button next to “Bad Samples”. The “Yttrium” tab also shows internal standard recoveries. These two tools are used in conjunction with viewing the raw data printout and IDAT run report for each sample in order to determine appropriate dilution factors for any samples requiring rereads (either due to analytes over the linear range, the presence of internal standards in the sample, or matrix effects which causes internal standard drift). Print the Reread report, if needed.
11. Note any dilutions on the Reread Report, then sign and date the top of the reread report.
12. Close QC review once review of the data is complete. Select *IDAT >> Upload*.
13. Click “New Runs”; then select the appropriate run number and click “Upload”. Click “OK”; then close Upload.

F. Operation of the Agilent 7700 ICP-MS

NOTE: Additional information on the operation of the MassHunter Workstation software can be found in the Agilent 7700 Series ICP-MS Masshunter Workstation User Guide.

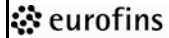
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1. Startup of the Agilent 7700 ICP-MS

- a. Power on the ESI autosampler and start the ESI software.
- b. Make sure the instrument is powered on before starting the ICP-MS software – the light on the front of the instrument will be red (shutdown mode), orange (standby mode) or green (analysis mode).
- c. If no light on the front of the instrument and the instrument is powered down: flip the main power switch on the back of the instrument up to the on position, and then make sure the Foreline Pump (red switch) is also up in the on position.
- d. Make sure the cool flow power switch is up in the on position. If the orange light on the front of the cool flow is on, you will need to turn off the cool flow and add coolant then turn the cool flow back on.

CAUTION: Before turning off the cool flow the instrument **MUST** be in standby, shutdown or powered off – **DO NOT** turn off the cool flow with the plasma on.


- e. Start ICP-MS Instrument Control (Masshunter).
- f. Select Instrument Control upon program startup.
- g. In lower left corner there are 4 buttons: Startup, Batch, Queue, and Hardware.
- h. Select Hardware.
- i. Verify that the program is in Online mode – the title bar should read “Online ICP-MS Mass Hunter”.

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- j. If the title bar says “Offline ICP-MS Mass Hunter” right click on the Mainframe picture in the Hardware pane and select Communication. Click the tick mark next to Online and click OK.
- k. Check the Instrument Status pane. The instrument should be in one of three modes: Shutdown (plasma and vacuum off, red light on front of instrument); Standby (plasma off but vacuum on, orange light on front of instrument); Analysis (plasma and vacuum on, green light on front of instrument).
- l. If in Shutdown mode right click on the Mainframe picture and select Vacuum On – the Foreline pump will start and the instrument will transition to Standby mode.
- m. Once Standby mode has been reached select Plasma On from either the Instrument drop down menu or the button at the top center of the software window.
- n. When asked if you want to “Run ‘Startup’ after plasma ignition?”, select No.
- o. The plasma will ignite and the instrument will transition to Analysis mode.
- p. Once Analysis mode is achieved you must allow the instrument to warm up for at least 20 minutes before running the EPA Daily Tune check sample.

2. Running the Daily Tune Check on the Agilent 7700 ICP-MS


- a. To run the EPA Daily Tune check place both probes into the EPA Tune Solution and allow sufficient time for the solution to flush through both lines (the internal standard line will take longer to flush).

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- b. Make sure to uncheck “FAST Control Enabled” in the ESI software and ensure that the FAST valve is in the LOAD position with the FAST vacuum off. Ensure that the cap for the sample cup in position 1 has been removed.
- c. Once the EPA Tune Solution is aspirating into the spray chamber take the following steps to start the EPA Daily Tune check.
- d. Select the Batch button in the lower left corner of the ICP-MS software.
- e. Open the batch “EPATUNE.b” by clicking on the following folder:

D:\Agilent\ICPMH\1\DATA\~EPATUNE.b
- f. In the Batch pane select the Acq Method tab then the Tune tab.
- g. Right click in the Signal Monitor grid and select Report, then Generate Tune Report.
- h. In the window that appears verify that the Report Template selected is as follows:

C:\Agilent\ICPMH\Report Templates\en\Letter\Tune
Report\TuneCheckReport.xltx
- i. Click Generate. The software will acquire the tune check data from the instrument and a report will be printed.
- j. If the EPA Daily Tune fails any of the criteria rerun the tune a second time. If it fails a second time take corrective action before running the EPA Daily Tune check again (maintenance or optimization of tuning parameters).

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3. Sample analysis on the Agilent 7700 ICP-MS

- a. Once the EPA Daily Tune passes all criteria, place the internal standard probe in the internal standard solution and place the carrier probe into the carrier solution.
- b. Once the carrier and internal standard solution have flushed through the tubing and are aspirating into the spray chamber, sample analysis can begin.
- c. Open a batch folder that is suitable for the type of samples and analytes to be analyzed (Example: “~ICPMS.b” when all three gas modes are needed).
- d. Save the batch with a new name using the same convention that is used in the Chemstation software on the Agilent 7500 ICP-MS:

YYMDDR## where

YY is the two digit year,

M is the letter of the alphabet corresponding to the month (A for January, B for February, etc.)

DD is the two digit day of the month

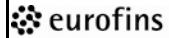
R is the letter of the alphabet that changes for each attempted run sequence

is used to create a unique batch for each run attempt as needed

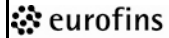
Example: For the first run started on March 19 in the year 2012 the batch folder would be named 12C19A01.b

NOTE: If you need to remove a run and start another run you can also advance the 01 to 02 etc. to create a unique batch for each run.


- e. Select the Sample List tab in the Batch pane.

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- f. Under Sequence Flow the Blank Samples block may be used for running pre run rinses and conditioning samples (clear this table if you don't need pre run rinses or conditioning, or adjust this table as needed to condition the instrument for your run).
 - g. The Unknown Sample block is used to run the sample sequence.
 - h. Select the Unknown Sample block and clear the sample table, then right click on the first row in the sample table and select Import Sample List.
 - i. Select the appropriate CSV file for the sample batch you will be analyzing and the sequence table will be filled in.
 - j. Verify the entries are correct and match the samples and locations for the samples to be analyzed and load calibration standards, check standards and samples into the correct positions on the autosampler.
 - k. Click Add to Queue to add the current Sample List to the analysis and to begin the run – if it is the first run you are adding to the Queue the autosampler will move to the first position in the Blank Sample block right after you click Add to Queue.
 - l. Once the Queue is active and running samples you can repeat the above steps to add additional runs to the Queue.
4. Data analysis and import for the Agilent 7700 ICP-MS:
- a. Once the sample run is complete you will switch to or open the Offline ICP-MS Data Analysis program to make any changes to internal standard selection and generate the file for import into Parallax.
 - b. Once in the Offline ICP-MS Data Analysis program open the batch that contains the run data you are going to process by clicking Open Analysis File (open folder icon or from the File drop down menu).

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- c. Evaluate appropriate internal standard selection based on the Quality Control section of this SOP and method requirements for the samples analyzed.
- d. If it is appropriate to change internal standard selection from the defaults in the method used click the DA Method Editor button (skip to step e. if alternate internal standard selection is not needed).
 - (1) Under Method Development Tasks (in the left pane of the DA Method Editor window) select “FullQuant” under item number 4 (Set up Analysis Parameters).
 - (2) Under the analyte list that appears in the right hand pane of the DA Method Editor you will see a list of the analytes.
 - (3) Change internal standards for any analytes where alternate internal standard selection is both necessary and appropriate.
 - (4) Then click “Return to Batch-at-a-Glance” in the left hand pane.
 - (5) When prompted to “Update Analysis Method?” select “Yes”.
 - (6) Click the “Process Batch” button to recalculate all concentration values in the batch folder using the internal standard selections you made while in the DA Method Editor.
- e. To generate the file for import into Parallax you must first select all the data rows needed for your run, starting with the calib blank down to the last row in your run. If you restarted the run only select the most recent calib blank and all samples below it.
- f. Once the appropriate rows of data are selected click Actions from the Tools drop down menu and select “Generate Import File” to run the script that compiles the file for import.

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- g. Once the script is complete you will get a message indicating the location and name for the import file (Example "File Location: C:\IDAT\Import\12H14B01.E05").
- h. Click OK then open Parallax and Import the data file.

Routine Maintenance:

A. Maintenance for the Agilent 7500 ICP-MS and ESI SC-8 FAST Autosampler

1. Documentation

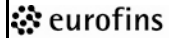
Any adjustment to an instrument, replacement of parts, etc., must be documented in the appropriate instrument logbook.

NOTE: For more details on procedures in this document please refer to the Agilent 7500 Hardware Manual or the Agilent 7500 Series ICP-MS Maintenance Video (DVD). The Agilent 7500 Series ICP-MS Maintenance Video contains high quality video and complete descriptions of all necessary maintenance tasks.


NOTE: Since the system is now using the ESI SC-8 FAST autosampler, ESI PC³ cooled spray chamber, and ESI nebulizer, some components of the sample introduction system are different from those described in the Agilent 7500 Series ICP-MS Maintenance Video.

2. Routine maintenance

- a. Remove and clean the sample introduction system when instrument performance declines.
 - (1) Clean nebulizer and spray chamber.
 - (a) Put in standby mode (Turn off plasma in ChemStation).

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- (b) Flip up dust shield. Open top cover.
- (c) Remove torch box with two bolts.
- (d) Remove two metal clip clamps.
- (e) Disconnect the makeup gas line and remove glass sample transfer tube.
- (f) Unthread the mixing tee from the end of the nebulizer, then unthread and remove the nebulizer from the spray chamber. Leave the gas tubing attached to the ESI nebulizer and detach it from the top of the Argon humidifier instead.
- (g) Remove chiller top cover by loosening the white bolt.
- (h) Lift spray chamber and carefully remove drain line.
- (i) Unthread the plastic cap that is attached to the optional gas addition port on the top of the spray chamber and set aside.
- (j) Pump clean water through nebulizer in the opposite direction. Be very careful not to handle the nebulizer more than necessary to avoid damage to the tip.
- (k) Sonicate spray chamber and glass transfer tube in 10% nitric. Rinse with reagent water.
- (l) Dry the outside of the spray chamber and transfer tube with a paper towel. Remove any excess water from the spray chamber using compressed air. It is not necessary to completely dry the inside of the spray chamber.

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- (m) The transfer tube must be completely dry before reinstallation. Accelerate drying, if necessary, placing the transfer tube in a drying oven set to 100 degrees Celsius for approximately 10 minutes.

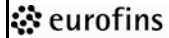
(2) Removing and cleaning the torch

- (a) Follow steps (1)i through (1)v in nebulizer removal section above.
- (b) Remove gas tubings from torch. Inspect the gas tubing lines: notify a supervisor immediately if any cracks or signs of weakness are observed.
- (c) Open quick release clamp. Remove from coil.
- (d) Remove bonnet and shield bar (the glass sleeve and thin metal sleeve).
- (e) Check bonnet and shield bar for cracks or deformation.
- (f) Sonicate torch and bonnet in 10% nitric. Rinse with reagent water.
- (g) Replace torch if it shows excessive wear, or build-up that cannot be removed.
- (h) The torch and bonnet must be completely dry before reinstallation. Drying may be accelerated by placing these parts in a drying oven set to 100 degrees Celsius for approximately 10 minutes.

(3) Reassembling sample introduction system

- (a) Put shield bar and bonnet back on torch.


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- (b) Slide torch into coil. Make sure the small glass bump is aligned with the corresponding hole on the torch stand to ensure proper torch alignment.
 - (c) Close quick release clamp.
 - (d) Reconnect gas lines. Gas lines are different sizes to avoid accidental incorrect connection.
 - (e) Reassemble spray chamber. Attach drain line and put spray chamber back in chiller. Replace top cover and tighten plastic bolt.
 - (f) Reattach the nebulizer gas line to the top of the humidifier. Rethread the mixing tee to the end of the nebulizer. Reattach the plastic cap on the optional gas port on top of the spray chamber.
 - (g) Replace glass sample transfer line. Reattach with metal clips and reattach makeup gas line.
 - (h) Replace torch box and tighten it down. Close top cover.
- (4) Cleaning the FAST valve assembly

NOTE: Detailed descriptions and diagrams of the FAST valve assembly are located in the pdf document “ESI SC Manual.pdf” located in the dept. 22 folder at K:\DEPT22\ICPMS Training and Reference Materials.

- (a) Periodically clean the FAST valve assembly when instrument performance declines and instrument maintenance does not correct the problem.

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- (b) In the ChemStation software open the tuning window and stop the nebulizer pump.
- (c) Unthread and set aside all six connections going into the FAST valve head.
- (d) Use a 9/64" Allen wrench to remove the valve head from the FAST hut.
- (e) Use a 7/64" Allen wrench to remove the three screws from the valve assembly.
- (f) Disassemble the valve assembly and place components on a clean dry surface.
- (g) Rinse the rotor with reagent water and use compressed air to remove any deposits. Remove stubborn deposits by sonicating the rotor in a solution of up to 10% nitric acid for approximately 10 minutes, followed by rinsing with reagent water. Replace the rotor if it shows signs of excessive wear. Dry rotor with compressed air prior to reinstallation.
- (h) Use compressed air on each of the six ports on the stator. Visually inspect the openings and confirm that nothing obstructs any of the six ports.
- (i) Reassemble the valve assembly. When reinserting the 3 screws, alternate between the 3 screws to keep them evenly threaded.
- (j) It is very important to avoid over tightening the 3 screws. Once you reach the point where the stator, body ring, and valve body are flush with one another tighten each screw gently until it feels snug (using forefinger and thumb only).

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DO NOT tighten with full force to avoid damage to the valve assembly.

- (k) Reattach the valve assembly to the FAST hut. While keeping the valve assembly firmly seated against the hut, use the 9/64" Allen wrench to firmly tighten the screw. It is necessary to apply enough force to make sure the valve head does not rotate when the FAST switches between LOAD and INJECT.
- (l) Carefully thread each of the six connections to the valve head. You MUST avoid cross threading and over tightening to avoid damaging the threaded connections. Threading must be smooth. If you encounter resistance STOP, reverse and restart the threading. Gently finger-tighten each connection.

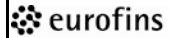
b. Removing and cleaning the cones.

(1) Removing cones

- (a) Follow steps i. through v. in "Cleaning Nebulizer" section above
- (b) On the ChemStation instrument control panel click maintenance and then choose sample introduction. Click the maintenance button in the window. This moves the torch housing and nebulizer out and away from the cones.

NOTE: Move the argon humidifier aside so that the FAST valve assembly does not collide with it as the torch housing moves.

- (c) Use sampling cone wrench line up so that the pins fit in the holes on the outer part of the cone. Place a long

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screwdriver through the holes on the wrench for leverage in loosening the sample cone.

- (d) Slide skimmer cone wrench into hole where skimmer cone is and turn until magnets lock pins into place. Use screwdriver for leverage in loosening the skimmer cone.


(2) Cleaning cones

- (a) Remove the O-ring from the larger sampling cone and rinse cones in reagent water. Use a wet paper towel to help remove deposits.
- (b) If deposits are still observed after completing step i., additional cleaning must be performed following steps iii. and iv. below. Otherwise skip to step v. below.
- (c) Prepare a slurry using a small amount of alumina powder and reagent water. Dip a cotton tipped swab in the slurry and gently polish the inner and outer surfaces of the cone. To clean the cone orifice, the cotton swab is inserted in the back of the cone using a twisting motion to remove deposits. DO NOT polish any threaded portion of either cone with the slurry.
- (d) More aggressive deposits are removed using #400 grit waterproof abrasive paper. Gently polish the cone surfaces with the cone still wet. DO NOT polish the tip of either cone or the threaded portions of either cone.
- (e) Rinse each cone thoroughly with reagent water to remove all traces of loose deposits and alumina powder.
- (f) Sonicate cones in a beaker containing only reagent water for 20 minutes.

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- (g) Remove form Beaker. Rinse with reagent water and dry. Accelerate drying, if necessary, by placing the cones in an oven set to 100°C for approximately 10 minutes. Cones must be completely dry before reinstallation.
 - (h) Visually check the tip of the cone and the back of the cone for abnormalities. Replace any cone that appears to have an oversized or non-round tip, or has surface deformities on the back of the cone.
 - (i) Visually inspect O-ring for cracks or hard spots. Replace if necessary.
- (3) Reinstalling cones
- (a) Put skimmer cone in the skimmer cone wrench and turn until magnets lock pins into place. Slide wrench with cone attached into cone housing and carefully thread the cone back into place. Be sure to not cross thread. Tighten this cone down by using the screwdriver for leverage.
 - (b) Carefully thread the sampler cone back into housing by hand. Be careful not to cross thread it. Before tightening with the cone wrench refer to the maintenance video titled “Installing the Sampling Cone” and follow the procedure exactly to obtain the correct tightness: first hand tighten without the O-ring in place; then mark the cone and interface; next, remove the cone and reinstall with the O-ring in place; tighten using the cone wrench and screwdriver for additional leverage so the marks on the cone and interface match. DO NOT tighten past the mark to avoid damage to the cone and/or interface.
 - (c) In ChemStation, go to “maintenance” on the instrument panel and select sample introduction. Click the initialize

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button. This moves the torch housing and nebulizer forward.

(d) Replace the torch box.

(e) Close cover.

c. Removing and cleaning the lenses

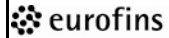
(1) Removing Lenses (There are multiple lenses to clean: the Extraction Lens-Omega-Lens assembly, the Reaction cell which contains the Cell Focus and Cell Entrance Lens, Plate Bias Lens.)

(a) Follow steps i. through v. in the Cleaning Nebulizer section.


(b) Click “maintenance” in the ChemStation instrument control panel and choose sample introduction. Click the “maintenance” button in the window. This moves the torch housing and nebulizer out and away from the cones.

NOTE: If you are not cleaning the Reaction Cell it is not necessary to put the instrument in shutdown mode or to vent the vacuum chamber. Once the instrument is in standby mode skip to step vii. below. DO NOT put the instrument in shutdown mode or vent the vacuum chamber if you are only cleaning the Extraction Lens-Omega-Lens assembly.

(c) Put the instrument in shutdown mode (turn off vacuum). Turn computer off and then turn off instrument using the button on the lower right of the front of the instrument.

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- (d) Flip open cover. Turn the vent valve (located on the front left of the vacuum chamber) one turn. A slight hissing sound is heard.
 - (e) While the chamber is hissing remove screws on the vacuum chamber lid.
 - (f) Once the vacuum chamber has equalized, remove the lid. Remember to retighten the vent valve. Rest the lid on top when not working in the vacuum chamber to avoid entrance of dust and particles.
 - (g) Remove the sampling cone and skimmer cone by following steps iii. and iv. in Removing cones section.
 - (h) Loosen three screws on skimmer base. Remove Extraction Lens-Omega Lens assembly. Carefully remove three screws on the Omega Bias. Slide off each lens and keep spacers in order. There are four lenses.
- NOTE:** If you are not cleaning the Reaction Cell skip to Cleaning lenses section (2) below. Follow steps ix. through xii. only if you are cleaning the Reaction Cell.
- (i) Open vacuum lid and loosen reaction cell screw. Loosen but do not completely remove plate bias wire terminal screw. Remove wire. Unplug plastic wire connector. Carefully remove reaction cell by lifting out at an angle.

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- (j) Loosen but do not completely remove plate bias wire screws. Remove wire ends. Remove the four cell assembly screws. Separate housing and carefully remove octopole unit. Be sure not to touch the octopole to avoid misaligning the poles.
- (k) Remove the two screws from the entrance side of the octopole. Slide off the cell focus, spacer and cell entrance lens. Secure octopole plate with same screws. Remove the other two screws from the exit side. Remove cell exit lens, spacer and QP focus. Secure octopole plate with same screws. Place octopole unit aside to avoid damage. There are four lenses.
- (l) Open the vacuum chamber lid and loosen the plate bias lens screws. Remove cell exit guide and plate bias lens.

(2) Cleaning lenses

- (a) Polish each lens with #400 polishing paper. Then use #1200 paper. Clean the orifice of each lens using an alumina powder slurry.
- (b) Rinse with water.
- (c) Sonicate in water for 5 minutes after polishing.
- (d) Rinse with water.
- (e) Sonicate in water for additional five minutes.


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- (f) Allow lenses to dry. Do not wipe. Accelerate drying, if necessary, by placing the lenses in an oven set to 100 degrees Celsius for approximately 10 minutes. Lenses must be completely dry before reinstallation.

(3) Reinstalling lenses

NOTE: If you are not cleaning the Reaction Cell skip to step vi. below. Follow steps i. through v. only if you are cleaning the Reaction Cell.

- (a) Remove vacuum chamber cover. Put plate bias lens and cell exit guide in place. Secure with screws.
- (b) Remove each octopole plate and reattach the lenses on either side of the octopole. Be aware that there are two different sized holes so that the lenses go back on in the correct orientation. Place reassembled octopole unit into the reaction cell and put the four screws back in.
- (c) Reattach the wires to the back of the reaction cell. The top screw holds down the wire that is attached to the reaction cell. The bottom screw holds the currently loose wire.
- (d) Carefully put the reaction cell back into the vacuum chamber. Tighten the reaction cell screw. Replace wire in the plate bias lens screw and tighten screw. Plug the wire connector back in.
- (e) Put the vacuum chamber lid back on. Secure it with the four screws tightly. Make sure the vent valve is tight as well. Close top cover.
- (f) Reassemble the entrance lens-omega lens. Slide into skimmer housing. Tighten the screws.

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- (g) Put cones back in. Use steps i. and ii. in reinstalling cones section.
 - (h) Turn instrument and computer on. Turn on vacuum in ChemStation. Wait 15 to 60 minutes for the vacuum to pump down. Once instrument is pumped down, go into the Maintenance menu and then sample introduction. Click the initialize button. This moves the torch housing back into place. Reattach torch box and secure with screws. Close top cover.
 - (i) Turn Plasma on. Give the instrument time to equilibrate with the vacuum and the plasma both on. Check instrument performance.
- d. Replace pump tubing when it shows stretching, flat spots, or increased relative standard deviations. Inspect all tubing to insure that it is secure and in good condition. Periodically perform visual check on the oil level of vacuum pumps and the water level in the coolflow. Also check water in coolflow for algae growth.

B. Maintenance for the Perkin Elmer Elan 9000 ICP-MS

For more details on procedures in this document (including detailed pictures) refer to the Elan 9000 Hardware Guide.


NOTE: Any adjustment to an instrument, replacement of parts, etc., must be documented in the appropriate instrument logbook.

1. Routine Maintenance

- a. Remove and clean the sample introduction system when instrument performance declines.


(1) Removing spray chamber

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- (a) Remove dust cover located above spray chamber
 - (b) Disconnect sample capillary tubing and argon gas tubing from nebulizer.
 - (c) Unscrew spray chamber retaining ring completely (plastic-knurled ring) and remove spray chamber from torch assembly.
 - (d) Loosen two knurled screws and remove nebulizer from spray chamber.
 - (e) To clean spray chamber, remove drain tubing and rinse with reagent water.
 - (f) Clean nebulizer by sonicating in 10% HNO₃ for a few minutes.
- (2) Removing and cleaning the torch
- (a) Use Allen wrench to push release mechanism on interface lever. Open interface by moving lever fully to the right.
 - (b) Remove torch-box cowling by loosening the two black-knurled knobs. Set aside. (**Caution:** there is an electrical connection; cowling cannot be removed, just move out of the way.)
 - (c) Remove gas line connections from the torch by loosening the Swagelok fittings a few turns. Then slide the fittings and tubing up and away from the torch.
 - (d) Rotate the torch mount (large-knurled metal ring) an eighth of a turn counterclockwise, and remove entire torch assembly from spray chamber side.

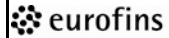
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- (e) Separate the torch from the adapter. Pull torch tip out of the adapter.
 - (f) Sonicate torch in 10% HNO₃ for a few minutes. Rinse with reagent water.
 - (g) Inspect tip. Sonicate along with torch if necessary. Rinse with reagent water.
 - (h) Replace torch and/or tip if either shows excessive wear, or build-up that cannot be removed.
- (3) Reassembling sample introduction system
- (a) Slide tip back into adapter. Next slide torch onto adapter. Both pieces must slide in until they hit a stop.
 - (b) Feed torch through hole on right side of instrument. Rotate torch assembly an eighth of a turn clockwise until bayonet mount is fully seated.
 - (c) Slide both gas fittings and tubing onto torch ends. Fittings are marked “B” for the back fitting and “F” for the front fitting. Tighten finger tight.
 - (d) Reinstall torch box cowling. Both black-knurled knobs must be snug, but not over tightened.
 - (e) Place torch alignment tool on torch so that it butts up against the outermost RF coil.

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- (f) Loosen the torch-locking collar (smaller-metal knurled ring) until torch moves freely. Then align the torch so that it is even with the outermost edge of the alignment tool. Retighten torch-locking collar.
- (g) Slide tool out approx. ½ inch. Then close the interface by moving the lever full to the left.
- (h) Open the interface by moving the lever fully to the right. The edge of the torch must be aligned with the 5.5 mm cutout of the alignment tool. (If not, refer to Elan 9000 hardware guide)
- (i) Remove alignment tool.
- (j) Close interface by moving lever fully to the left. (Safety interlock must click into place.)
- (k) Reconnect nebulizer to spray chamber. Tighten both knurled screws finger tight. Align nebulizer so that the sample capillary tubing inlet is at approx. the 2 o'clock position when installed on the torch.
- (l) Reconnect argon gas, sample capillary, and drain tube fittings.
- (m) Reconnect spray chamber to torch extension with back end of chamber angled down for proper drainage.
- (n) Finger tighten spray chamber retaining ring. Recheck torch alignment.
- (o) Optimize the procedures in Section 3 of the Elan software guide.

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b. Removing and cleaning the cones

(1) Removal of cones

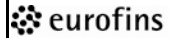
- (a) Turn off plasma if plasma is lit. Allow two (2) minutes or more for cooling and vacuum to equilibrate.
- (b) Open top cover. Use Allen wrench to push release mechanism on interface lever. Open interface by moving lever fully to the right.
- (c) Align removal/insertion tool with cutout in sampler cone. Insert and rotate a quarter turn. Pull cone forward using rocking twisting motion.
- (d) Reverse removal/insertion tool so pins face skimmer cone. Seat tool into holes in cone. Turn tool counterclockwise to remove cone.

(2) Cleaning cones

- (a) Remove O-rings from both cones and rinse cones in reagent water. A wet paper towel may also be used to help remove deposits.
- (b) If deposits are still observed after completing step i. ; additional cleaning must be performed following steps iii. and iv., otherwise skip to step v..

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- (c) Prepare a slurry using a small amount of alumina powder and DI water. Dip a cotton tipped swab in the slurry and gently polish the inner and outer surfaces of the cone. To clean the cone orifice, the cotton swab may be inserted in the back of the cone using a twisting motion to remove deposits. DO NOT polish the threaded portion of the skimmer cone or the outside edge of the sampler cone with the slurry.
 - (d) More aggressive deposits may be removed using #400 grit waterproof abrasive paper. Gently polish the cone surfaces with the cone still wet. DO NOT polish the tip of either cone, the outside edge of the sampler cone or the threaded portion of the skimmer cone.
 - (e) Rinse each cone thoroughly with reagent water to remove all traces of loose deposits and alumina powder.
 - (f) Sonicate cones in a beaker containing only DI water for 20 minutes.
 - (g) Remove from beaker. Rinse with reagent water and dry.
 - (h) Visually check tip of cone for abnormalities. Replace any cone that appears to have an oversized or non-round tip.
 - (i) Visually inspect O-rings for cracks or hard spots. Replace if necessary.
- (3) Reinstalling cones
- (a) Using removal/insertion tool, screw skimmer cone clockwise into place.

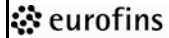
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- (b) Reverse tool and install sampler cone. Cone is pressure fitted into place. Cone seats flush with interface.
- (c) Move interface region back into operating mode by moving interface lever fully to the left.
- (d) Restart plasma. Sampler cone will fully seat when vacuum pump starts.
- (e) Optimize following procedures in Section 3 of the Elan software guide.

c. Removing and cleaning the lens

(1) Removing the Lens

- (a) Shut down plasma if lit and shut down vacuum pumps.
- (b) Wait at least 15 minutes for vacuum chamber to vent.
- (c) Using a Phillips screwdriver, loosen screws that hold ion optics region vacuum chamber lid in place (right-hand lid, smaller of the two). Remove lid. (May require a little prying to break seal, use caution).
- (d) Detach electrical connection from lens. This is the gray ball and socket connector on top.
- (e) Using 2 mm Allen wrench, loosen the two lens mounting screws. DO NOT REMOVE SCREWS.
- (f) Remove lens by rotating it slightly counter clockwise and pulling it out. Remove the shadow stop by rotating counter clockwise and pulling it out.

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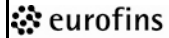
- (g) Unscrew lens mount nut and remove the small insulator.
Slide the lens out of the mount.

(2) Cleaning the lens and shadow stop

- (a) Place lens in a beaker containing no more than 2.5% HNO₃.
- (b) Sonicate for no more than 5 minutes. DO NOT leave the lens in the acid for more than 5 minutes.
- (c) Remove lens from beaker and rinse with reagent water, methanol then reagent water again.
- (d) Blow dry. Reinstall.
- (e) If unable to sufficiently remove residue, replace with new lens.
- (f) Shadow stop must be cleaned by wiping off surface with 2.5% HNO₃ on a cotton swab. Sonicate with lens if needed. Rinse same as lens.

(3) Reinstalling Lens

- (a) Place lens into lens mount.
- (b) Place small insulator on top of lens.
- (c) Tighten the lens-mount nut back into place. Finger tight is sufficient.

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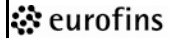
- (d) Place shadow stop onto mounting screw and rotate clockwise to lock. Next place lens assembly onto mounting screws and rotate clockwise to lock. Make sure electrical connector is facing up.
- (e) Tighten screws.
- (f) Reattach electrical connector.
- (g) Replace vacuum chamber lid, making sure cut-out is back and to the right. Tighten screws. (Do not over tighten)
- (h) Restart vacuum by pressing switch on the left side of the instrument, or through the Vacuum Start button in the Instrument window of the software.
- (i) Once system reaches adequate vacuum and the system comes to ready, retighten screws on vacuum chamber lid.
- (j) Optimize the following procedures in Section 3 of the Elan software guide.

d. Replace pump tubing when it shows stretching, flat spots, or RSDs start drifting up. Inspect all tubing to insure that it is secure and in good condition. Periodically perform visual check on the oil level of vacuum pumps and the water level in the coolflow.

C. Preventative Maintenance (performed as needed) for the Agilent 7500, Agilent 7700 and Perkin Elmer Elan 9000.

1. Vacuum instrument air filters
2. Vacuum coolflow air filters; coolflow air filters may also be removed and run under tap water to remove dust build up.

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3. Change vacuum pump oil
4. Replace interface rough pump oil
5. Replace turbo backing pump oil

D. Nonroutine Maintenance for both Agilent 7500 and Perkin Elmer Elan 9000

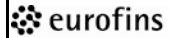
Sections 4 and 5 of both the Agilent 7500 Hardware Manual and the Perkin Elmer Elan 9000 Hardware Guide contain more information on the maintenance and trouble shooting of the ICP-MS. Consult an Agilent or Perkin Elmer service representative for further information on troubleshooting and maintenance.

E. Taking an instrument/analysis out of service/returning an instrument/analysis to service

NOTE: The following information is taken from 1-P-QM-QMA-9017325. In the event of an equipment failure, perform the following:

1. Document the nature of the failure in the maintenance logbook.
2. Document how and when the defect was discovered.
3. Notify a supervisor or responsible person to decide on appropriate action to take.
4. The instrument must be clearly tagged as *Out of Service*. The tag must contain the following information:
 - a. Date taken out of service
 - b. Employee who took the instrument out of service
 - c. Reason for tagout

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5. The date taken out of service and the date returned to service must be documented in the logbook.
6. Document any corrective action that was taken to bring the equipment back into service.
7. Document results of the corrective action (e.g., system calibration within specifications, etc.)
8. Supervisory personnel must perform a documented evaluation and review of instrumentation/equipment where a major or uncommon failure has occurred to assess the potential impact of the failure on the calibration and/or qualification of the instrument.
9. After repair, document whether the function has been fixed. Calibration or verification activities are performed before the instrumentation is put back into service.

F. Maintenance for the Agilent 7700 ICP-MS


For detailed instructions for all maintenance refer to the Agilent 7700 Series ICP-MS Hardware Maintenance Manual.

Calculations:

1. Final result

a. Water sample

$$\frac{\text{Instrument Reading}}{\text{Aliquot Volume}} \times \frac{\text{Dilution Volume}}{\text{Sample Volume}}$$

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b. Solid sample (mg/kg)

$$\frac{\text{Instrument Reading}}{\text{Dilution Volume}} \times \frac{\text{Aliquot Volume}}{\text{Sample Weight (grams)}} \times \frac{\text{Final Volume}}{\text{Sample Weight (grams)}}$$

All dilution factors must be recorded and used in the calculation. [To enter dilution data into the LIMS when multiple dilutions are used, a factor must be formed (Ex. 1), which contains no more than three figures for the volume or the aliquot (Ex. 2).]

$$\text{Ex. 1. } 50/.5 \times 10/1 = 500/.5$$

$$\text{Ex. 2. } 50/.5 \times 25/.5 = 1250/.25 = 125/.025$$

NOTE: The default units are µg/L

2. Relative percent different (RPD)

$$RPD = \frac{S - D}{(S + D)/2} \times 100$$

Where:

S = first sample value

D = duplicate sample value

3. Spike recovery

$$\% \text{ Recovery} = \frac{SSR - SR}{SA} \times 100$$


Where:

SSR = spiked sample result

SR = sample result

SA = spike added

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4. Correlation Coefficient

$$r = \frac{\sum XY - \frac{\sum X \sum Y}{N}}{\sqrt{(\sum X^2 - \frac{(\sum X)^2}{N})(\sum Y^2 - \frac{(\sum Y)^2}{N})}}$$

Where :

X = the known concentration

Y = the instrument response

N = the total number of data points

5. Serial Dilution

$$\% \text{ Difference} = \frac{(5 \times SDR) - SR}{SR} \times 100$$


Where:

SDR = serial dilution result

SR = sample result

6. Methods of standard additions (MSA)

Take either 4 identical aliquots (for 3 point MSA) or 2 identical aliquots (for one point MSA) of the same sample. Leave one unspiked. Spike the other 3 aliquots with different levels of a standard solution (for 3 point MSA) and spike the other aliquot at approximately the indigenous concentration of the sample (for one point MSA). Add blank solution to sample aliquots so that the final volume is the same for all. Use small volumes of spiking solution to avoid diluting the sample more than 10%. Analyze the 4 aliquots or 2 aliquots and record the instrument readings in absorbance. Use the readings and spike values to find the slope and x- and y- intercepts. The x- intercept is the result.

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$$\text{Slope} = m = \frac{\sum x_i y_i - (\sum x_i \sum y_i) / n}{\sum x_i^2 - (\sum x_i)^2 / n}$$

$$\text{Y-Intercept} = b = \bar{y} - m\bar{x}$$

$$\text{Result} = \frac{b}{m}$$

$$\text{Correlation Coefficient} = r = \frac{\sum \{(x_i - \bar{x})(y_i - \bar{y})\}}{\sqrt{[\sum (x_i - \bar{x})^2][\sum (y_i - \bar{y})^2]}}$$

The correlation coefficient (r) for the least squares fit must be ≥ 0.995 . If the r value is < 0.995 , the MSA must be repeated at the same dilution. If the r value is again low, the result with the higher r value is verified and both are flagged with a "+" in the data package. If the r value is < 0.990 , the sample is run at an interference dilution to overcome matrix effects. This usually requires a raised limit of quantitation. If a client requests a particular limit of quantitation that prohibits further dilution, then the sample is repeated at the same dilution and the best of the two results is verified.

7. Average, Standard Deviation and Relative Standard Deviation

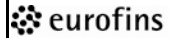
The average result, \bar{x} , is calculated by summing the individual results and dividing this sum by the number (n) of individual values:

$$\bar{x} = \frac{x_1 + x_2 + x_3 + x_4 + \dots x_n}{n}$$

Standard deviation is a measure of how precise the average is or how well the individual numbers agree with each other.

$$\text{Standard deviation, } S = \sqrt{\frac{(x_1 - \bar{x})^2 + (x_2 - \bar{x})^2 + (x_3 - \bar{x})^2 + \dots + (x_n - \bar{x})^2}{n - 1}}$$

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Relative standard deviation (RSD) is expressed in percent and is obtained by multiplying the standard deviation by 100 and dividing this product by the average.

$$\text{Relative standard deviation, RSD} = \frac{100 \times S}{\bar{x}}$$

Statistical Information/Method Performance:


Generate MDLs and LOQs according to 1-P-QM-QMA-9017309. Perform an MDL study on each instrument used for the analysis. Determine the MDL by taking seven spiked replicates through the entire digestion and analysis procedure. Compare and pool results to determine the final reporting MDL. The department supervisor maintains annual study data. The department supervisor requests that a Quality Assurance Specialist update to the LIMS as needed. Update the department database via a download from the LIMS.

Refer to 1-P-QM-QMA-9017313 for statistical information.

Quality Assurance/Quality Control:

- A. For 6020, and 6020A, each digestion batch (up to 20 samples) must contain a method blank, LCS, and either an US, D, MS, MSD or an LCS/LCSD.
- B. For 200.8, each digestion batch (up to 10 samples) must contain a method blank, LCS, and either an US, D, MS or an LCS/LCSD.
- C. QC limits for MS/MSD, and LCS/LCSD are established through statistical analysis of historical data.
 1. The limits are maintained in the LIMS for the relevant analysis numbers.
 2. The limits are evaluated every 6 months and updated as needed.
 3. The limits are subject to change without notification.

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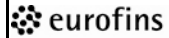
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D. Batch Quality Control

1. For the preparation and concentrations of Batch Quality Control see Form 1-P-QM-FOR-9009076.
2. For the frequency, acceptance criteria and corrective action see Tables I, and II.

E. Raw data quality checks


1. Make sure that the run is correctly labeled, and dated and that the corresponding cover sheet is attached to the run.
2. Verify that the appropriate Tuning Report is with the run.
3. For run and batch QC/Calibration frequency, acceptance criteria and corrective action, see Method Specific Tables I (EPA 200.8), and II (EPA 6020). For information on statistical windows refer to 1-P-QM-QMA-9017313.
4. Spike levels of batch QC are available in the LIMS and on 1-P-QM-FOR-9009182.
5. LOQs are available to analysts in the LIMS.
6. Check to make sure that all results are not > 90% of the Linear Range (see Definition 16). If a sample reading is above 90% of the linear range, then reread the sample at a dilution sufficient to bring the sample concentration to approximately the middle of the calibration range.
7. Check that the **absolute** value of all nondetected analytes is less than the LOQ. A technical decision must be made as to whether a reread is warranted for readings <|-LOQ|.

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8. Check for carryover between samples. Sample RSD >20%, with a concentration > the LOQ decreasing progressively over time (i.e., Reading 3<2<1). Flag any suspect samples for reread.

NOTE: Whenever a sample is encountered that exceeds the calibration range, the following sample must be checked for carryover for the over range analyte (s) and any suspect results must be deselected and reanalyzed. During reanalysis the sample order must be modified as needed to avoid carryover from any over range sample(s).

9. For all EW (samples from public drinking water sources), check the results against the MCL (maximum contaminant level). If an analyte **exceeds** the MCL notify a verifier at once. An automated email is sent to the Client Service Representative and the state for the analytes listed below with the exception of Pb and Cu which follow the 90th percentile rule (the CSR tracks the lead and copper and notifies the supplier when necessary). Suppliers must be notified within 24 hours.


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Analyte	MCL (mg/L)
Sb	0.006
As	0.01
Ba	2 (1)**
Be	0.004
Cd	0.005
Cr	0.1 (0.05)**
Pb	0.015
Se	0.05 (0.01)**
Tl	0.002
Al*	0.2
Cu*	1.0
Fe*	0.3
Mn*	0.05
Ag*	0.1 (0.05)**
Zn*	5.0

*Secondary regulated contaminants

**The federal MCLs for these analytes are greater than Pennsylvania MCLs. The numbers in parentheses are the MCLs effective in Pennsylvania

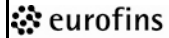
10. ICP-MS is an analytical technique that can be subject to significant interference on certain analytes including but not limited to Cr, Ni, Cu, As, Se, and Cd. In prior versions of this procedure the approach used to deal with these types of interferences involved a significant amount of additional data review, including monitoring multiple masses, selecting alternate masses to avoid interference, comparison of suspect data to alternate techniques and additional measures. This approach is no longer necessary due to the effective removal of these types of interferences using collision cell ICP-MS.
11. To avoid the risks associated with polyatomic interferences in wastewater and soil matrices all analytes must be analyzed on the collision cell ICP-MS (Agilent 7500ce, Equipment #11332 OR Agilent 7700x, Equipment #19204) with the following exceptions:
 - a. Be, Sb, Ba, Tl and Pb are also analyzed in wastewater and soil samples using the non-collision cell ICP-MS (Perkin Elmer ELAN 9000, Equipment #10007). These analytes have historically been free of the types of interferences that are corrected using collision cell ICP-MS.

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- b. Because EPA 200.8 rev. 5.4 does not currently allow the analysis of drinking water samples using collision cell ICP-MS all drinking water samples must be analyzed using the non-collision cell ICP-MS (Perkin Elmer ELAN 9000, Equipment #10007) or by using a method with no gas mode for all analytes on either the Agilent 7500 or 7700. The following analytes are analyzed in drinking water samples: Be, Cr, Ni, Cu, As, Se, Ag, Cd, Sb, Tl, and Pb. Drinking water samples have also been historically free of the types of interferences that made alternate mass selection necessary; multiple masses are no longer used in the instrument method and only the masses referenced at the beginning of this procedure are used.
12. Check the internal standard level for the entire run. If the internal standard reading for any sample is out of the acceptance range of the S0 reading, evaluate whether this is a result of the sample matrix or drift from other samples in the run. Only reread the sample at a dilution if the internal standard appears to be out of range due to the sample matrix. For samples where an internal standard is above the acceptance range it is acceptable to reprocess the data using an alternate internal standard. This is the preferred approach in order to avoid raised reporting limits. The acceptance criteria differ based on the method being used. Refer to Table I, and II for the method acceptance criteria.

NOTE: The internal standard is added in equal concentration to all of the samples and standards via a dedicated line on the peristaltic pump. The analytical lines referenced to an internal standard report a corrected concentration value based on the ratio of analyte to internal standard intensities. All the calculations for determining concentration are based on Intensity Ratio (IR). The IR is defined as the background corrected intensity signal of the analyte line (Ia) divided by the internal standard value (Iis).

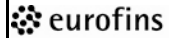
$$IR = I_a / I_{is}$$

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13. For TCLP and SPLP samples, an MSA (method of standard additions) is required if:
 - a. The sample concentration falls between 80% and 100% of the regulatory limit.
 - b. If the TCLP or SPLP matrix spike (QA) recovers <20%, all samples in the leachate batch must be reanalyzed using the method of standard additions for that analyte.
14. When items 1 – 13 are complete, check the following:
 - a. All samples requiring reread/redigestion are listed on the reread/redigestion schedule forms.
 - b. The data are uploaded to Parallax via IDAT by the reviewer.

F. Verification process

1. Confirm that all required pieces of QC have been uploaded to Parallax and are within specification. If there is partial QC on the current run and the samples have been analyzed more than once, check to see if there are associated runs in the hold bin waiting for additional QC to be verified.
2. Choose method of verification. (Metals verification by run, verify by multiple elements per sample, or verify by individual element).
3. Check lab notes and project notes for each sample group.

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4. If a technical decision or a client decision has been made to accept data that is not within specification, a nonconformance form Form1-P-QM-FOR-9007858 must be filled out and signed by the investigator and a verifier. An electronic copy of the nonconformance form must be placed in the nonconformance forms folder located under the dept 22 folder on lldata/env. Quality Assurance reviews these forms on a monthly basis. Notify your supervisor each time that a nonconformance form has been generated.

5. Once all of the elements are verified for a digest, verify the digest number. Suite and tracking numbers will auto verify after all the metals analyses are verified.


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Figure I

Daily Performance Acceptance Criteria

In Sensitivity	>300,000 cps
Mg Sensitivity	>40,000 cps
Pb Sensitivity	>100,000 cps
CeO/Ce	≤0.03
Ba ⁺⁺ /Ba ⁺	≤0.03
Background	<30 cps @ Mass 220
Net RSd	≤%5.0

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Table I
EPA 200.8
ICP-MS Metals

	Frequency	Acceptance	Corrective Action
Tuning	Daily	No AMU diff. of >0.1 P.W. ≥ 0.64 and ≤ 0.66 (Elan 9000) P.W. < 0.9 at 10% height (Agilent 7500 and 7700) %RSD <5 for masses used for tuning	Perform mass calibration for AMU. Adjust mass calibration for P.W.
Daily Performance	Daily	Evaluated for information only	Instrument maintenance and optimization as needed.
Calibration	The calibration must contain a blank and 1 standard		
Calibration for samples that require or use a multipoint calibration	The calibration must contain a blank and three standards.	Correlation coefficient (r^2) for the curve must be ≥ 0.995 .	Terminate run sequence and recalibrate. Data must not be reported for the analyte unless the correlation coefficient is ≥ 0.995
Initial Calibration Verification (ICV)	Must be analyzed immediately following calibration.	$\pm 10\%$ of the true value	If the ICV is out of specification high and the result is not < - LOQ, accept results that report as non-detect for the affected analyte(s). Results for the affected analyte(s) \geq to the reporting limit must not be reported (reanalyze).
Initial Calibration Blank (ICB)	Must be analyzed immediately following the ICV.	ICB must be $< 3 \times \text{IDL}$. If ICB is Out of Specification positive (+), accept results that are $> 10 \times$ the ICB, or < reporting limit. If ICB is Out of Specification negative (-), only accept results that are $> 10 \times$ ICB.	Data for that analyte must not be reported from the run (reanalyze).
Low Level Check (LLC)	Must be analyzed at the beginning and end of each run and before the ICSA and ICSAB.	$\pm 50\%$ of the true value. Not applicable if sample concentrations are $> 10 \times$ the true value of the LLC.	Data for that analyte must not be reported from the sample (reanalyze).
Interference Check Standard A and AB (ICSA/ICSAB)	The ICSA must be analyzed at the beginning and end of each run immediately following the LLC. The ICSAB must be analyzed at the beginning and end of each run immediately following the ICSA.	$\pm 20\%$ of the true value for the analytes that are spiked. ICSA or ICSAB must be $< 2 \times \text{LOQ}$ for analytes that are not spiked.	Data for that analyte must not be reported from the run (reanalyze).
Continuing Calibration Verification (CCV)	Must be analyzed immediately following the ICSAB and at a frequency of every 10 samples	$\pm 15\%$ of the true value.	If the CCV is out of specification and the result is not < - LOQ, accept results that report as non-detect for the affected analyte(s). Results for the affected analyte(s) \geq to the reporting limit must not be reported (reanalyze).


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Table I – Continued
EPA 200.8
ICP-MS Metals

	Frequency	Acceptance	Corrective Action
Continuing Calibration Blank (CCB)	Must be analyzed immediately following CCV's at a frequency of every 10 samples	CCB must be <3*IDL. If CCB is Out of Specification positive (+), accept results that are >10× the CCB, or < reporting limit. If CCB is Out of Specification negative (-), only accept results that are >10× CCB.	Data bracketing the CCB for the affected analyte must not be reported (reanalyze).
Preparation Blank (PB)	Must be prepped at a frequency of 1 per analytical batch of 10 samples or less.	PB must be < ½ LOQ or 2.2× MDL whichever is greater. Does not apply to samples >10× blank value.	Redigest all associated samples.
Laboratory Fortified Blank (LCS)	Must be prepped at a frequency of 1 per analytical batch of 10 samples or less.	Use statistical limits or the method limit of ±15%, as indicated by the client requirement.	Redigest all associated samples. If the LCS or LCSD is OOS high and the sample reads < than its reporting limit, the data is acceptable.
Laboratory Fortified Blank Duplicate (LCSD)	If insufficient sample volume is submitted to perform batch QC then a LCSD is prepped at a frequency of 1 per analytical batch of 20 samples or less.	Use statistical limits or the method limit of ±15%, as indicated by the client requirement. RPD must be <20%.	Redigest all associated samples. If the LCS or LCSD is OOS high and the sample reads < than its reporting limit, the data is acceptable. Redigest if RPD is out of specification.
Matrix Spike (MS)	Rate of 10% of analytical samples	Use statistical limits or the method limit of ±30%, as indicated by the client requirement.	Data is flagged in the QC Summary and/or in the data package. If sample concentration <4× the spike added a PDS must be performed.
Duplicate (D)	Must be prepped at a frequency of 1 per analytical batch of 10 samples or less	If the samples are >5× the LOQ the RPD must be <20%	'*' -Flag the data package forms.
Post Digestion Spike (PDS)	Must be prepared with each background sample. Evaluated when matrix spike is not within specification.	±15%	Report % rec. on FormVB-IN.
Serial Dilution	Must be prepared with each background sample. Evaluated only when analyte concentrations are >50 MDL.	The percent difference must be <10%	'E' - Flag data on DP Forms

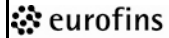
 Lancaster Laboratories Environmental	Document Title: Metals by Inductively Coupled Plasma Mass Spectrometry for SW-846 Methods 6020/6020A (aqueous, solid, tissue) and EPA 200.8 (aqueous)	Eurofins Document Reference: 1-P-QM-WI -9018443
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Table I – Continued
EPA 200.8
ICP-MS Metals

	Frequency	Acceptance	Corrective Action
Samples		Sample reading must be within the linear range (see Definition 16). Elements reported as non-detect are accepted if the ICV/CCV is out of specification high, and the sample is not < - LOQ. RSD must be <20% for results >2× LOQ.	Reanalyze at dilution that brings sample concentration within 90% of the linear range. Reanalyze for elements that do not meet this criteria. Reanalyze for elements that do not meet this criteria.
Linear Range (LR)	Analyzed quarterly.	±10% of the true value	Samples reading greater than 90% of the calibration range must be reanalyzed.
Internal Standards	Added to all samples by way of second pump channel.	Must be 60%-125% of the Calibration Blank	Reanalyze @ DF2

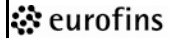
 Lancaster Laboratories Environmental	Document Title: Metals by Inductively Coupled Plasma Mass Spectrometry for SW-846 Methods 6020/6020A (aqueous, solid, tissue) and EPA 200.8 (aqueous)	Eurofins Document Reference: 1-P-QM-WI -9018443
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Table II
EPA 6020 and EPA 6020A Revision 0 Sept. 1994
ICP-MS Metals

	Frequency	Acceptance	Corrective Action
Tuning	Daily	No AMU diff. of >0.1 P.W. ≥ 0.64 and ≤ 0.66 (Elan 9000 only) P.W. < 0.9 at 10% height (Agilent 7500 and 7700) %RSD <5 for masses used for tuning	Perform mass calibration for AMU. Adjust mass calibration for P.W.
Daily Performance	Daily	Evaluated for information only	Instrument maintenance and optimization as needed.
Calibration	The calibration must contain a blank and 1 standard.		
Calibration for samples that require or use a multipoint calibration	The calibration must contain a blank and three standards.	For EPA 6020: Correlation coefficient (r^2) for the curve must be ≥ 0.995 . For EPA 6020A: Correlation coefficient (r^2) for the curve must be ≥ 0.998 .	For EPA 6020: Terminate run sequence and recalibrate. Data must not be reported for the analyte unless the correlation coefficient is ≥ 0.995 For EPA 6020A: Terminate run sequence and recalibrate. Data must not be reported for the analyte unless the correlation coefficient is ≥ 0.998
Initial Calibration Verification (ICV)	Must be analyzed immediately following calibration.	$\pm 10\%$ of the true value	If the ICV is out of specification high and the result is not < - LOQ, accept results that report as non-detect for the affected analyte(s). Results for the affected analyte(s) \geq to the reporting limit must not be reported (reanalyze).
Initial Calibration Blank (ICB)	Must be analyzed immediately following the ICV.	ICB must be $< 3 \times \text{IDL}$. If ICB is Out of Specification positive (+), accept results that are $> 10 \times$ the ICB, or < reporting limit. If ICB is Out of Specification negative (-), only accept results that are $> 10 \times$ ICB.	Data for that analyte must not be reported from the run (reanalyze).
Low Level Check (LLC)	Must be analyzed at the beginning and end of each run and before the ICSA and ICSAB	For 6020: $\pm 50\%$ of the true value Not applicable if sample concentrations are $> 10 \times$ the true value of the LLC For 6020A: $\pm 30\%$ of the true value Not applicable if sample concentrations are < LOQ, or if sample concentrations are greater than the CCV (CCV must be within specification).	Data for that analyte must not be reported from the sample (reanalyze).

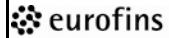
 Lancaster Laboratories Environmental	Document Title: Metals by Inductively Coupled Plasma Mass Spectrometry for SW-846 Methods 6020/6020A (aqueous, solid, tissue) and EPA 200.8 (aqueous)	Eurofins Document Reference: 1-P-QM-WI -9018443
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Table II - Continued
EPA 6020 and EPA 6020A Revision 0 Sept. 1994
ICP-MS Metals

	Frequency	Acceptance	Corrective Action
Interference Check Standard A and AB (ICSA/ICSAB)	The ICSA must be analyzed at the beginning and end of each run immediately following the LLC. The ICSAB must be analyzed at the beginning and end of each run immediately following the ICSA.	$\pm 20\%$ of the true value for analytes that are spiked. ICSA or ICSAB must be $< 2 \times$ LOQ for analytes that are not spiked.	Data for that analyte must not be reported from the run (reanalyze).
Continuing Calibration Verification (CCV)	Must be analyzed immediately following the ICSAB and at a frequency of every 10 samples	$\pm 10\%$ of the true value.	If the CCV is out of specification high and the result is not $< -$ LOQ, accept results that report as non-detect for the affected analyte(s). Results for the affected analyte(s) \geq to the reporting limit must not be reported (reanalyze).
Continuing Calibration Blank (CCB)	Must be analyzed immediately following CCV's at a frequency of every 10 samples	CCB must be $< 3 \times$ IDL. If CCB is Out of Specification positive (+), accept results that are $> 10 \times$ the CCB, or $<$ reporting limit. If CCB is Out of Specification negative (-), only accept results that are $> 10 \times$ CCB.	Data bracketing the CCB for the affected analyte must not be reported (reanalyze).
Preparation Blank (PB)	Must be prepped at a frequency of 1 per analytical batch of 20 samples or less.	PB must be $< \frac{1}{2}$ LOQ For 6020: Not applicable if analyte reading in the sample is $> 20 \times$ the PB reading or $<$ the reporting limit. For 6020A: Not applicable if analyte reading in the sample is $> 10 \times$ the PB reading or $<$ the reporting limit.	Redigest all associated samples.
Laboratory Control Standard (LCS)	Must be prepped at a frequency of 1 per analytical batch of 20 samples or less.	Use statistical limits or the method limit of $\pm 20\%$, as indicated by the client requirement.	Redigest all associated samples. If the LCS or LCSD is OOS high and the sample reads $<$ than its reporting limit, the data is acceptable.
Laboratory Control Standard Duplicate (LCSD)	If insufficient sample volume is submitted to perform batch QC then a LCSD is prepped at a frequency of 1 per analytical batch of 20 samples or less.	Use statistical limits or the method limit of $\pm 20\%$, as indicated by the client requirement. RPD must be $< 20\%$.	Redigest all associated samples. If the LCS or LCSD is OOS high and the sample reads $<$ than its reporting limit, the data is acceptable. Redigest if RPD is out of specification.

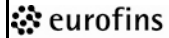
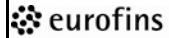
 Lancaster Laboratories Environmental	Document Title: Metals by Inductively Coupled Plasma Mass Spectrometry for SW-846 Methods 6020/6020A (aqueous, solid, tissue) and EPA 200.8 (aqueous)	Eurofins Document Reference: 1-P-QM-WI -9018443
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Table II - Continued
EPA 6020 and EPA 6020A Revision 0 Sept. 1994
ICP-MS Metals

	Frequency	Acceptance	Corrective Action
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	Must be prepped at a frequency of 1 per analytical batch of 20 samples or less.	Use statistical limits or the method limit of $\pm 25\%$, as indicated by the client requirement. RPD must be $< 20\%$	Data is flagged in the QC Summary and/or in the data package. If sample concentration $< 4\times$ the spike added a PDS must be performed.
Duplicate (D)	Must be prepped at a frequency of 1 per analytical batch of 20 samples or less	If the samples are $> 5\times$ the LOQ the RPD must be $< 20\%$.	Flagged in data package and in the QC Summary.
Post Digestion Spike (PDS)	Must be prepared with each background sample. Evaluated when matrix spike is not within specification.	$\pm 15\%$ of the true value	The data is flagged in the data package.
Serial Dilution	Must be prepared with each background sample. Evaluated only when analyte concentrations are $> 100\times$ MDL.	The percent difference must be $< 10\%$.	The data is flagged in the data package.
Samples		Sample reading must be within the linear range (see Definition 16). Elements reported as non-detect are accepted if the ICV/CCV is out of specification high, and the sample is not $< -$ LOQ. RSD must be $< 20\%$ for results $> 2\times$ LOQ.	Reanalyze at dilution that brings sample concentration within 90% of the linear range. Reanalyze for elements that do not meet this criteria. Reanalyze for elements that do not meet this criteria.
Linear Range (LR)	Analyzed quarterly..	$\pm 10\%$ of the true value	Samples reading greater than 90% of the calibration range must be reanalyzed.
Internal Standards	Added to everything through use of second pump channel	For 6020: 30%-120% for samples 80%-120% for ICV, CCVs, ICB, and CCBs. 30%-120% for LLC, ICSA, and ICSAB. For 6020A: 70-130% for samples.	Reanalyze @ DF5. Terminate analysis and reanalyze. Reanalyze. Reanalyze @ DF5.

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Eurofins Document Reference	1-P-QM-WI -9018442	Revision	8
Effective Date	Jan 28, 2015	Status	Effective
Historical/Local Document Number	Analysis 6966, 1643, 6935, 7914, 6946, 6947, 1650, 6949, 6952, 6951, 6953, 1654, 1662, 1656, 1657, 6958, 6960, 1667, 6961, 10145, 6955, 6944, 6936, 6969, 7968, ...		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
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Reviewed and Approved by	Robert Strocko;Review;Wednesday, January 28, 2015 8:31:26 AM EST Barbara Reedy;Approval;Wednesday, January 28, 2015 8:48:44 AM EST

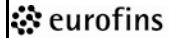
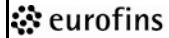
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Revision Log:

Revision: 8		Effective Date:	This version
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Throughout Document	Reflects re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers	
Routine Methods	Correction	Removed highlight from Te, Th, W wavelengths	
Quality Assurance/ Quality Control D.2.	Correction	Removed reference to table III	

Revision: 7		Effective Date:	Nov 21, 2014
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Throughout Document	Reflects re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers	
	No longer applicable	Deleted references to CLP and SW846 6010A.	
	Updated to current procedure	Minor clarifications	
Routine Methods	Updated to current procedure	Added Thorium, Tungsten, and Tellurium	
Calculations	Updated to current procedure	Included information for 1-point MSA.	

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Reference:

1. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 6010B, December 1996
2. Method 200.7 (rev. 4.4), Determination of Metals and Trace Metals in Water and Wastes by Inductively Coupled Plasma-Atomic Emission Spectrometry, USEPA 600/R-94/111 May 1994.
3. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 6010C, February 2007
4. ICAP™ 6000 Series ICP-OES Spectrometer Operator Manual, 2005/2006.
5. *Chemical Hygiene Plan*, current version.

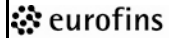
Cross Reference:

Document	Document Title
1-P-QM-FOR-9008385	ICP LOQs (mg/L)
1-P-QM-FOR-9008807	MSA Prep for Samples with MS/MSD <50%
1-P-QM-FOR-9008905	MSA Prep for Samples within TCLP Limits
1-P-QM-FOR-9009067	Working Instructions for Preparation of ICP Solutions and Standards
1-P-QM-FOR-9009182	Working Instructions for Prep Solutions and Standards
1-P-QM-PRO-9015403	Fixed-Volume Hand-Held Pipettes
1-P-QM-PRO-9015511	Liquid Sample Preservation
1-P-QM-QMA-9017309	Determining Method Detection Limits and Limits of Quantitation
1-P-QM-QMA-9017313	Establishing Control Limits
1-P-QM-QMA-9017325	Instrument and Equipment Maintenance and Calibration

Purpose:

The purpose of this SOP is to describe the proper analysis of aqueous and solid samples for metals by ICP. This SOP also outlines the proper operation and maintenance of the ICP instrumentation and provides consistent guidelines for the evaluation of ICP data.

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Scope:


This procedure applies to analyses performed in Environmental Sciences using ICP for identification and quantitation of metallic constituents.

LOQs are based on annual statistical evaluation of laboratory data and are subject to change. The current MDLs and LOQs are maintained in the LIMS.

Limits of Quantitation are subject to change without notification.

Routine Methods:

Elements routinely analyzed on the Thermo Scientific iCAP 6000 Series Analyzer include Eurofins Lancaster Laboratories Environmental, LLC (ELLE) analyses:


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<u>Element</u>	<u>Waters Analysis #</u>	<u>Solids Analysis #</u>	<u>Wavelength (nm)</u>
Ag	7066	6966	328.06
Al	1743	1643	308.21
As	7035	6935	189.04
Au	11762	11761	242.80
B	8014	7914	249.67
Ba	7046	6946	455.40
Be	7047	6947	313.04
Ca	1750	1650	317.93
Cd	7049	6949	226.50
Co	7052	6952	228.62
Cr	7051	6951	267.72
Cu	7053	6953	327.40
Fe	1754	1654	261.19
K	1762	1662	766.49
Li	1756	1656	670.78
Mg	1757	1657	285.21
Mn	7058	6958	257.61
Mo	7060	6960	202.03
Na	1767	1667	589.59
Ni	7061	6961	231.60
P	10143	10145	177.49
Pb	7055	6955	220.35
S	12004	12003	182.03
Sb	7044	6944	206.83
Se	7036	6936	196.09
Si	1765	12763	251.60
Sn	7069	6969	189.99
Sr	8068	7968	421.55
Te	13494	13498	214.281
Th	13495	13499	401.913
Ti	7070	6970	334.94
Tl	7022	6925	190.86
V	7071	6971	292.40
W	13496	13500	207.911
Zn	7072	6972	213.86
Zr	10144	10146	339.19

Basic Principles:

An instrument run sheet is prepared using the information provided on the sample batch sheet received from the prep area. Appropriate standards, check standards and interference check standards are added. Standards and samples are poured as needed to be analyzed on the instrument.

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Samples are received from the prep area in Nalgene containers. The samples are analyzed directly on the instrument, with the exception of the spiked sample and a serial dilution of the same background sample. The spiked and serial dilution sample is prepared in a volumetric flask or directly into the graduated plastic digestion tube that is placed on the autosampler for instrument analysis. Any sample that requires a dilution is prepared in the same fashion. Standards and samples are entered in to a sequence file on the instrument in the same order as on the ICP run sheet.

Water and soil samples are treated with acids and heated to solubilize the metals present. These digestates are then analyzed for trace metals by an atomic emission spectroscopic technique. Samples are transported to a nebulizer via an autosampler and peristaltic pump. The nebulizer introduces an aerosol into a spray chamber; the resulting mist is then transported to an argon plasma torch where excitation of atoms occurs. Characteristic atomic-line emission spectra are produced by a radio-frequency (R.F.) inductively coupled plasma. The spectra are dispersed by a diffraction grating and the intensities of the light at each wavelength are monitored by a photosensitive device. The signals from the photosensitive device are processed by a computer. A background correction technique is required to compensate for variable background contribution to the spectra of trace elements.


The Quality Control requirements for accurately reviewing and verifying a sample data run are listed in this SOP.

Definitions:

Batch and instrument QC

1. Analytical Batch – A group of field samples that are digested and analyzed together. A batch consists of no more than 10 samples for EPA 600 methods or no more than 20 samples for other methods.

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2. Analytical Samples – Analytical sample is defined as any solution introduced into an instrument on which an analysis is performed, excluding instrument calibration, ICV, ICB, CCV, and CCB. Analytical samples include undiluted and diluted samples, matrix spike samples, duplicate samples, serial dilution samples, analytical spike samples, post-digestion spike samples, ICSs, LLCs, PBs, LCSs, and PEs.

3. Background Sample (U) – The original sample from which the batch QC is derived. The background sample is either site specific or randomly selected.

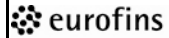
4. Continuing Calibration Blank (CCB) – A reagent blank run immediately after every CCV. This is used to monitor the stability of the low end of the calibration.

5. Continuing Calibration Verification (CCV) – A mid-range standard run at a frequency of 10% (every ten samples) throughout the run. This is used to monitor instrument drift.

6. Duplicate Sample (D) – A replicate of the original sample, processed in parallel. This sample is used to provide a measure of the in-lab repeatability (precision) of the analytical process. The duplicate sample is either site specific or randomly selected.


7. Initial Calibration Verification (ICV) – This is a standard near the middle of the calibration range, prepared from a different source than the calibration standards. It is used to prove that the instrument is calibrated correctly at the start of the run.

8. Initial Calibration Blank (ICB) – This is a standard reagent blank, used to prove that the low end of the calibration is acceptable. It must be run immediately after the ICV.


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9. Interelement Correction Standard-A (ICSA) – A standard containing high concentrations of commonly interfering elements. It is used to assess the spectral interferences due to matrix elements that are normally expected to be found in a sample.
10. Interelement Correction Standard-AB (ICSAB) – A standard containing both interfering elements and target analytes, run immediately after the ICSA. It is used to demonstrate the effectiveness of the interelement correction factors in use.
11. Instrument detection limit (IDL)

EPA SW846 and EPA 600 Analyses – A value determined for the purpose of evaluating the ICB/CCBs for data package samples. It is determined by calculating the standard deviation on 7 standard solutions at a concentration 3× to 5× the anticipated IDL. This standard deviation is then multiplied by the student's t value to obtain the MDL. This value is obtained quarterly on each instrument used for an analyte.
12. Laboratory Control Sample (LCS) – A spiked reagent blank of known composition carried through the digestion process. It is used to judge efficiency of the digestion procedure, as measured by the % recovery of the analytes.
13. Laboratory Control Sample Duplicate (LCSD) – This is a duplicate of the LCS. It is used to judge efficiency of the digestion procedure, as measured by the % recovery of the analytes. It is also used as a measure of the precision of the analytical process.
14. Limit of Quantitation (LOQ) – The level above which quantitative results are obtained with a specified degree of confidence. It is based on a value 3× to 5× the MDL.

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15. Low Level Check Standard (LLC) – A low-level standard used to monitor the performance of the instrument near the detection limit.
16. Matrix Spike Sample (R) – A replicate of the original sample spiked with a known amount of analyte. This sample is used to determine if there are any matrix effects that could influence analyte recovery during the digestion procedure. The matrix spike sample is either site specific or randomly selected.
17. Matrix Spike Duplicate (M) – A duplicate of the Matrix Spike Sample (R) which is a replicate of the original sample spiked with a known amount of analyte. This sample is used to determine if there are any matrix effects that could influence analyte recovery during the digestion procedure. It is also used as a measure of the precision of the analytical process. The matrix spike duplicate sample is either site specific or randomly selected.
18. Method Detection Limit (MDL) – The minimum concentration of a substance reportable with 99% confidence that the analyte concentration is greater than 0. It is determined by calculating the standard deviation on 7 digested standards at an estimated concentration 2.5× to 5× the signal/noise ratio. This standard deviation is then multiplied by the student's t value to obtain the MDL. MDLs are performed on all instruments used to determine each analyte. MDLs are not listed in this SOP. They can be found in the LIMS system due to the fact that they change on a regular basis.
19. Post Digestion Spike (PDS) – This sample is a spike of the Background Sample prepared after digestion, at the time of analysis. It is used to determine if out-of-specification spike recoveries are due to problems in the digestion or are matrix related.
20. Preparation Blank (PB) – This is a reagent blank carried through the entire digestion procedure. It is used to determine if contamination has occurred during the digestion procedure.

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21. Serial Dilution (SD) – This sample is a 1:4 (5×) dilution of the background sample, prepared after the digestion. It is used to indicate the presence of any matrix effects that could cause a nonlinear response at the instrument.
22. Linear Range (LR) – This is the highest sample concentration that can be analyzed by the method with criteria of $\pm 5\%$ of the true value. Sample results must be < 90% of the true value of the linear range.
23. Analytical Value – Analytical reading obtained by the average of three instruments replicates.

Interferences:

Spectral interferences are caused by background emission, stray light from high concentration elements or overlap from a spectral line from another element. Spectral interferences are compensated for by the use of background points, alternate wavelengths and interelement corrections.

Physical interferences caused by the change in sample matrix affecting sample transport and/or nebulization must be compensated for by using internal standardization.


Memory interference, or carryover, is the contribution of analyte signal from a previous sample onto the next sample analysis. Adequate rinse time of the autosampler tubing overcomes any memory interference.

Safety Precautions and Waste Handling:

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

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Preparing samples for inorganic analysis involves working with concentrated acids and other chemicals which are dangerous if not handled carefully:

Nitric acid (HNO₃) – This acid can cause skin burns. Add nitric acid to samples in a hood to avoid exposure to toxic fumes.

Hydrochloric acid (HCl) – This acid can cause skin burns. Never mix HCl with concentrated H₂SO₄ to avoid a violent reaction. Always use in a fume hood.

Hydrogen Peroxide 30% (H₂O₂) - This oxidizer can cause skin burns. Always use in a fume hood.

When diluting strong acids, never add water to acid; always add acid to water.

Store concentrated acids in the prep room acid lockers. Only acids are to be stored in these lockers. (Store solvents in the flammable liquid storage cabinet.) Some concentrated acids are kept in the acid reagent bottles on prep room counters. Fill reagent bottles in an operating fume hood using caution to avoid spills.

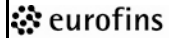
Use spill pillows to absorb large acid spills (small spills are cleaned with wet paper towels.) Use SPILL-X-A powder or equivalent to neutralize any remaining acid and then rinse the area thoroughly with water. Spill pillows and SPILL-X-A are stored on the prep room shelf.

Dispose of acid waste properly. Collect all acid digestions, waste solutions, and expired reagent solutions in waste containers. When the acid waste containers are full, a designated acid waste handler transfers the waste to the acid neutralization tank.

Personnel Training and Qualifications:

1. All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability.

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2. Initially, each analyst performing the instrumental analysis must work with an experienced analyst for a period of time until they can independently calibrate the instrument, use the sequence editor to set up the run, perform calculations, interpret raw data, and enter data into the LIMS. Proficiency is measured through documented audits of the tasks listed and over checking of data as well as an IDOC (Initial Demonstration of Capability).
3. The IDOC and the DOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation.

Sample Collection, Preservation, and Handling:

A. Aqueous samples

1. Samples are collected in plastic or glass containers.
2. Samples are preserved with nitric acid and stored at 0° to 6°C, not frozen.
3. Samples must be digested within 180 days of collection for all methods.


B. Solid samples

1. Samples are collected in glass containers and stored at 0° to 6°C, not frozen.
2. Samples must be digested within 180 days of collection.
3. Solid samples require no chemical preservation.

C. pH Adjustment

1. Upon receipt at the laboratory, Sample Storage personnel check the pH of water samples. If the pH is greater than 2, the pH of the sample is adjusted to a pH less than 2 following the protocol outlined in 1-P-QM-PRO-9015511.

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2. Drinking water samples require pH check immediately before digestion and analysis. If the pH is greater than 2, the client service representative (CSR) is notified. The CSR must notify the client for direction on how to proceed with the sample (i.e. proceed as is or add more acid.)

3. Dissolved Metals

- a. Samples to be analyzed for metals requiring filtration at the lab must be submitted unpreserved.
- b. The sample is run through a 0.45 micron filter within 5 days of receipt.
- c. Samples are filtered into containers and preserved to a pH of <2 with HNO₃.

D. Storage - Store sample digestates in plastic bottles at room temperature. Store standards and digestates separately.


E. Sample Discard - The general practice in the metals group is to discard the digestions after all the required metals from a batch of samples have been analyzed and verified in the LIMS. Samples which require the digestate to be held for long term storage are periodically evaluated for discard.

Apparatus and Equipment:

The following is a list of the hardware and apparatus necessary for ICP analysis. More detailed hardware information is located in the *Operator's Manuals*.

1. Test tube racks
2. 15-mL graduated polypropylene screw cap tubes (certified $\pm 1\%$)
3. 16-mL polystyrene tubes
4. Filter paper – Whatman No. 540, 90-mm ashless

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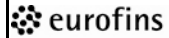
5. FilterMate filtration device with 0.45- μ m PTFE fiber filter and insertion tool
6. 1 \times 100 10-mL sterile disposable syringes
7. 25-mm syringe filters, PTFE, 0.45- μ m
8. 30-mL polypropylene medicine cups
9. Adjustable electronic and fixed volume hand-held pipettes and tips (10 – 5000 μ L) - FisherBrand or equivalent.

NOTE: For routine operation, calibration, and maintenance of FisherBrand (or equivalent) electronic or fixed volume hand-held pipettes, see 1-P-QM-PRO-9015403.

10. Spectrometer

The Thermo Scientific iCAP™ 6000 series Trace Analyzer utilizes a high performance solid state Charge Injection Device (CID) camera system to deliver high contrast/low noise imaging and quantification of all wavelengths in the analytical range. With the entire spectrometer and foreoptics purged with either Argon or Nitrogen, it features a 52.91 grooves/mm grating and dual-view detector.

11. Auto-sampler – The ESI SC-14 auto-sampler and integrated “FAST” system offer increased capacity and reduce sample introduction times. The parameters for each automated run are entered into the auto-sampler table in the iTEVA™ software as described in Instrument Operation, Section A of this SOP.

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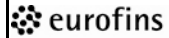
12. Peristaltic pump – The peristaltic pump regulates the flow of the following: sample, internal standard, instrument rinse and spray chamber waste. Special care must be taken to ensure that all pump tubing is connected properly. The Teflon concentric and glass V-groove nebulizers have a natural uptake, but a peristaltic pump is used to compensate for differences in sample viscosity. After traveling through the peristaltic pump, the sample and internal standard tubing are combined by a “Y” connector, and then allowed to mix in a mixing coil before entering the nebulizer.
13. R.F. generator –The iCAP™ 6000 series Trace Analyzer utilizes an internal solid state RF Generator at 27.12MHz with a power efficiency greater than 78%.
14. Coolflow –The ThermoFlex™ 900 cooling device for the iCAP™ 6000 series Trace Analyzer operates at 17°C.
15. Personal computer – The iCAP™ 6000 series Trace Analyzer is controlled by PCs.

Reagents and Standards:

Reagent and standard information and the preparation of the following standard and solution sections are located in 1-P-QM-FOR-9009067.

- A. ICP Standards
- B. ICP Initial and Continuing Calibration
- C. ICP LOQ Check Standard Solutions (LLC)
- D. Interference Check Solutions
- E. Rinse/Carrier and Profile Solutions
- F. Internal Standard Solution

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G. IDL and MDL Solutions

H. Matrix Matched Standards Table

Calibration:

A. Initial Calibration.

1. For the preparation and concentrations of calibration blanks and calibration standards see 1-P-QM-FOR-9009067.
2. For the frequency, acceptance criteria and corrective action see Tables I and II.

B. Initial Calibration Verification (ICV).

1. For the preparation and concentrations of ICV standard see 1-P-QM-FOR-9009067.
2. For the frequency, acceptance criteria and corrective action see Tables I and II.

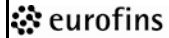
C. Continuing Calibration Verification (CCV).

1. For the preparation and concentrations of CCV standard see 1-P-QM-FOR-9009067.
2. For the frequency, acceptance criteria and corrective action see Tables I and II.

D. Low Level Check Standard (LLC)

1. For the preparation and concentrations of the LLC standard see 1-P-QM-FOR-9009067.

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2. For the frequency, acceptance criteria and corrective action see Tables I and II.

E. ICSA/ICSAB

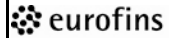
1. For the preparation and concentrations of ICSA/ICSAB standards see 1-P-QM-FOR-9009067.
2. For the frequency, acceptance criteria and corrective action see Tables I and II.

Procedure:

A. Setting up an ICP run

1. Determine the batches to be analyzed and determine any special requirements by viewing lab notes and/or project notes that are with the batch paperwork delivered from the metals prep area.
2. Assign an ICP metals storage location and document the location on the batch sheet(s) and on the sample lid for the Prep Blank of each batch.
3. Log in to Parallax and select Sequence Editor from the IDAT menu. In the Sequence Editor window, select the appropriate batch digest type (EPA or SW-846).
4. Choose the appropriate digest from the list, and click on "Get Batches"
5. Select a batch from the list to display the incomplete samples in that batch.
6. Select the appropriate template (pre-designed with the correct QC standards and auto-sampler locations) from the template list; a blank form is opened. If that batch has been previously documented, the existing sequence file is also loaded.

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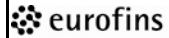
7. Add all required samples into the form, either by choosing “Add batch” for all samples, or by “dragging” individual samples into the field.

a. Sample names include:

- (1) PBW – Prep blank (water)
- (2) LCSW – Laboratory control sample (water)
- (3) LCSDW – Laboratory control sample duplicate (water)
- (4) PBS – Prep blank (solid)
- (5) LCSS – Laboratory control sample (solid)
- (6) LCSDS – Laboratory control sample duplicate (solid)
- (7) Lancaster Laboratories’ sample number
- (8) CCV – Continuing calibration verification
- (9) CCB – Continuing calibration blank
- (10) LLC – Low level check
- (11) ICSA – Interelement correction standard – A
- (12) ICSAB – Interelement correction standard - AB

b. Batches with only field blanks or equipment blanks do not need a post-digest spike or a serial dilution.

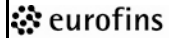
c. “As Received” samples must be run with a blank and LCS, LCSD (prepared and documented in LLENS by the analyst).

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8. Edit dilution factors (DF), protocols, and auto-sampler locations as needed. Consult the Incomplete List sheet to determine the analysis requirements for each sample.
9. Remove all unnecessary QC standards by clicking on the “QC” button. Unnecessary lines are removed by selecting individual lines and clicking on the red “X” button.
10. Save the sequence file. Click “OK” to acknowledge that the file has been saved and the cover sheet document has been created. The document opens automatically.
11. Edit the cover sheet document as needed, including batch location information and any additional comments or instructions.
12. When setting up a run, Batch QC (the order of the batch QC is typically PB, LCS, (LCSD), Bkg, PDS, DUP, MS, (MSD), SD.) must be placed in the same block of ten or fewer samples. If there are two LCSs, they must be placed one after the other.
 - a. ICV/ICB must be analyzed immediately after the calibration curve.
 - b. CCV/CCB must be analyzed after every ten analytical samples.
 - c. LLC, ICSA, ICSAB, CCV, CCB must immediately follow the ICV/ICB and must conclude each run.

NOTE: As of 10/11/2012 for all DOD protocols, it is not necessary to analyze the ending ICSA/ICSAB and LLC check samples. This is for DOD only!

- d. Any deviations from protocol must be noted in the Comments Section of the cover page.

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- e. Any unused portion of the run sheet must be “Z’d” out with initial and date.

B. Pouring an ICP run

It is important to minimize any chance of contamination, both of yourself and the samples. Keep your hands and the work area clean at all times. Do not re-use any pipette tips.

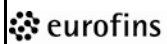
NOTE: Run QC standards are prepared separately, and kept in separate auto-sampler racks to be obtained at the time of analysis.

1. Use the batch location information on the selected run sheet to locate the corresponding batch(es). In the “Poured by:” section of the header, record: initials, employee number, and the date.
2. Carefully examine the batch to ensure there are no discrepancies between the Batch Preparation Sheet, run cover sheet, and the physical placement of samples in the batch.


NOTE: In most instances, samples are analyzed in their digestion vessels, in a foam storage rack.

3. Obtain and label all required test tubes, and place them in test tube racks. Any poured sample that does not require a graduated test tube is to be poured into a polystyrene tube.
4. Prepare and label the PDS required for each new batch (sample volume permitting).
 - a. A PDS is prepared using 0.2 mL of a custom-ordered PDS solution into 9.8 mL of background sample.
 - b. Equivalent amounts of the custom PDS must be used if decreasing sample volume.

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- c. Record preparation details in the comments column of the ICP run sheet.
5. Prepare a serial dilution by diluting the background sample by 5x.
 - a. If the background sample chosen for serial dilution has been diluted due to matrix interference or to bring the concentration into the linear range of the instrument, the serial dilution must also be diluted by 5 times the dilution factor of the background (i.e., if Bkg = DF5, S.D. must = DF25).
 - b. Document preparation details in the comment section.
6. Using Whitman No. 540 filter paper or the Filter Mate filtration device, filter those samples that are cloudy or contain particulate.
 - a. If the filtrate remains cloudy, filter again.
 - b. Samples with limited sample volume must be filtered using a 10-mL sterile disposable syringe fitted with a 0.45 µm PTFE syringe filter.
 - c. If any samples are filtered, the prep blank must also be filtered.
 - d. Document all filtrations on the run cover sheet and mark each sample lid with an "F" to indicate that it was filtered.
7. For TCLP samples that requires method of standard additions, refer to 1-P-QM-FOR-9008905 or 1-P-QM-FOR-9008807 for instructions.
8. Perform any additional spiking or dilutions and document preparation details in the comment section.
9. Cover the samples with lids or with plastic wrap to prevent contamination.
10. Place the poured batch on the bench top to await analysis, or return samples to their ICP sample storage location.

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NOTE: A post-digest spike and a serial dilution must be performed on one sample in each digestion batch. Typically, the background sample is chosen. If the batch QC is split between two samples, the post-digest spike is performed on the background sample accompanied by a matrix spike; the serial dilution is performed on the background sample accompanied by a matrix duplicate. If sample volume is limited, it is acceptable to use the duplicate for the PDS and SD.

NOTE: Analysis information, including standard lot numbers, run number, rinse time, method, analyst and date of analysis, are documented on the cover sheet at the time of analysis.

NOTE: Documentation is of utmost importance. Double check all entries.

NOTE: Dilute samples when necessary to yield a response that falls within the calibration range. Report the results for the least dilute sample where the concentration measured is within the acceptable calibration range.

NOTE: If a batch requires re-analysis, it is acceptable to re-use dilutions and/or spiked samples that were prepared for the previous analysis. A “P” in the comments section is used to indicate that a previously poured test tube is being re-used.


Instrument Operations:

A. iTEVA™ software: The Thermo Scientific iCAP™ 6000 series instrument is operated through iTEVA™ software. From the Start menu, select “iTEVA™ Control Center” to start the software.

1. Plasma ignition of the iCAP™ 6000

- a. Open the plasma status window by clicking on the icon at the bottom of the screen.
- b. Verify that all parameters are within acceptable range for ignition as indicated by a green light.

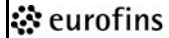
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- c. Ensure that the drain tubing for the spray chamber is properly connected to the peristaltic pump and positioned to drain into a waste carboy.
- d. Select “Ignite plasma”. After the plasma has ignited, the instrument automatically performs optimization of the nebulizer gas pressure, and then starts the on-board peristaltic pump.
- e. If the plasma does not light, repeat steps b-d.
- f. Once the plasma operating parameters have engaged, exit the Plasma status window by clicking on Close.
- g. If the plasma has been off for more than 15 minutes let the instrument warm up for 30 minutes. If the plasma has been off less than 15 minutes, let the instrument warm up 5 to 10 minutes.

2. Automated analysis using the iTEVA™ software

- a. Open the Analyst window from the Control Center by clicking on the Analyst icon. When prompted, select the appropriate method.
- b. In the Analyst window, click on the Sequence tab at the bottom of the screen.
- c. From the Auto-session menu, select Open new session.
- d. The “New auto-session” window opens. Choose the appropriate autosampler configuration set.
- e. Click on “New” to add a sequence and the “Add sequence” window appears.

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- f. Click on the “Import comma delimited text file” option and choose an appropriate template or previously prepared run sequence from the drop-down menu for the run to be entered. Click OK to close this window and continue.
- g. Change the sequence name to reflect the run number, but do not change the method revision number.
- h. Click OK at the bottom of the “New auto-session” window to continue.
- i. The sequence template is loaded. When prompted, click OK to choose the “Use positions” option, then Yes to accept duplicate positions.
- j. Edit the table as needed to include sample number, class, dilution factor, batch number and protocol for each sample.
- k. Additional samples and QC are added using the “Add sample” and “Add QC” icons, respectively, at the top of the screen. Unused rows are removed by selecting the entire row(s) and using the “remove sample” icon at the top of the screen.
- l. Right-click on the calibration standards list and select “Auto-locate” to have autosampler positions automatically assigned.
- m. Verify that the sample list begins and ends at the correct tube numbers, and check all entries for errors.
- n. Click on the “Initialize Autosampler” icon to initialize the autosampler for the current configuration.
- o. Click on the printer icon and choose to print page 1 only. This printout is kept with the run cover sheet.

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- p. Carefully examine the batch to ensure there are no discrepancies between the run cover sheet, auto-sampler sequence table and the physical placement of samples in the batch.
- q. Click on the “Start automated run” icon to start the run sequence. If a run sequence is to be started at a sample or standard other than the initial calibration, right-click on the appropriate sample and choose “Start Auto-Session Run at this Sample” and elect not to run the “start actions.”


3. Running an AutoPeak in iTEVA™

- a. In an open autosampler session (autosampler must be initialized), right-click on the location of the AutoPeak solution, and choose “Go to...”
- b. Click on the Analysis tab to open the Analysis window.
- c. From the Instrument menu, select Perform AutoPeak.
- d. Click on All elements, then OK.
- e. When prompted to aspirate the high standard, click OK. The AutoPeak is now performed.
- f. When the AutoPeak has finished, click on Done.

4. Manual analysis in iTEVA™

- a. In an open autosampler session (autosampler must be initialized), add sample(s) to be analyzed to a new or existing sequence as detailed in section A.2 of this SOP.
- b. To start analysis, right-click on the appropriate sample and choose “Start Auto-Session Run at this Sample” and elect not to run the “start actions.”


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- c. When analysis is complete, results can be printed from the Analysis tab by right-clicking on the sample name and selecting “Print Sample...”

5. Performing an interelement correction (IEC) in iTEVA™


- a. Prepare a solution of the interfering element at the linear range of the instrument. Perform manual analysis according to section A.4 of this SOP.
- b. Note results of elements with a known interference that are greater than the limit of quantitation.
- c. Divide the result of each interfered element by that of the interfering element. These values represent the amount the current IECs need to be adjusted.
- d. In the Method window, click on Elements to expand the list of elements in the method.
- e. Click on the targeted element to view the settings for that element.
- f. Click on the IECs tab to view the current IECs for that element.
- g. Add each calculated result to the correction factors currently in the first column corresponding to each pair of elements.
- h. Enter the new correction factors in the table.
- i. Repeat steps d-f as needed.
- j. Click on the Save method icon to save the method.

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B. Import and QC review of run data

Importing run data

- a. Open the iCAP Data Reprocessor.
- b. Ensure the correct database is listed.
- c. Click on “Get run name list”.
- d. Select the appropriate run.
- e. Click on “Reprocess”.
- f. Start the Parallax LIMS software and log in.
- g. Select Import from the IDAT menu.
- h. Open the appropriate run file.
- i. If prompted, enter the storage location of batch(es) requested.
- j. Verify that the following information is accurate: sample number, standard name, class, batch number, matrix, protocol, method reference, LCS ID, initial volume, final volume and dilution factor. Make corrections as needed.
- k. Enter the correct rinse time.
- l. Enter the appropriate analyst number.
- m. Click on Check/Save.


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- n. When the confirmation screen appears, verify that the file name and run number are the same. Choose to either Exit or Import another run and the run is imported and printed.

Routine Maintenance for the ICAP™ 6000 Duo Analyzer:

- A. Sample introduction system removal and cleaning: Remove and clean the sample introduction system when instrument performance declines (See **Figure 1**). Any adjustment to an instrument (replacement of parts, etc.) must be documented in the appropriate instrument logbook.

1. Remove spray chamber and nebulizer.
 - a. Unclamp spray chamber from spray chamber adapter by gently squeezing clamp with one hand while supporting the spray chamber with the other hand.
 - b. Gently remove the nebulizer from the spray chamber by pulling it out.
 - c. Disconnect the argon and sample tubing from the nebulizer by pinching the Luer lock and pulling the tubing off the nebulizer.
 - d. Clean the spray chamber if residue is observed coating the sides. If cleaning is necessary, remove the drain tubing from the spray chamber.
2. Remove and disassemble the torch
 - a. Gently pull the spray chamber adapter out of the torch assembly.
 - b. Unlock the torch assembly by turning it clockwise and remove it from the instrument.
 - c. Turn the injector tip assembly clockwise to separate it from the torch housing.


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- d. Gently pull the center tube out of housing to clean.
3. Prepare ultrasonic bath. Make sure the bath is at least ½ full with clean reagent water.
 4. Clean torch, injector tip, and nebulizer.
 - a. Invert the torch in a 250-mL vacuum flask of 50% HCl and place in the sonicator for 10 minutes. After sonication, rinse the torch with reagent water. (Be careful not to get a lot of water down into the base of the torch.) Carefully dry the torch with a paper towel.
 - b. Place the injector tip in 50% HCl for 10 minutes. Rinse the injector tip with reagent water and carefully dry with a paper towel.
 - c. For a glass nebulizer, place the nebulizer in 50% HCl for 10 minutes. (Do not place nebulizer in the sonicator.) If there is a visible clog, carefully insert 0.13 diameter fishing line through the tip of the nebulizer to assist in removing the clog. Force the 50% HCl solution through the argon and sample inlets in the nebulizer and rinse with reagent water when finished. (Make sure all of the water is out of the argon cavity of nebulizer.) For a plastic nebulizer, use a syringe to force the 50% HCl solution through the nebulizer to clean and/or remove any clogs.
 - d. If the spray chamber needs to be cleaned, place it in the sonicator for approximately 5 minutes, and then rinse it out with matrix B rinse, followed by reagent water.

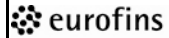
B. Reassemble the sample introduction system: (See **Figure 1**)

1. Reassemble the torch.
 - a. The o-rings on the metal torch mount must be inspected and replaced if any wear or damage is visible.

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- b. The quartz torch is pushed fully into the metal torch mount with a gently twisting pressure.
 - c. The circular “target” design on the torch **MUST** align with the circular notch on the torch mount.
 - d. Insert the injector tip fully into the center tube holder.
 - e. Insert the center tube assembly into the torch mount and rotate it counter-clockwise to lock it in position.
 - f. Mount the torch assembly back into the instrument by inserting it straight through the torch hole and coil, being careful not to disturb the quartz bonnet above the radial view lens.
 - g. Turn the assembly counter-clockwise to lock it into position.
 - h. Gently push the spray chamber adapter into the back of the center tube assembly.
2. Reassemble the spray chamber and nebulizer.
 - a. If removed for spray chamber cleaning, reattach the drain tube to the spray chamber.
 - b. With a twisting motion, insert the nebulizer into the spray chamber so that the collar is a tight fit.
 - c. Attach the sample and nebulizer gas tubing to the nebulizer.
 - d. Clamp the spray chamber to the spray chamber adapter.

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3. Ignite the plasma.

- C. Changing the pump tubing: Change pump tubing on the peristaltic pump when the tubing shows wear. Inspect all tubing to insure that it is secure and in good condition.
- D. Documentation for instrument/analysis tag out and return to service.


NOTE: The following information is taken from 1-P-QM-QMA-9017325: In the event of an equipment failure, the following must be performed:

1. Document the nature of the failure in the maintenance logbook
2. Document how and when the defect was discovered
3. Notification of supervisor or responsible person who can decide on appropriate action to take
4. The instrument must be clearly tagged as *Out of Service*. The tag must contain the following information:
 - a. Date taken out of service
 - b. Employee who took the instrument out of service
 - c. Reason for tagout

Form 1-P-QM-FOR-9007909 is used for “tagging out”.

5. The date taken out of service and the date returned to service must be documented in the logbook.
6. Document any corrective action that was taken to bring the equipment back into service.

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7. Results of the corrective action (i.e., system calibration within specifications, etc.)
8. Supervisory personnel must perform a documented evaluation and review of instrumentation/equipment where a major or uncommon failure has occurred to assess the potential impact the failure could have on the calibration and/or qualification of the instrument. This is done on a case-by-case basis.
9. After repair, document whether the function has been fixed. Then determine if calibration or verification activities need to be performed before the instrumentation is put back into service.

Calculations:

1. Final result

a. Water sample

$$\frac{\text{Instrument Reading}}{\text{Aliquot Volume}} \times \frac{\text{Dilution Volume}}{\text{Sample Volume}} \times \frac{\text{Final Volume}}{\text{Sample Volume}}$$

b. Solid sample (mg/kg)

$$\frac{\text{Instrument Reading}}{\text{Aliquot Volume}} \times \frac{\text{Dilution Volume}}{\text{Sample Weight (grams)}} \times \frac{\text{Final Volume}}{\text{Sample Weight (grams)}}$$


All dilution factors must be recorded and used in the calculation. [To enter dilution data into the LIMS when multiple dilutions are used, a factor must be formed (Ex. 1), which contains no more than three figures for the volume or the aliquot (Ex. 2).]

$$\text{Ex. 1. } 50/.5 \times 10/1 = 500/.5$$

$$\text{Ex. 2. } 50/.5 \times 25/.5 = 1250/.25 = 125/.025$$

NOTE: The default units are µg/L

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2. Relative percent different (RPD)

$$RPD = \frac{S - D}{(S + D)/2} \times 100$$

Where:

S = first sample value

D = duplicate sample value

3. Spike recovery

$$\% Recovery = \frac{SSR - SR}{SA} \times 100$$

Where:

SSR = spiked sample result

SR = sample result

SA = spike added

4. Correlation Coefficient

$$r = \frac{\sum XY - \frac{\sum X \sum Y}{N}}{\sqrt{(\sum X^2 - \frac{(\sum X)^2}{N})(\sum Y^2 - \frac{(\sum Y)^2}{N})}}$$


Where :

X = the known concentration

Y = the instrument response

N = the total number of data points

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5. Serial Dilution

$$\% \text{ Difference} = \frac{(5 \times SDR) - SR}{SR} \times 100$$

Where:

SDR = serial dilution result

SR = sample result

6. Methods of standard additions (MSA)

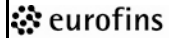
Take either 4 identical aliquots (for 3 point MSA) or 2 identical aliquots (for one point MSA) of the same sample. Leave one unspiked. Spike the other 3 aliquots with different levels of a standard solution (for 3 point MSA) and spike the other aliquot at approximately the indigenous concentration of the sample (for one point MSA). Add blank solution to sample aliquots so that the final volume is the same for all. Use small volumes of spiking solution to avoid diluting the sample more than 10%. Analyze the 4 aliquots or 2 aliquots and record the instrument readings in absorbance. Use the readings and spike values to find the slope and x- and y- intercepts. The x- intercept is the result.

$$\text{Slope} = m = \frac{\sum x_i y_i - (\sum x_i \sum y_i) / n}{\sum x_i^2 - (\sum x_i)^2 / n}$$

$$\text{Y-Intercept} = b = \bar{y} - m\bar{x}$$

$$\text{Result} = -\frac{b}{m}$$

$$\text{Correlation Coefficient} = r = \frac{\sum \{(x_i - \bar{x})(y_i - \bar{y})\}}{\sqrt{[\sum (x_i - \bar{x})^2][\sum (y_i - \bar{y})^2]}}$$

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The correlation coefficient (r) for the least squares fit must be ≥ 0.995 . If the r value is < 0.995 , the MSA must be repeated at the same dilution. If the r value is again low, the result with the higher r value is verified and both are flagged with a “+” in the data package. If the r value is < 0.990 , the sample is run at an interference dilution to overcome matrix effects. This usually requires a raised limit of quantitation. If a client requests a particular limit of quantitation that prohibits further dilution, then the sample is repeated at the same dilution and the best of the two results is verified.

Statistical Information/Method Performance:

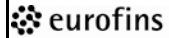
Generate MDLs and LOQs according to 1-P-QM-QMA-9017309. Perform an MDL study on each instrument used for the analysis. Determine the MDL by taking seven spiked replicates through the entire digestion and analysis procedure. Compare and pool results to determine the final reporting MDL. The department supervisor maintains annual study data. The department supervisor requests that a Quality Assurance Specialist update to the LIMS as needed. Update the department database via a download from the LIMS.

Each analyst training to perform a new analysis must complete an IDOC that meets the requirements for accuracy and precision before working independently on that test method. Typically, this is accomplished by the successful analysis of four known samples or one blind sample. Maintain copies of the IDOC in the analyst's training records.

Quality Assurance/Quality Control:

- A. For 6010B, and 6010C, each digestion batch (up to 20 samples) must contain a method blank, LCS, and either an U, D, MS, MSD or an LCS/LCSD.
- B. For 200.7, each digestion batch (up to 10 samples) must contain a method blank, LCS, and either an U, D, MS or an LCS/LCSD.
- C. QC limits for MS/MSD, and LCS/LCSD are established through statistical analysis of historical data.

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1. The limits are maintained in the LIMS for the metals analysis numbers.
2. The limits are evaluated every 6 months and updated as needed.
3. The limits are subject to change without notification.

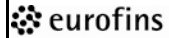
D. Batch Quality Control

1. For the preparation and concentrations of Batch Quality Control see 1-P-QM-FOR-9009067
2. For the frequency, acceptance criteria and corrective action see tables I and II.


E. Raw data quality checks

1. Confirm that the batch and cover sheets are correctly labeled, dated, and signed where necessary. Review the batch sheet, project notes and lab notes with the incomplete list for special comments and due dates. Check that the run protocol has been selected correctly.
2. Check to see that the autosampler table printout is with the run and has a review signature from the analyst and run importer.
3. Refer to the calculation section of this SOP for calculations used for ICP analysis.
4. Refer to Tables I, and II for run and batch calibration and QC frequency, acceptance criteria and corrective action. For information on statistical limits refer to 1-P-QM-QMA-9017313.
5. Each analytical run must have a QC review attached. All samples on the run must be listed on the QC review with notation as to whether the sample was verified or needed to be redigested/reanalyzed. The verifier must document on the QC review if any sample(s) were selected/deselected.

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6. For spike levels of run QC see 1-P-QM-FOR-9009067
7. Spike levels of batch QC are available in the LIMS and on 1-P-QM-FOR-9009182.
8. LOQs are available in the LIMS and on 1-P-QM-FOR-9008385.
9. Check to make sure that all results are below 90% of the linear range. If a sample reading is above 90% of the linear range, then reread the sample at an appropriate dilution. Verifiers footnote the coversheet indicating that all dilutions were performed correctly by comparing to the previous undiluted sample data.
10. Check that the **absolute** value of all nondetected analytes is less than the LOQ. A technical decision must be made as to whether a reread is warranted for readings <(-LOQ). Comments are added during verification to any non-detect sample readings that were diluted due to <(-LOQ).
11. For SPLP and TCLP samples, an MSA (method of standard additions) is required if:
 - a. The sample concentration falls between 80% to 100% of the regulatory limits.
 - b. If the SPLP or TCLP Matrix Spike (QA) recovers < 20%, all samples in the leachate batch must be reanalyzed using the method of standard additions for that analyte.
12. For all EW samples (samples from public drinking water sources); check the results against the MCL (maximum contaminant level). If an analyte **exceeds** the MCL, notify a verifier at once. An automated email is sent to the Client Service Representative and the state for the analytes listed below with the exception of lead and copper which follow the 90th percentile rule (the CSR tracks the lead and copper and notifies the supplier when necessary). Suppliers must be notified within 24 hours.

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<u>Analyte</u>	<u>MCL (mg/L)</u>
Sb	0.006
As	0.01
Ba	2 (1)**
Be	0.004
Cd	0.005
Cr	0.1 (0.05)**
Se	0.05 (0.01)**
Tl	0.002
Al*	0.2
Cu	1.0
Fe*	0.3
Mn*	0.05
Ag*	0.1 (0.05)**
Zn*	5.0

*Secondary regulated contaminants

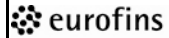
**The federal MCLs for these analytes are greater than Pennsylvania MCLs. The numbers in parentheses are the MCLs effective in Pennsylvania.

13. Check the internal standard (Yttrium) level for the entire run. If the Yttrium reading for any sample is < 50% or >130% of the reading for S0, then reread the sample at a dilution.

NOTE: The internal standard is added in equal concentration to all of the samples and standards via a dedicated line on the peristaltic pump. The analytical lines referenced to an internal standard report a corrected concentration value based on the ratio of analyte to internal standard intensities. All of the calculations for determining concentration are based off of Intensity Ratio (IR). The IR is defined as the background corrected intensity signal of the analyte line (Ia) divided by the internal standard value (Iis). $IR = I_a/I_{is}$

14. For EPA600 series samples, an ICV2 is analyzed immediately after the initial ICV. The average of the six total replicates is used with a requirement of $\pm 5\%$ accuracy and an RSD of <3%.
15. Check for high concentrations of interfering elements. Analytes must be flagged for possible interference if any interfering element concentration is greater than the level used for semi-annual IECs. Comments must be added during verification to any samples reading under the reporting limit that were

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diluted due to possible interference(s). For the iCAP 6000 series instrument (T70, #11016; T71, #16315; T72, #16417, T73, #18255) Si is monitored due to an interference on Pb. Pb data must be reread if Si is not within $\pm 10\%$ in CCVs.

NOTE: All samples requiring postspikes must be postspiked at 2 times the CRQL or approximately 2 times the indigenous level of the sample.

F. When raw data checks are complete, check the following:

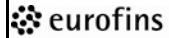
1. All samples requiring reread/redigestion are listed on the reread/redigestion schedule forms. Any dilutions required have been calculated correctly and added to the reread/redigestion form. Specific instrument has been noted for client requirements if necessary.
2. Data for samples following Good Laboratory Practices (GLP) must be retained as permanent storage.
3. The data are uploaded to Parallax via IDAT by the reviewer and are verified from Parallax by the verifier.

G. Instrument detection limits are performed on a quarterly basis and method detection limits are performed on a yearly basis for each analytical instrument.

H. Verification process

1. Confirm that all required pieces of QC have been uploaded to Parallax and are within specification. If there is partial QC on the current run and the samples have been analyzed more than once, check to see if there are associated runs in the hold bin waiting on additional QC to be verified.
2. In Parallax, choose method of verification. (Metals verification by run, or verify by individual element.)
3. Ensure that all lab notes and project notes were followed.

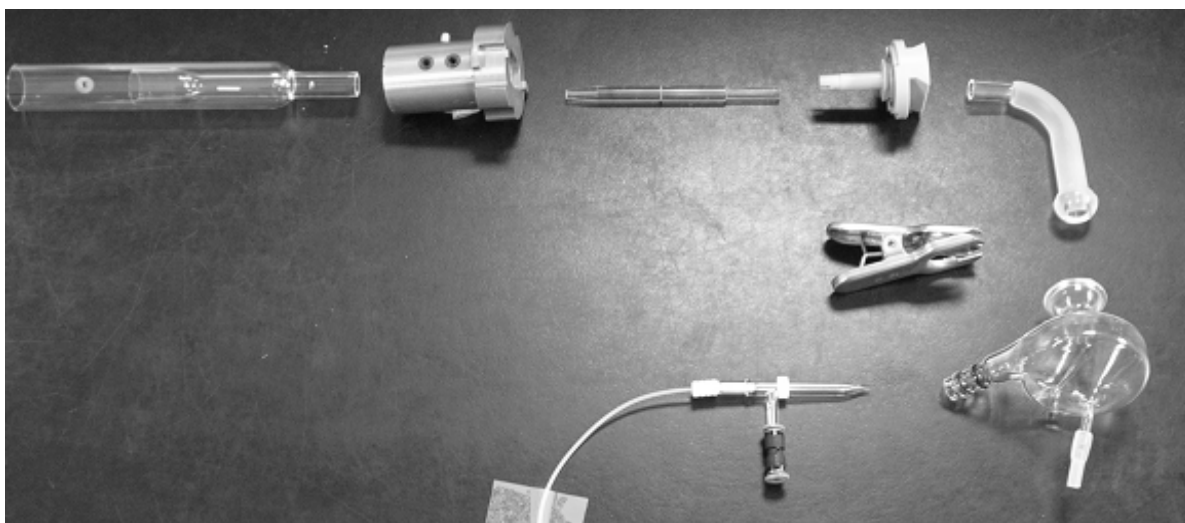
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4. Non-compliant data can be reported only after all required corrective actions have been taken. Document the nonconformance using Form 1-P-QM-FOR-9007858.

5. When all of the elements are verified for a digest, verify the digest number. Associated tracking numbers and suite numbers are routinely auto-verified within hours of verifying all of the elements and digests on each sample.

Figure 1



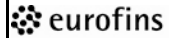
 Lancaster Laboratories Environmental	Document Title: Metals by Inductively Coupled Plasma Atomic Emissions Spectroscopy for SW-846 Methods 6010B/C (aqueous, solid, tissue) and EPA 200.7(aqueous)	Eurofins Document Reference: 1-P-QM-WI -9018442
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Table I
QC requirements for SW-846 6010B and 6010C (ICP Metals)

	Frequency	Acceptance	Corrective Action
Calibration	The calibration contains a blank and 1 standard.		
Initial Calibration Verification (ICV)	Must be analyzed immediately following Calibration Standards.	$\pm 10\%$ of the true value. RSD must be $< 5\%$ (6010B, 6010C).	If the ICV is out of specification high for an analyte and the result is not $< -LOQ$, accept results that report as non-detect for affected analyte. Results for the affected analyte(s) $>$ or $=$ to the reporting limit must not be reported from the run (reanalyze).
Initial Calibration Blank (ICB)	Must be analyzed immediately following the ICV.	$ ICB $ must be $< 3 \times IDL$ (6010B, 6010C) If ICB is Out of Specification positive (+), accept results that are $> 10X$ the ICB, or $<$ reporting limit. If ICB is Out of Specification negative (-), only accept results that are $> 10X$ ICB. (6010B, 6010C).	Data for that analyte cannot be reported from the run for the affected samples (reanalyze the affected samples for that analyte) (6010B, 6010C).
Low Level Check (LLC)	Must be analyzed at the beginning and end of each run and before the ICSA and ICSAB.	6010B: $\pm 50\%$ of True Value. Not applicable if sample concentrations are $> 10 \times$ the true value of the LLC. For LLC results $>$ the high limit, samples $<$ reporting limit can be accepted. 6010C: $\pm 30\%$ of True Value. Not applicable if sample concentrations are $< LOQ$, or if sample concentrations are greater than the CCV (CCV must be within specification).	Data for that analyte cannot be reported from the run for the affected samples.
Interference Check Standard A and AB (ICSA/ICSAB)	The ICSA must be analyzed at the beginning and end of each run immediately following the LLC. The ICSAB must be analyzed at the beginning and end of each run immediately following the ICSA.	$\pm 20\%$ of the true value for analytes that are spiked. $ ICS $ or $ ICSAB $ must be $< 2 \times LOQ$ for analytes that are not spiked.	Data for that analyte cannot be reported from the run (reanalyze all samples requiring that element).

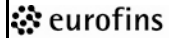
 Lancaster Laboratories Environmental	Document Title: Metals by Inductively Coupled Plasma Atomic Emissions Spectroscopy for SW-846 Methods 6010B/C (aqueous, solid, tissue) and EPA 200.7(aqueous)	Eurofins Document Reference: 1-P-QM-WI -9018442
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Table I (Continued)

	Frequency	Acceptance	Corrective Action
Continuing Calibration Verification (CCV)	Must be analyzed immediately following the ICSAB and at a frequency of every 10 samples.	$\pm 10\%$ of the true value. RSD must be $< 5\%$ (6010B, 6010C)	If the CCV is out of specification high for an analyte and the result is not $< -LOQ$, accept results that report as non-detect for affected analyte. Results for the affected analyte(s) $>$ or $=$ to the reporting limit must not be reported from the run (reanalyze).
Continuing Calibration Blank (CCB)	Must be analyzed immediately following CCV's at a frequency of every 10 samples	CCB must be $< 3 \times IDL$ (6010B, 6010C) If CCB is Out of Specification positive (+), accept results that are $> 10X$ the CCB, or $<$ reporting limit. If CCB is Out of Specification negative (-), only accept results that are $> 10X$ CCB. (6010B, 6010C).	Data bracketing the CCB for that analyte cannot be reported for the affected samples (reanalyze the affected samples in the bracketing blocks for that analyte) (6010B, 6010C).
Preparation Blank (PB)	Must be prepped at a frequency of 1 per analytical batch of 20 samples or less.	PB must be $< 1/2 LOQ$. For 6010B: Not applicable if analyte reading in the sample is $> 20 \times$ the PB reading or $< LOQ$. For 6010C: Not applicable if analyte reading in the sample is $> 10 \times$ the PB reading or $< LOQ$.	Redigest all associated samples.
Laboratory Control Standard (LCS)	Must be prepped at a frequency of 1 per analytical batch of 20 samples or less.	Use statistical limits or the method limit of $\pm 20\%$, as indicated by the client requirement. If the LCS is out of specification high and the sample result is less than the LOQ the data can be taken.	Redigest all associated samples if the LCS is out of specification low. If the LCS is out of specification high redigest samples that are greater than the LOQ.

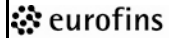
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Table I (Continued)

	Frequency	Acceptance	Corrective Action
Laboratory Control Standard Duplicate (LCSD)	If insufficient sample volume is submitted to perform batch QC then a LCSD is prepped at a frequency of 1 per analytical batch of 20 samples or less.	<p>Use statistical limits or the method limit of $\pm 20\%$, as indicated by the client requirement</p> <p>If the LCS is out of specification high and the sample result is less than the LOQ the data can be taken.</p> <p>RPD must be $< 20\%$.</p>	<p>Redigest all associated samples if the LCS is out of specification low.</p> <p>If the LCS is out of specification high redigest samples that are greater than the LOQ.</p> <p>Redigest samples if RPD is out of specification</p>
Matrix Spike/ Matrix Spike Duplicate (MS/MSD)	Must be prepped at a frequency of 1 per analytical batch of 20 samples or less.	<p>Use statistical limits or the method limit of $\pm 25\%$ (6010B, 6010C), as indicated by the client requirement.</p> <p>RPD must be $< 20\%$.</p>	<p>Data is flagged in the QC Summary and/or in the data package.</p> <p>If sample concentration $< 4\times$ the spike added a PDS must be performed.</p> <p>Flagged in the Data Package and in the QC summary.</p>
Duplicate (D)	Must be prepped at a frequency of 1 per analytical batch of 20 samples or less.	<p>If the samples are $> 5\times$ the LOQ the RPD must be $< 20\%$.</p> <p>If either the sample or duplicate is $< 5\times$ the LOQ the difference between the two values must be $< \text{LOQ}$.</p> <p>Not applicable if both samples are $< \text{LOQ}$.</p>	Data is flagged in the QC Summary and/or in the data package.
Post Digestion Spike (PDS)	Must be prepared with each background sample. Evaluated when matrix spike(s) are not within specification.	$\pm 25\%$ of the true value.	The data is reported in the data package.
Serial Dilution	Must be prepared with each background sample. Evaluated only when analyte concentrations are $> 50\times$ the MDL.	The percent difference must be $< 10\%$.	The data is flagged in the data package.

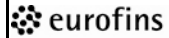
 Lancaster Laboratories Environmental	Document Title: Metals by Inductively Coupled Plasma Atomic Emissions Spectroscopy for SW-846 Methods 6010B/C (aqueous, solid, tissue) and EPA 200.7(aqueous)	Eurofins Document Reference: 1-P-QM-WI -9018442
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Table I (Continued)

	Frequency	Acceptance	Corrective Action
Samples		Results must be < 90% of the linear dynamic range, >-LOQ. RSD must be <20% for results >2x LOQ. Elements reported as non-detect are accepted if the ICV/CCV is out of specification high, and the sample is not < - LOQ.	Sample is diluted and reanalyzed. Sample is reanalyzed. Reanalyze for elements that do not meet this criteria.
Linear Range Standard (LRS)	LRS not evaluated on all runs. Use as needed.	±10% of the true value	Samples reading greater than 90% of the calibration range must be reanalyzed.
Internal Standard	Added to samples in line by use of a mixing T.	Must be 50% -130% of the calibration blank.	Reanalyze at a dilution.

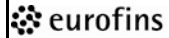
 Lancaster Laboratories Environmental	Document Title: Metals by Inductively Coupled Plasma Atomic Emissions Spectroscopy for SW-846 Methods 6010B/C (aqueous, solid, tissue) and EPA 200.7(aqueous)	Eurofins Document Reference: 1-P-QM-WI -9018442
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Table II
QC requirements EPA-600/R-94/111 (PW, EW, WW) ICP Metals

	Frequency	Acceptance	Corrective Action
Calibration	The calibration contains a blank and 1 standard.		
Initial Calibration Verification (ICV)	Must be analyzed immediately following calibration.	Avg of ICV and ICV2 must be $\pm 5\%$ of the true value.	If the ICV is out of specification high for an analyte and the result is not < - LOQ, accept results that report as non-detect for affected analyte. Results for the affected analyte(s) > or = to the reporting limit must not be reported from the run (reanalyze).
ICV2	ICV2 must be analyzed immediately after the ICV to attain the average of six replicates.	RSD for 6 replicates must be <3%.	
Initial Calibration Blank (ICB)	Must be analyzed immediately following the ICV.	ICB must be < 3x IDL If ICB is Out of Specification positive (+), accept results that are > 10X the ICB, or < reporting limit. If ICB is Out of Specification negative (-), only accept results that are > 10X ICB.	Data for that analyte cannot be reported from the run (reanalyze all samples requiring that analyte).
Low Level Check (LLC)	Must be analyzed at the beginning and end of each run and before the ICSA and ICSAB.	Use statistical limits. Not applicable if sample concentrations are >10x the true value of the LLC. For LLC results >the high limit, samples <reporting limit can be accepted.	Data for that analyte cannot be reported from the sample.
Interference Check Standard A and AB (ICSA/ICSAB)	The ICSA must be analyzed at the beginning and end of each run immediately following the LLC. The ICSAB must be analyzed at the beginning and end of each run immediately following the ICSA.	$\pm 20\%$ of the true value for analytes that are spiked. ICSA or ICSAB must be <2x LOQ for analytes that are not spiked.	Data for that analyte cannot be reported from the run (reanalyze all samples requiring that element).

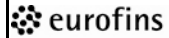
 Lancaster Laboratories Environmental	Document Title: Metals by Inductively Coupled Plasma Atomic Emissions Spectroscopy for SW-846 Methods 6010B/C (aqueous, solid, tissue) and EPA 200.7(aqueous)	Eurofins Document Reference: 1-P-QM-WI -9018442
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Table II (Continued)

	Frequency	Acceptance	Corrective Action
Continuing Calibration Verification (CCV)	Must be analyzed immediately following the ICSAB and at a frequency of every 10 samples.	$\pm 10\%$ of the true value.	If the CCV is out of specification high for an analyte and the result is not $< -LOQ$, accept results that report as non-detect for affected analyte. Results for the affected analyte(s) $> \text{or} =$ to the reporting limit must not be reported from the run (reanalyze).
Continuing Calibration Blank (CCB)	Must be analyzed immediately following CCV's at a frequency of every 10 samples.	CCB must be $< 3 \times IDL$ If CCB is Out of Specification positive (+), accept results that are $> 10 \times$ the CCB, or $<$ reporting limit. If CCB is Out of Specification negative (-), only accept results that are $> 10 \times$ CCB.	Data bracketing the CCB for the affected analyte cannot be reported (reanalyze all samples in the bracketing blocks for that element).
Preparation Blank (PB)	Must be prepped at a frequency of 1 per analytical batch of 10 samples or less.	PB must be $< 1/2 LOQ$. Not applicable if analyte reading in the sample is $> 10 \times$ the PB reading or $< LOQ$.	Redigest all associated samples.
Laboratory Control Standard (LCS)	Must be prepped at a frequency of 1 per analytical batch of 10 samples or less.	Use statistical limits or the method limit of $\pm 15\%$ (PW, EW)/ 20% (WW) ,as indicated by the client requirement. If the LCS is out of specification high and the sample result is less than the LOQ the data can be taken.	Redigest all associated samples if the LCS is out of specification low. If the LCS is out of specification high redigest samples that are greater than the LOQ.
Laboratory Control Standard Duplicate (LCSD)	If insufficient sample volume is submitted to perform batch QC then a LCSD is prepped at a frequency of 1 per analytical batch of 10 samples or less.	Use statistical limits or the method limit of $\pm 15\%$ (PW, EW)/ 20% (WW) ,as indicated by the client requirement. If the LCS is out of specification high and the sample result is less than the LOQ the data can be taken. RPD must be $< 20\%$.	Redigest all associated samples if the LCS is out of specification low. If the LCS is out of specification high redigest samples that are greater than the LOQ. Redigest samples if RPD is out of specification

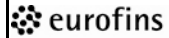
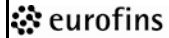
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Table II (Continued)

	Frequency	Acceptance	Corrective Action
Matrix Spike (MS)	Must be prepped at a frequency of 1 per analytical batch of 10 samples or less.	Use statistical limits or the method limit of $\pm 30\%$, as indicated by the client requirement.	Data is flagged in the QC Summary and/or in the data package. If sample concentration $< 4\times$ the spike added a PDS must be performed.
Duplicate (D)	Must be prepped at a frequency of 1 per analytical batch of 10 samples or less.	If the samples are $> 5\times$ the LOQ the RPD must be $< 20\%$. If either the sample or duplicate is $< 5\times$ the LOQ the difference between the two values must be $< \text{LOQ}$. Not applicable if both samples are $< \text{LOQ}$.	Data is flagged in the QC Summary and/or in the data package.
Post Digestion Spike (PDS)	Must be prepared with each background sample. Evaluated when matrix spike is not within specification.	$\pm 15\%$ of the true value.	Data is reported in the data package.
Serial Dilution	Must be prepared with each background sample. Evaluated only when analyte concentrations are $> 50\times$ IDL.	The percent difference must be $< 10\%$.	Data is flagged in the data package.
Samples		Results must be $< 90\%$ of the linear dynamic range, $> -\text{LOQ}$. RSD must be $< 20\%$ for results $> 2\times \text{LOQ}$. Elements reported as non-detect are accepted if the ICV/CCV is out of specification high and the sample is not $< -\text{LOQ}$.	Sample is diluted and reanalyzed. Sample is reanalyzed. Reanalyze for elements that do not meet this criteria.
Linear Range Standard (LRS)	LRS not evaluated on all runs. Use as needed.	$\pm 10\%$ of the true value	Samples reading greater than 90% of the calibration range must be reanalyzed.
Internal Standard	Added to samples in line by use of a mixing T.	Must be 50% -130% of the calibration blank.	Reanalyze at a dilution.

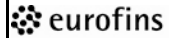
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Appendix I

Definitions and explanations of the codes and symbols used on the raw data

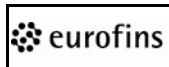
A. Sample table information

1. The run number.
2. The page number.
3. The tube number.
4. The sample number.
5. The first and second of four asterisks denote whether the sample is a background (U*), duplicate (D*), spike (R*), MSD (M*), post-digestion spike (UP), serial dilution (UL), or not a QC sample (**).
6. The weight to volume or volume to volume digestion ratio, consisting of the initial quantity of sample used and the final digest volume.
7. The dilution factor – Indicating if the digest solution was diluted prior to analysis. An undiluted sample is labeled DF1.
8. Digestion batch number – Assigned when designated samples are scheduled for preparation, this number is used to track samples and QC prepared together.
9. The protocol by which the data is reviewed (SW-846, EPA-600).

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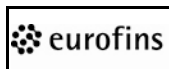
Appendix I (Continued)

10. Date and time of the sample injection into the instrument.
 11. The ICAP identification number.
- B. The ICP scans all of the method elements simultaneously during the analysis. The QC review lists all the samples on the run. The QC review lists elements verified, good phantom, and elements/phantom that are bad (need to be reread for run or batch QC). The reviewer or verifier documents on the QC review if any element(s)/sample(s) were selected/deselected.
- C. The following are error codes in the iTEVA™ software .
1. S = Saturation – The concentration of the element is more than the detector can quantify.
 2. K = The Elements Affected by a Saturated Element – The concentration listed is not accurate, and a more accurate result can be obtained by running the sample at a dilution.
- D. Along with the average concentration (in ppm), the average intensity, %RSD and all three replicates are shown for each analyte. Internal standard values are intensities (cts/s).

 <div>Lancaster Laboratories Environmental</div>	Document Title: Preparation of Soils for Volatile Analysis by EPA SW-846 Method 5035	Eurofins Document Reference: 1-P-QM-WI -9015193
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Eurofins Document Reference	1-P-QM-WI -9015193	Revision	17
Effective Date	Feb 21, 2015	Status	Effective
Historical/Local Document Number	Analysis DOD - 8389, 8390, 6130, 6117, 6174, 7578, 7320		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

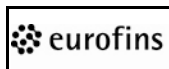
Prepared by	Chad Wettig
Reviewed and Approved by	Dana Kauffman;Review;Wednesday, February 4, 2015 7:30:51 PM EST Christiane Sweigart;Approval;Saturday, February 7, 2015 10:30:27 AM EST

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Revision Log:

Revision: 17		Effective Date:	This version
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Throughout Document	Reflects re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers	
	Reflects new reference to the information management system	Removed references to Parallax and replaced with LIMS	

Revision: 16		Effective Date:	Mar 10, 2011
Section	Justification	Changes	
Revision Log	Formatting requirements per LOM-SOP-LAB-201	Removed revision logs up to the previous version.	
Header	No longer used	Removed deactivated Analysis #0065.	
Procedure A.4.	No longer used	Removed procedure for preparing vials for Analysis #0065.	
Reagents and Standards	Reflects current practice	Updated freezer temperature to -10 to -15.	
Procedure B.1.	Reflects current practice	Note updated to reflect that a representative sample is used.	

 Lancaster Laboratories Environmental	Document Title: Preparation of Soils for Volatile Analysis by EPA SW-846 Method 5035	Eurofins Document Reference: 1-P-QM-WI -9015193
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Reference:

1. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 5035, November 2004.
2. *Test Methods for Evaluating Solid Wastes*, SW-846, Method 5035A, July 2002.
3. *Method AK101 for the Determination of Gasoline Range Organics*, April 8, 2002.
4. *Chemical Hygiene Plan*, current version.

Cross Reference:

Document	Document Title
1-P-QM-FOR-9008457	Analysis/Bottle Table for Volatile Soil Prep
1-P-QM-PRO-9015516	Preservation and Bottles Room Preservative Traceability
1-P-QM-QMA-9017328	Reagents and Standards
1-P-QM-QMA-9021767	Laboratory Notebooks, Logbooks, and Documentation for Environmental Testing

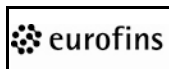
Purpose:

The purpose of this SOP is to describe the proper technique to perform the preparation of soil samples for low and high concentration volatile analysis when submitted in a coring device.

Scope:

This SOP covers the preparation of vials used when preparing soil samples for low and high concentration volatile analysis. It also covers preparing soil samples that have been collected in a coring device for analysis, such as the Encore™ sampler.

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 <div>Lancaster Laboratories Environmental</div>	<div>Document Title:</div> <div>Preparation of Soils for Volatile Analysis by EPA SW-846 Method 5035</div>	<div>Eurofins Document Reference:</div> <div>1-P-QM-WI -9015193</div>
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Basic Principles:

The sample is collected in a coring device (Encore™) and extruded into a pre-weighed volatile-free container and preserved within 48 hours of collection. The weight of the container, preservative, and soil is captured and the net weight of the sample is calculated and captured in the Volatile Preparation program in LIMS.

Definitions:

VOA Prep Summary and VOA Prep Summary by SDG - Reports that reside on the LIMS database. Using the Volatile Prep application and moisture results pulled from LIMS, the report is populated and the calculations are performed to achieve a Final Extraction Volume to be used when necessary by the GC and GC/MS groups.

Interferences:

Sample preparation must be performed in a volatile free environment to avoid contamination. Therefore, this process must be performed in one of the designated volatile free laboratories. It is possible for samples to become contaminated by diffusion of volatiles through the sample vial septum; a trip blank carried through sampling, storage and handling acts as a check for such contamination.

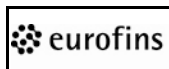
Safety Precautions and Waste Handling:

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Methanol is flammable. Containers of this solvent must be kept away from any sources of open flames or sparks. Due to the potentially toxic nature of samples received from clients for analysis, safety precautions must be observed when handling samples. Safety glasses, lab coats, and gloves are required. Weighing of hazardous samples must always take place in a hood; see lab notes for further direction.

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 Lancaster Laboratories Environmental	Document Title: Preparation of Soils for Volatile Analysis by EPA SW-846 Method 5035	Eurofins Document Reference: 1-P-QM-WI -9015193
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The solvents utilized in this procedure are disposed of in a solvent waste container which is transferred to a lab-wide disposal facility. Expired standards in methanol are disposed of as hazardous waste. Bulk sample containers and methanolic sample preparations are returned to the sample storage area for future disposal. Other wastes generated by Lancaster Labs are disposed of via incineration at EPA licensed facilities.

Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP which is maintained in the employee's training record.

The initial training consists of observing the procedure being carried out by an experienced analyst/technician. Next, the trainee performs the procedure while the experienced person watches, answers questions, and gives feedback. Following the initial training, experienced individuals are available as a resource until no longer required. Analysts are considered proficient when able to perform the procedure independently.

Sample Collection, Preservation, and Handling:

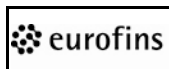
Samples in either Encore™ sampling devices or jars used for the effervescence check must be refrigerated at $4^{\circ} \pm 2^{\circ}\text{C}$, not frozen. (Jars used for collection must be glass with a PTFE-lined lid.) Samples must be preserved or frozen in reagent water at -10°C to -15°C within 48 hours of collection. See individual technical area SOPs for method specific hold times.

Apparatus and Equipment:

It is acceptable to use alternate weights and volumes as long as the final concentrations remain the same. See 1-P-QM-QMA-9017328 for proper labeling documentation.

1. 40-mL vials with stir bars, Teflon™-lined low-bleed septa, and screw caps. SciSpec Catalog #376740-MB or equivalent.

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2. Encore™ sampler, or equivalent.
3. Pipette capable of dispensing up to 25 mL.
4. Analytical balance capable of weighing 0.01 g
5. Preprinted labels with vial ID code.
6. Extruder tool for EnCore™ sampler.
7. Voa Prep Application - integrates a PC with a balance to collect data directly from the balance. It organizes the data, performs calculations (when required), and stores final results in the Laboratory Information Management System. This procedure must be used whenever possible to facilitate data transfers and other tracking; however, it is allowable to record data traditionally in a logbook if necessary. Refer to 1-P-QM-QMA-9021767.

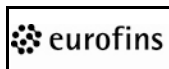
Reagents and Standards:

The sodium bisulfate and methanol used must have been previously tested and approved for use by the labs. See 1-P-QM-PRO-9015516 for further information.

NOTE: A rinse using reagent water followed by methanol must be performed on the pipette dispensers before adding a new lot of solution or standards.

1. Methanol – Purge and trap grade, store at room temperature and re-analyze yearly. The methanol used must have been previously tested and approved for use by the labs. See 1-P-QM-PRO-9015516 for further information.
2. 8260A/B Surrogate Mix, Restek Catalog #30340 (2500 µg/mL) or equivalent. Store at -10° to -15°C for up to 1 year. This standard is used as is or diluted in methanol to a final concentration of 2.5 µg/mL. Diluted standard must be stored at -10° to -15°C for up to 6 months. This standard is used for the GC/MS analyses.

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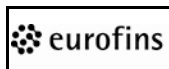
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3. Custom a,a,a-trifluorotoluene (TFT), Restek Catalog #54357 (15,000 µg/mL) or equivalent. This standard is used as is or diluted in methanol to a final concentration of 750 µg/L. Store at -10° to -15°C for up to 30 days. This standard is used for the GC analyses.
4. Sodium hydrogen sulfate anhydrous powder, Fluka, Catalog #2316657 or equivalent. Store at room temperature and re-analyze yearly. If compounds are detected above the method detection limit (MDL), prepare another vial and repeat the analysis. If compounds are still detected above the MDL, a new container must be tested and used.
5. Sodium Bisulfate Solution – prepared by diluting 200 ± 0.5 g of the sodium hydrogen sulfate anhydrous into 1000 mL of reagent water in 1000-mL volumetric flask. Cap and invert at least 10 times to mix. Store at room temperature and re-analyze every six months if supply remains. If compounds are detected above the method detection limit (MDL), repeat the analysis. If compounds are still detected above the MDL, remake the solution and test before using.
6. Reagent water – water in which target analytes are not detected at or above the reporting limit for parameters of interest. In general, the deionized water supplied at the taps in the laboratory meets criteria. If the reagent water does not meet the requirements, see your supervisor for further instructions.

Calibration:

Not applicable to this procedure

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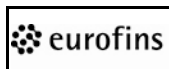
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Procedure:

A. Preparing vials

1. Sodium bisulfate solution vials used in preparation for low concentration analysis 8389.
 - a. Add 5 mL of sodium bisulfate solution to a clean 40-mL vial with a magnetic stir bar.
 - b. Seal the vial with a screw cap and septum seal. (Septum seal must be able to withstand an acidic solution—low bleed septum recommended).
 - c. Label the vial with a tracking number and capture the information using the Volatile Prep application.
 - d. Store at room temperature until sample preparation occurs.
2. Reagent water vials used when effervescence occurs during preparation for low level concentration analyses.
 - a. Add 5 mL of reagent water to a clean 40-mL vial with a magnetic stir bar.
 - b. Seal the vial with a screw cap and septum seal. (Septum seal must be able to withstand an acidic solution—low bleed septum recommended).
 - c. Label the vial with a tracking number and capture the information using the Volatile Prep application.
 - d. Store at room temperature until sample preparation occurs.
3. Methanol vials used in preparation for high concentration GC/MS analysis 8390, 6174, and 7578.

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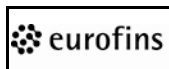
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- a. Add required amount of methanol with 8260 surrogate (pre-made solution) to a clean 40-mL vial. See 1-P-QM-FOR-9008457.
 - b. Seal the vial with a screw cap and septum seal.
 - c. Label the vial with a tracking number and capture the information using the volatile prep application.
 - d. Store at $4^{\circ} \pm 2^{\circ}\text{C}$, not frozen.
4. Methanol vials used in preparation for high concentration GC analysis 6117 and 6130.
- a. Add required amount of methanol with TFT surrogate (pre-made solution) to a clean 40-mL vial. See 1-P-QM-FOR-9008457.
 - b. Seal the vial with a screw cap and septum seal.
 - c. Label the vial with a tracking number and capture the information using the volatile prep application.
 - d. Store at $4^{\circ} \pm 2^{\circ}\text{C}$, not frozen.

B. Preparing the sample

1. Samples are stored at $4^{\circ} \pm 2^{\circ}\text{C}$, not frozen, prior to preparation.
2. Samples are removed from the refrigerator/cooler for preparation in small numbers to ensure that they remain cold.
3. Samples for low concentration analysis require three replicate collections.
 - a. Two replicates are prepared into sodium bisulfate.

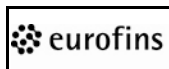
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- b. One replicate is prepared into methanol as a back up in case we need to change to high level.
 - c. If the sample effervesces in sodium bisulfate, those two replicates are prepared into reagent water and frozen.
4. Samples for high concentration analysis only require one collection prepared into methanol.
5. The methanol vial must be prepared first to ensure at least one vial is available for each required solution.
6. Sodium bisulfate solution or reagent water vials

NOTE: Take a representative sample from a container not collected in an EnCore™ sampler and place it in a vial containing sodium bisulfate solution. Check the pH of the sample in solution to ensure that it is <2. If it is not, add enough sodium bisulfate to bring the pH <2. Also check for effervescence. If a rapid or vigorous reaction occurs, prepare the EnCore™ collections into vials that contain a stir bar and 5 mL reagent water and then freeze at -10° to -15°C.

- a. Weigh a prepared vial to the nearest 0.01 g. Capture the weight.
- b. Extrude the sample from the sampling device into the vial and immediately recap the vial.
- c. Weigh the vial which now contains the soil to the nearest 0.01 g and capture the weight.

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- d. The weight of the soil is determined by a calculation performed by the volatile prep program based on subtracting the weight of the prepped vial from the weight of the vial with soil. Note in the comment section if the Encore™ sampling device is not properly sealed or if the device is not full causing a low weight. The volatile prep application generates an e-mail and sends it to the appropriate client services representative.
- e. Record any unusual observations about the sample.

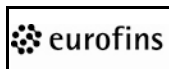
7. Methanol vials

- a. Weigh a prepared vial to the nearest 0.01 g. Capture this weight.
- b. Extrude the sample from the sampling device into the vial and immediately recap the vial.
- c. Weigh the vial, which now contains the soil to the nearest 0.01 g, and capture this weight.
- d. The weight of the soil is determined by a calculation performed by the volatile prep program based on subtracting the weight of the prepped vial from the weight of the vial with soil. Note in the comment section if the Encore™ sampling device is not properly sealed or if the device is not full causing a low weight. The volatile prep application generates an e-mail and sends it to the appropriate client service representative.
- e. Record any unusual observations about the sample.

C. Deliver sample to the labs

Once the samples are prepared into either sodium bisulfate or methanol, or frozen in reagent water, they must be transported to the laboratory that performs the analysis. Each department has a designated drop-off spot. Analysis is then performed per the methods of that department.

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Calculations:

$$\text{Calculation of sample weight : } W_n = W_s - W_f$$

Where:

W_f = weight of container + solution (first weight)

W_s = weight of container + solution + soil (second weight)

W_n = net weight of soil sample

To Determine Final Extraction Volume:

When there is no moisture value to consider, the Final Extract Volume = the preservation volume (mL) + MeOH added (mL).

When the moisture volume is to be considered, the Final Extract Volume = the preservative volume (mL) + MeOH added (mL) + the moisture volume (mL).

The moisture volume (mL) = weight (g) x (% moisture/100)

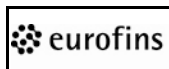
Statistical Information/Method Performance:

Not applicable to this procedure.

Quality Assurance/Quality Control:

The number of sampling devices requested from client services must include enough extra to serve as matrix QC for the volatile analyses requested. Generally, the low-level analysis requires a total of seven Encore™ sampling devices. Four are prepared in sodium bisulfate: two for the unspiked sample, one for the matrix spike sample (MS), and one for the matrix spike duplicate sample (MSD). Three are prepared in methanol: one for the unspiked sample, one for the MS, and one for the MSD. Other numbers of sampling devices for matrix QC purposes are sent at the client's request.

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All other QC samples such as the Laboratory Control Samples (LCS), Laboratory Control Sample Duplicates (LCSD), and method blanks are prepared and outlined in the individual technical areas SOPs.

The only surrogate addition performed under this procedure is for the high level containers as noted in Procedure A.3.a and A.4.a, are prepared and outlined in the individual technical areas SOPs

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Eurofins Document Reference	1-P-QM-WI -9015192	Revision	11
Effective Date	May 30, 2014	Status	Effective
Historical/Local Document Number	Analysis DOD - 8357, 0038, 0039, 10010, 10137, 10138, 10725, 11915, 11917, 12969, 12970, 12971		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

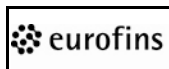
Prepared by	Mark Clark
Reviewed and Approved by	Richard Karam;Review;Wednesday, May 14, 2014 8:48:48 AM EDT Kathryn Brungard;Approval;Friday, May 16, 2014 2:46:36 PM EDT

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Revision Log:

Revision: 11		Effective Date:	This version
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Historical/Local Document Number	Additional LIMS numbers relevant to this procedure	Add analysis numbers 12969, 12970, and 12971	
	Deactivated LIMS numbers	Remove analysis numbers 2858 and 10722	
Sample Collection, Preservation and Handling	Reflects current industry standards	Updated refrigeration conditions from 4° ± 2°C	

Revision: 10		Effective Date:	Mar 13, 2013
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Throughout Document	Reflect re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers	
Title	Enhancement	Added the method to the title.	
Historical/Local Document Number	Missing scans that follow this procedure	Added Parallax scans 11915 and 11917.	
Cross Reference	Referenced in document	Added Demonstrations of Capability	
Personnel Training and Qualifications	Enhancement	Added additional information on DOCs.	
Procedure A.1.	Missing information	Added information relative to the internal standard.	
Procedure A.3.a.	New calibration levels for reduced volume extraction	Added instructions on how to prepare standards for mini-separatory funnel extractions	
Procedure C.2. (Table)	Reflects current practices	Deleted old surrogates and added new surrogates.	
Procedure F	Missing calculation	Added calculation for concentration in samples for soils	
Quality Assurance/Quality Control 3.	Reflects current practices	Listed new surrogate standards and removed old surrogate standards	
Figure 1	Reflects current practices	Listed new surrogate standards and removed old surrogate standards	

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Reference:

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 8270D (SIM), February 2007.
2. Test Methods for Evaluating Solid Wastes, SW-846 Method 8270C (SIM), December 1996.
3. Test Methods for Evaluating Solid Wastes, SW-846 Method 8000B (SIM), December 1996.
4. *Hewlett-Packard Operations Manuals.*
5. *Chemical Hygiene Plan*, current version.

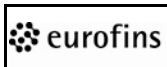
Cross Reference:

Document	Document Title
1-P-QM-FOR-9007858	Nonconformance Form
1-P-QM-PRO-9015393	GC/MS Preventative and Corrective Maintenance
1-P-QM-PRO-9015455	GC/MS Audit Process
1-P-QM-QMA-9015390	Demonstrations of Capability

Scope:

This method is suitable for the determination of low-level semivolatile compounds (PAHs) from soils and waters by selected ion monitoring (SIM) gas chromatography/Mass Spectrometry (GC/MS). The analysis applies to a concentration range that spans from an MDL of 0.01 µg/L in water (0.33 µg/kg for soil) to an upper calibration concentration of 10 µg/L in water (330 µg/kg for soil).

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Basic Principles:

An environmental sample (soil, water, sludge, etc.) is solvent extracted and then analyzed by electron impact gas chromatography/mass spectrometry (EI GC/MS). By analyzing for specific masses over a narrow mass range, SIM analysis allows for longer dwell times at specific masses. This allows for significantly greater sensitivity of analysis with a small reduction in specificity of analysis.

Interferences:

Sample matrices can have an effect on the ability of the GC/MS system to resolve the individual masses used for quantification. Samples may require dilutions or a reduction in the extraction volume/weight used in order to achieve proper target separation and determination.

Safety Precautions and Waste Handling:

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

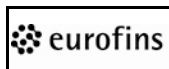
See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

The toxicity of each reagent has not been precisely determined. However, each reagent should be treated as a potential health hazard. Safety measures would include the use of fume hoods, safety glasses, lab coats, and gloves.

Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

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Initially, each analyst performing the instrumental analysis must work with an experienced analyst for a period of time until they can independently calibrate the instrument, use the chromatography data system to set up sequences, perform the calculations, interpret chromatograms, and enter data into the LIMS. Proficiency is measured through documented audits of the tasks listed and over checking of data as well as an Initial Demonstration of Capability (IDOC).

The IDOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four laboratory control samples, one blind sample, or one ICAL with ICVs and/or CCVs. Refer to 1-P-QM-QMA-9015390 (LOM-SOP-ES-238) for more guidance on these options.

Sample Collection, Preservation, and Handling:

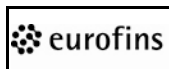
Water samples are collected in glass bottles with PTFE-lined lids and stored at 0° to 6°C, not frozen, prior to extraction. Samples must be extracted within 7 days of collection. Extracts are stored in the freezer at -10° to -15°C.

Soil samples are collected in wide-mouth glass jars with PTFE-lined lids and stored at 0° to 6°C, not frozen, prior to extraction. Samples must be extracted within 14 days of collection. Extracts are stored in the freezer at -10° to -15°C.

Apparatus and Equipment:

1. Hewlett-Packard Model 5890 Gas Chromatograph or equivalent
2. Hewlett-Packard Model 5971, 5972, or Agilent Model 5973 Mass Selective Detector or equivalent
3. Hewlett-Packard Chemstation Software, Thru-Put Systems Target data system or equivalent
4. Volumetric flask – Assorted sizes

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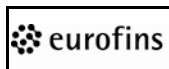
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- Hamilton Gastight syringe – Assorted sizes

Reagents and Standards:

- Tune Check Solution – 50-ng/μL solution of decafluorotriphenylphosphine (DFTPP) containing pentachlorophenol, benzidine and *p,p'*-dichlorodiphenyltrichloroethane (DDT) in methylene chloride, Absolute Standards Inc. Catalog #43030, or equivalent; store at 4°± 2°C
- Methylene chloride – (MeCl₂ or CH₂Cl₂) – Baker Ultra Resi–Analyzed, or equivalent
- Internal standard solution – 2000 ppm in methylene chloride Supelco Catalog #46955-U, or equivalent
- Absolute PAH Standard – 1000-ppm solution of PAHs in methylene chloride, Catalog #93462, or equivalent
- 8270 Surrogate standard solution – 4000-ppm solution in methylene chloride, Supelco Catalog #47960-U, or equivalent
- Restek (ICV) Solution Kit – 2000 ppm in methylene chloride, or equivalent
- Quinoline – 1000 ppm in methylene chloride, Absolute Standards Catalog #70353, or equivalent
- Benzenethiol – 1000 ppm in methylene chloride, Absolute Standards Catalog #70900, or equivalent
- Hexachlorobenzene – 1000 ppm in acetone, Absolute Standards Catalog, #70195, or equivalent
- 1,2-Diphenylhydrazine – 1000 ppm in methylene chloride, Absolute Standards Catalog #70024, or equivalent

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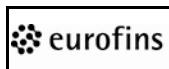
11. EPA Method 8070 – Nitrosamines - 2000 ppm in Methanol, Absolute Standards Catalog #19222 or equivalent
12. EPA Method 606 – Phthalates – 2000 ppm in Methanol, Absolute Standards Catalog # 19242 or equivalent
13. 1,4-Dioxane – 2000 ppm in methanol, Absolute Standards Catalog #90871 or equivalent

NOTE: Special compounds may be added to spikes and calibration standards as necessary. These compounds and concentrations are determined by the analyst and added in appropriate proportions to achieve proper concentrations. If a modification to a solution's final volume is required, adjust the volume of stock solutions added to achieve the appropriate concentrations.

Calibration:

- A. Calibration is accomplished using an internal standard calibration technique. Calibration standards at five or more concentration levels are analyzed. The relative response factor is calculated for each compound at each concentration level. The relative standard deviation of the response factors determines the suitability of the average relative response factor for calculation of concentration.
 1. If the performance criteria are met for the DFTPP solution (from Procedure step B.), perform an initial calibration by analyzing at least five or more calibration standard solutions referenced previously.
 2. After the calibration standard analyses, inject the MDL/LOQ solution. The GC/MS system must be able to detect the compounds in the MDL/LOQ solution. If the system does not detect the compounds, then the tuning and calibration procedure must be repeated under conditions that will yield a detection for the compounds in the MDL/LOQ solution. Instrument maintenance as outlined in 1-P-QM-PRO-9015393 (MC-EX-001) may be required.

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3. After the MDL/LOQ solution has been run, inject the ICV solution. This standard must be analyzed after the initial calibration standards and before any samples are analyzed.
- B. Calculate the relative response factor for each compound and surrogate for each calibration solution.

Calculation of the relative response factor (RRF):

$$RRF = \frac{[A(x) \times C(is)]}{[A(is) \times C(x)]}$$

Where:

A(x) = Area of the quantitation ion for the compound being measured

C(is) = Concentration of the specific internal standard

A(is) = Area of the quantitation ion for the specific internal standard

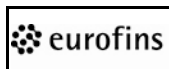
C(x) = Concentration of the compound being measured

- C. For each compound and surrogate, calculate the average RRF from the RRFs of the calibration standards. For 8270D, each compound must meet the minimum response factor criteria listed in Table III. Calculate the relative standard deviation:

$$\% RSD = \frac{SD}{\overline{RRF}} \times 100$$

Where:

$$SD = \sqrt{\frac{\sum (RF - \text{avg } RF)^2}{n - 1}} \text{ and } \overline{RRF} = \frac{\sum RRF}{n}$$

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For 8270C, if the %RSD of the response factors is less than or equal to 15%, then the average relative response factor (\overline{RRF}) is used for quantitation. If the %RSD exceeds 15% then an alternate curve fit must be used for quantitation. A linear curve fit is a suitable alternative when only 5 calibration standards have been analyzed.

For 8270D, if the %RSD of the response factors is less than or equal to 20%, then the average relative response factor (\overline{RRF}) is used for quantitation. If the %RSD exceeds 20% then an alternate curve fit must be used for quantitation. A linear curve fit is a suitable alternative when only 5 calibration standards have been analyzed. When calculating the calibration curves using the linear regression model, a minimum quantitation check on the viability of the lowest calibration point should be performed by re-fitting the response from the low concentration calibration standard back into the curve. The recalculated concentration of the low calibration point should be within $\pm 30\%$ of the standard's true concentration.

$$1^{\text{st}} \text{ Order (linear) regression : } Y = M(X) + B$$

Where:

$$Y = \frac{\text{Conc Std}}{\text{Conc Istd}}$$

$$X = \frac{\text{Area Std}}{\text{Area Istd}}$$

$$M = 1^{\text{st}} \text{ degree slope}$$

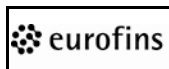
$$B = Y \text{ intercept}$$

D. Continuing calibrations

Verify the MS tune and initial calibration at the beginning of every 12-hour work shift during which analyses are performed.

1. The MS tune is verified following the instructions given in Procedure B. If the mass spectrum of the DFTPP peak does not meet the abundance criteria described in Table I for 8270C and Table II for 8270D, the mass spectrometer must be retuned until all criteria are met.

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2. Perform a continuing calibration verification (CCV) by analyzing a mid-point calibration standard, alternating from the last CCV in the following order: 1.0 ppm, 5.0 ppm, 0.5 ppm. Then repeat the order 1.0 ppm, 5.0 ppm, 0.5 ppm, etc., until a new initial calibration is required. For 8270D, each compound must meet the minimum response factor criteria listed in Table III. Calculate the percent drift:

$$\% \text{ Drift} = \frac{C(i) - C(c)}{C(i)} \times 100$$

Where:

C(i) = Calibration check compound standard concentration

C(c) = Measured concentration using selected quantitation method

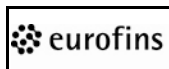
The % Drift for each compound should not be greater than $\pm 20\%$. If the %Drift exceeds 20%, then corrective action must be taken and a new initial calibration may need to be performed.

3. The absolute areas of the quantitation ions of the internal standard must fall within -50% to +100% of the average areas from the last initial calibration. If the area for each internal standard is not within this window then corrective action must be taken and documented.

Procedure:

The GC/MS is configured in the selected ion monitoring (SIM) mode with a total cycle time (including voltage reset time) of 1 second or less. The GC/MS system must be capable of meeting the following specifications:

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Mass range:	35 to 500 amu
Scan time:	1 scan/sec
GC column:	30 m × 0.25 mm × 0.5 µm film Restek Rxi – 5 or equivalent
Injector temperature:	250° to 300°C
Transfer line temperature:	250° to 300°C
GC Oven:	Time and Temperature Programmable
El condition:	70 eV
Mass scan:	Capable of SIM scanning (see manufacturer's instructions)
Carrier gas:	Helium at approximately 30 cm/sec.

A. Standard preparation

1. Internal standard

Internal standard mix is added to all standards and subsequent samples.

- a. Soils and 1000 mL water extractions are at a concentration of 1 µg/mL. Using a 25-µl syringe, 10 µL of Supelco Equity Semivolatile Internal Standard Mix or equivalent (100 µg/mL in methylene chloride) is added to the 1 mL of standard or sample extract.
- b. 250 mL water extractions are at a concentration of 0.25 µg/mL. Using a 25-µl syringe, 10 µl of Supelco Equity Semivolatile Internal Standard Mix or equivalent (25 µg/ml in methylene chloride) is added to the 1 mL of standard or sample extract.

2. Stock standard preparation

To prepare the 100-ppm and 10-ppm PAH working stocks, using a Hamilton Gastight syringe, measure the following stocks into 10-mL volumetric flasks and dilute to volume with methylene chloride. See Figure 1 for a list of compounds. Stocks are prepared every 6 months or sooner, if comparison with the QC check samples indicates a problem.

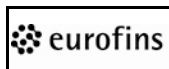
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Mix	Concentration (ppm)	100-ppm Stock Amount Added (µL) to 10 mL	10-ppm Stock Amount Added (µL) to 10 mL
PAH Standard	1000	1000	100
8270 Surrogate Standard	4000	250	25
1,2-Diphenylhydrazine	1000	1000	100
Hexachlorobenzene	1000	1000	100
Pentachlorophenol	1000	1000	100
Benzidine	10000	2000	200
Nitrosamines	2000	500	50
Phthalates	2000	500	50
1,4-Dioxane	1000	1000	100

3. Calibration levels

Standard ID	Preparation	Final Volume
Level 1: LPAH0.05	5 µL of 10-ppm working stock + 10 µL of 100-ppm internal standard	To 1.0 mL MeCl ₂
Level 2: LPAH0.2	20 µL of 10-ppm working stock + 10 µL of 100-ppm internal standard	To 1.0 mL MeCl ₂
Level 3: LPAH0.5	50 µL of 10-ppm working stock + 10 µL of 100-ppm internal standard	To 1.0 mL MeCl ₂
Level 4: LPAH001	10 µL of 100-ppm working stock + 10 µL of 100-ppm internal standard	To 1.0 mL MeCl ₂
Level 5: LPAH005	50 µL of 100-ppm working stock + 10 µL of 100-ppm internal standard	To 1.0 mL MeCl ₂
Level 6: LPAH010	100 µL of 100-ppm working stock + 10 µL of 100-ppm internal standard	To 1.0 mL MeCl ₂
MDL/LOQ standard: (0.01ppm)	1 µL 10-ppm working stock + 10 µL of 100-ppm internal standard	To 1.0 mL MeCl ₂

- a. For samples extracted with miniature separatory funnels (250 mL), the calibration standards listed in the above table will be diluted 4x. The calibration range will be from 0.0125 µg/ to 2.5 µg/L. The MDL standard and ICV will also be diluted 4x.
- b. One of the calibration standards must be at a concentration near, but above, the limit of quantitation (LOQ). The other concentrations correspond to the expected range of concentrations found in samples or should define the working range of the GC/MS system.

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- c. The concentration of the MDL standard may require modification dependant upon the current MDL values. Document the procedure concentrations and volumes in the formatted and bound standards notebook.
- d. In addition to the calibration standards, initial calibration verification (ICV) standard must be prepared using a separate source from the working stock. The concentration of the ICV standard is at or around the mid-Level of the calibration curve. A PAH spike mix different from the working stock is diluted from 2000 ppm to 1 ppm by taking 0.5 µL of the spike mix and diluting to 1.0 mL. As referenced in 1-P-QM-PRO-9015455 (SOP-EX-009) there must be an ICV standard form that compares the average relative response factors from the ICAL with the response factors from the ICV standard. The ICV recovery must be within $\pm 30\%$ or approval is required for those targets outside of this window. The ICV must be listed on the form 5 for the tune. The preparation of these standards is recorded in the formatted and bound standards notebook. The calibration standards are prepared approximately every 2 weeks, or as needed based on the frequency of analysis and contingent upon successfully passing continuing calibration check standards.
- e. All standards are stored at 0° to 6°C and protected from light.

B. Tuning

1. The DFTPP tune check standard is used to assess GC column performance and injection port inertness as well as mass spectrometer performance. The GC/MS system's tune is checked by inspecting the mass spectrum of the DFTPP peak.
2. DFTPP must meet the criteria specified in Table I for 8270C and Table II for 8270D. If these criteria are met, standardization may begin at this point. If DFTPP fails the specified criteria, corrective action must be taken and the DFTPP reinjected until acceptable criteria are obtained. Tuning and DFTPP evaluation must take place every 12 hours that analyses are to be performed.

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C. Method set-up

1. Prior to analysis by SIM (Selective Ion Monitoring) a check standard must be analyzed in the full scan mode to determine where the specific start and stop times are for each of the groups.

NOTE: Each program must be identical for the Temperature and Pressure programs so that the peak retention times are the same.

2. Each time column maintenance is performed, the scan times are reviewed to ensure that all ions are included. The instrument setup in the method is as follows. In the Set Acquisition Mode, select SIM. See specific Group for Dwell time in msec. Set the Low Res to "N" and the Start Time for each group. In the m/z field, enter the ions for each group from the following tables:

GROUP 1 (Dwell – 60 msec)			
Compound		Quant Ion (m/z)	Monitor Ion (m/z)
1,4-Dioxane	Target	88	58
N-Nitrosodimethylamine	Target	74	42

GROUP 2 (Dwell – 40 msec)			
Compound		Quant Ion (m/z)	Monitor Ion (m/z)
Quinoline	Target	129	102
Benzenethiol	Target	110	66
1,4-Dichlorobenzene-d4	ISTD	152	150
Naphthalene-d8	ISTD	136	68
Naphthalene	Target	128	129

GROUP 3 (Dwell – 40-50 msec)			
Compound	1.2	Quant Ion (m/z)	Monitor Ion (m/z)
Diethylphthalate	Target	163	194
2-Methylnaphthalene	Target	142	141
1-Methylnaphthalene	Target	142	141
1-Methylnaphthalene-d10	Surrogate	152	
Acenaphthylene	Target	152	76
Acenaphthene-d10	ISTD	164	162
Acenaphthene	Target	154	152

GROUP 4 (Dwell – 25-30 msec)			
Compound	Type	Quant Ion (m/z)	Monitor Ion (m/z)
Diethylphthalate	Target	149	177
Fluorene	Target	166	165
Hexachlorobenzene	Target	284	142
1,2-Diphenylhydrazine	Target	77	182
Pentachlorophenol	Target	266	264
Phenanthrene-d10	ISTD	188	94
Phenanthrene	Target	178	176
Anthracene	Target	178	176

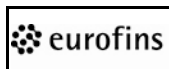
GROUP 5 (Dwell – 50 msec)			
Compound	Type	Quant Ion (m/z)	Monitor Ion (m/z)
Di-n-butylphthalate	Target	149	150
Fluoranthene	Target	202	101
Benzidine	Target	184	92
Pyrene	Target	202	101
Flouranthene-d10	Surrogate	212	106
Butylbenzylphthalate	Target	149	91

GROUP 6 (Dwell – 40 msec)			
Compound	Type	Quant Ion (m/z)	Monitor Ion (m/z)
Bis-2ethylhexylphthalate	Target	149	167
Benzo(a)anthracene	Target	228	226
Chrysene-d12	ISTD	240	236
Chrysene	Target	228	226
Di-n-octylphthalate	Target	149	150
Benzo(b)fluoranthene	Target	252	253
Benzo(k)fluoranthene	Target	252	253
Benzo(e)pyrene	Target	252	253
Benzo(a)pyrene	Target	252	253
Perylene-d12	ISTD	264	260
Benzo(a)pyrene-d12	Surrogate	265	132
Perylene	Target	252	253

GROUP 7 (Dwell – 100 msec)			
Compound	Type	Quant Ion (m/z)	Monitor Ion (m/z)
Indeno (1,2,3-cd) pyrene	Target	276	138
Dibenz (a,h) anthracene	Target	278	139
Benzo (g,h,i) perylene	Target	276	138

D. Analysis of Samples:

1. Analyze a predetermined aliquot of each sample extract under the same conditions used for the initial and/or continuing calibrations.
2. At the conclusion of data acquisition, use the same software to tentatively identify peaks within the retention time window of interest. Examine the ion abundances of components of the chromatogram. If the ion abundance of the main ion used for quantitation exceeds the calibration range, dilute the aliquot and reanalyze. When preparing dilutions, add sufficient internal standard to maintain the same concentration that was used.

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E. Qualitative Analysis:

1. A compound is identified by comparison of the sample mass spectrum (after background subtraction) with the mass spectrum of a standard of the target compound (standard reference spectra).
2. In order to verify identification, the sample component relative retention time (RRT) must be within 10 seconds of the RRT observed for the component when a calibration solution was analyzed.

F. Quantitative Analysis:

When a compound has been identified, quantitation is based on the internal standard technique and the integrated abundance from the extracted ion current profile (EICP) of the primary characteristic ion.

1. Waters:

$$\text{Concentration } (\mu\text{g/L}) = \frac{A(x) \times I(is)}{A(is) \times \overline{RRF} V(o)}$$

Where:

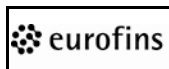
$A(x)$ = Area of the quantitation ion for the compound to be measured

$I(is)$ = Amount of internal standard added to the water sample (in micrograms)

$A(is)$ = Area of the quantitation ion for the appropriate internal standard

\overline{RRF} = Average response factor from the current initial calibration

$V(o)$ = Original water sample volume (in liters)

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2. Soils:

$$\text{Concentration } (\mu\text{g/kg}) = \frac{A(x) \times I(is)}{A(is) \times \overline{RRF} V(g)}$$

Where:

A(x) = Area of the quantitation ion for the compound to be measured

I(is) = Amount of internal standard added to the water sample (in micrograms)

A(is) = Area of the quantitation ion for the appropriate internal standard

\overline{RRF} = Average response factor from the current initial calibration

V(g) = Original soil sample weight (in grams)

Calculations:

See Calibration and Quantitative Analysis (Procedure F.) sections.

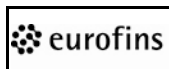
Statistical Information/Method Performance:

The LCS/MS and surrogate recoveries and RPD are compared to statistically generated limits for acceptance criteria. The current data is stored in the LIMS under the analysis numbers listed in the header of this SOP. The historical data for MDLs, MS/MSD, LCS/D, and measurement of uncertainty is reviewed at least annually and updated if necessary. Refer to the QA/QC section of this SOP and the criteria listed throughout this procedure for additional information on the performance of this method.

Quality Assurance/Quality Control:

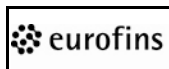
Each extraction batch must contain at least a method blank, laboratory control sample (LCS), and either an unspiked background sample (US), a matrix spike (MS), and a matrix spike duplicate (MSD) or a laboratory control sample/laboratory control sample duplicate (LCS/LCSD). The spiking solution contains all analytes of interest. Additional QC samples may be required to meet project or state requirements.

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1. The method blank will be evaluated to determine if any contamination exists. Contamination can occur during the extraction process or during analysis. If PAHs are detected in the method blank above the reporting limit (which may be the MDL or the LOQ depending on each client's reporting requirements), any samples with detections of these same PAHs may need to be re-extracted. Analyze a solvent blank using the same internal standard lot to verify that the analytical system and internal standard solution are free from contamination. Reanalyze the batch blank and if found to be free from contamination, re-inject all samples which contain a positive identification of the same compound. If the batch blank confirms the presence of the contaminant report any sample which contains a positive detection at a concentration greater than or equal to ten (10) times the concentration in the blank. Any samples which contain a detection less than ten (10) times the concentration in the blank must be re-extracted and reanalyzed. A Nonconformance Form 1-P-QM-FOR-9007858 (Form 2586) must be generated and submitted to a supervisor if noncompliant data will be reported.
2. The LCS/LCSD are analyzed to determine the precision of the extraction process. The recoveries of the spiked PAHs should be within the established recovery windows. The established recovery windows are statistically generated and reviewed twice a year. If the recovery for any reported PAH is below QC windows all affected samples will need to be re-extracted. If recoveries are above QC limits, data may be usable if the compounds that recovered above QC limits are not detected in samples. A Nonconformance Form must be generated and submitted to a supervisor.
3. All samples are spiked with 3 surrogate compounds (1-methylnaphthalene-d10, benzo(a)pyrene-d12, and fluoranthene-d10) to evaluate the extraction process. Surrogate windows should be within the established statistical windows. If surrogate recovery does not meet specifications, the samples may need to be re-extracted and reanalyzed.

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4. Each sample extract is spiked with an internal standard mix prior to analysis. The internal standard areas from each extract are compared to the internal standard areas from the ICAL. The extract areas must be within -50% to +100% of the ICAL areas. If these criteria are not met, the extract must be reinjected.

Figure 1 Mixes

Absolute PAH Standard

acenaphthene
acenaphthylene
anthracene
benzo(a)anthracene
benzo(a)pyrene
benzo(b)fluoranthene
benzo(g,h,i)perylene
benzo(k)fluoranthene
chrysene
dibenz(a,h)anthracene
fluoranthene
fluorene
indeno(1,2,3-cd)pyrene
naphthalene
phenanthrene
pyrene
2-Methylnaphthalene
1-Methylnaphthalene
Perylene

Benzo(e)pyrene
pentachlorophenol
Dibenzofuran
Dibenzothiophene

Surrogates

1-methylnaphthalene-d10
Benzo(a)pyrene-d12
Fluoranthene-d10

Internal Standards Mix

1,4-dichlorobenzene-d4
naphthalene-d8
acenaphthene-d10
phenanthrene-d10
chrysene-d12
perylene- d12

Table I
DFTPP Key Ion Abundance Criteria (8270C)

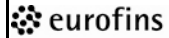
<u>Mass</u>	<u>Ion Abundance Criteria</u>
51	30% to 60% of mass 198
68	less than 2% of mass 69
70	less than 2% of mass 69
127	40% to 60% of mass 198
197	less than 1% of mass 198
198	base peak, 100% relative abundance
199	5% to 9% of mass 198
275	10% to 30% of mass 198
365	greater than 1% of mass 198
441	present but less than mass 443
442	greater than 40% of mass 198
443	17% to 23% of mass 442

Table II
DFTPP Key Ion Abundance Criteria (8270D)

<u>Mass</u>	<u>Ion Abundance Criteria</u>
51	10% to 80% of mass 198
68	less than 2% of mass 69
70	less than 2% of mass 69
127	10% to 80% of mass 198
197	less than 2% of mass 198
198	base peak, or >50% mass 442
199	5% to 9% of mass 198
275	10% to 60% of mass 198
365	greater than 1% of mass 198
441	present but less than 24% of mass 442
442	Base peak, or >50% of mass 198
443	15% to 24% of mass 442

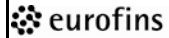
Table III
Recommended Minimum Response Factor Criteria
for Initial and Continuing Calibration Verification (8270D)

Semivolatile Compounds	Minimum Response Factor (RF)
Naphthalene	0.700
2-Methylnaphthalene	0.400
Dimethylphthalate	0.010
Acenaphthylene	0.900
Acenaphthene	0.900
Dibenzofuran	0.800
Diethylphthalate	0.010
Fluorene	0.900
N-Nitrosodiphenylamine	0.010
Hexachlorobenzene	0.100
Phenanthrene	0.700
Anthracene	0.700
Di-n-butylphthalate	0.010
Fluoranthene	0.600
Pyrene	0.600
Butylbenzylphthalate	0.010
Benzo(a)anthracene	0.800
Chrysene	0.700
Benzo(a)anthracene	0.800
Bis(2-ethylhexyl)phthalate	0.010
Di-n-octylphthalate	0.010
Benzo(b)fluoranthene	0.700
Benzo(k)fluoranthene	0.700
Benzo(a)pyrene	0.700
Indeno(1,2,3-cd)pyrene	0.500
Dibenz(a,h)anthracene	0.400
Benzo(g,h,i)perylene	0.500
Benzo(g,h,i)perylene	0.500

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Eurofins Document Reference	1-P-QM-WI -9015165	Revision	12
Effective Date	Jan 19, 2015	Status	Effective
Historical/Local Document Number	Analysis DOD - 6050, 10639		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

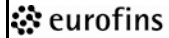
Prepared by	Debra Bryan
Reviewed and Approved by	Robert Strocko;Review;Monday, January 19, 2015 9:28:21 AM EST Barbara Reedy;Approval;Monday, January 19, 2015 9:51:35 AM EST

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Revision Log:

Revision: 12		Effective Date:	This version
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Reference	No longer applicable to the procedure	Removed 3010A Modified	
Reference Modifications	No longer applicable to the procedure	Removed 3010A modifications	
Procedure A and B	Clarification	Reworded numbers 2, 5 and 6 to clarify steps found in the EPA procedure for 3020A	

Revision: 11		Effective Date:	Nov 25, 2013
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Throughout Document	Reflect re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers	
Cross Reference	Reflect current procedure	Added reference to Analysis #6142, 6123, 6125,...	
Sample Collection, Preservation, and Handling	Process change	Changed sample storage temperature from 4° ± 2° C to 0° to 6° C but not frozen, prior to digestion.	
Safety Precautions and Waste Handling	No longer used	Deleted text pertaining to Hydrofluoric Acid.	
Reagent and Standards	Reflect current procedure	Added text pertaining to preparing solutions using different volumes, is acceptable, if exact ratios are maintained.	
Procedure A	Reflect current procedure	Deleted text, in NOTE, pertaining to using a smaller sample aliquot if insufficient sample is submitted. Deleted text, to NOTE, pertaining to samples concentration	
Procedure A.1	Reflect current procedure	Added text pertaining to adding spike solution, after the sample has been poured. Added text pertaining to reference to Analysis #6142, 6123, 6125,... for batch quality control requirements.	
Procedure B	Reflect current procedure	Deleted text in NOTE pertaining to using a smaller sample aliquot if insufficient sample is submitted. Deleted text to NOTE pertaining to samples concentration	
Procedure B.1	Reflect current procedure	Added text pertaining to reference to Analysis #6142, 6123, 6125,... for batch quality control	
Block Digester Instructions	Reflect current procedure	Clarified instruction steps. Deleted text pertaining to the difference between sample temperature and display temperature.	
Quality Assurance/Quality Control	Reflect current procedure	Added reference to Analysis #6142, 6123, 6125,... for batch quality control requirements.	

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Reference:

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 3020A, July 1992.
2. *Chemical Hygiene Plan*, current version.

Cross Reference:

Document	Document Title
Analysis #6142, 6123, 6125, 10801, 6126, 6127, 6129, 6128, 6132, 6131, 6133, 6134, 6140, 6136, 6137, 6138, 6143, 6139, 6135, 6124, 6141, 6146, 6144, 6147, 6145, ...	Metals by Inductively Coupled Plasma Mass Spectrometry for SW-846 Methods 6020/6020A (aqueous, solid, tissue) and EPA 200.8 (aqueous)
1-P-QM-FOR-9009182	Working Instructions for Prep Solutions and Standards
1-P-QM-QMA-9015390	Demonstrations of Capability

Purpose:

This digestion procedure is used to prepare leachate and other wastewater samples for measurement of total metals by inductively coupled plasma-mass spectrometer (ICP-MS) following SW846 protocol.


Scope:

This acid digestion procedure is used by the Metals Department of the Environmental Sciences Division to prepare leachate, wastewater, surface water, and groundwater samples for measurement of total recoverable metals by inductively coupled plasma-Mass Spectrometer (ICP-MS) following SW-846.

Basic Principles:

A mixture of nitric acid and the sample is refluxed in a covered beaker/digestion vessel at low volume to dissolve metals. It is cooled and brought up to volume with reagent water.

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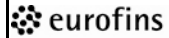
Reference Modifications:

1. A 50–mL sample aliquot and final volume is used instead of 100–mL to improve digestion throughput, conserve sample usage, and limit waste generation. Because all reagents are also adjusted so that concentrations are equivalent to a 100–mL aliquot, there is no impact on the data.
2. Ribbed watch glasses are not used; samples are evaporated without watch glasses in nonmetallic hoods to speed evaporation. No contamination trends have been observed in prep blanks evaporated without watch glasses.

Definitions:

1. ACS – American Chemical Society
2. ASTM – American Society of Testing and Materials
3. D – Sample Duplicate
4. DOC – Demonstration of Capability
5. IDOC – Initial Demonstration of Capability
6. LCS/LCSD – Laboratory Control Sample/ Laboratory Control Sample Duplicate
7. LCSW – Laboratory Control Sample Water
8. LLENS – the computer program that integrates a PC with an analytical balance to collect data directly from the balance. The program organizes the data and transmits the readings to the LIMS.
9. LIMS – Laboratory Information Management Systems
10. LLI Sample ID – unique 7-digit number assigned to a client sample.

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11. LOQ – Limit of Quantitation
12. MDL – Method Detection Limit
13. MS (R) – Matrix Spike
14. MSD (M) – Matrix spike duplicate
15. PB/PBW – Preparation Blank/ Preparation Blank Water
16. QC – Quality Control
17. Method Blank – equivalent to a Preparation Blank. A designated sample designed to monitor for sample contamination during the analysis process. A volume of reagent laboratory water is typically used to monitor water sample analysis, while solids blanks consist of a purified solid matrix or just the reagents used in the test. The blank demonstrates that no artifacts were introduced during the analysis process.
18. SOP – Standard Operating Procedure
19. SPLP – Synthetic Precipitation Leaching Procedure
20. STLC – Soluble Threshold Limit Concentration
21. TCLP – Toxicity Characteristic Leaching Procedure
22. U or US – unspiked background sample

Interferences:

Not applicable to this procedure.

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Safety Precautions and Waste Handling:

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Preparing samples for inorganic analysis involves working with concentrated acids and other chemicals which are dangerous if not handled carefully:

Nitric acid (HNO₃) – This acid can cause skin burns. Add nitric acid to samples in a hood or use the designated dispensing equipment to avoid exposure to toxic fumes.

When diluting strong acids, never add water to acid; always add acid to water.

Store concentrated acids in the prep room acid lockers. Only acids are to be stored in these lockers. (Store solvents in the flammable liquid storage cabinet.) Some concentrated acids are kept in the acid reagent bottles on prep room counters. Fill reagent bottles in an operating fume hood using caution to avoid spills.


Perform acid digestions in hoods that are turned on and have active alarms. Notify a supervisor immediately if the hood is malfunctioning or the alarm sounds.

Samples that contain dust may be hazardous. Open in a fume hood.

When a hazardous flag is added indicating possible cyanide, special precautions are required to avoid exposure to hydrogen cyanide gas. Contact your supervisor prior to adding acid. Always open these samples and add the acid in a hood.

Use spill pillows to absorb large acid spills (small spills are cleaned with wet paper towels.) Use SPILL-X-A , soda ash or equivalent, to neutralize any remaining acid and then rinse the area thoroughly with water. Spill pillows and SPILL-X-A are stored on the prep room shelf. Soda ash is located in the stairwell adjacent to the prep room.

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Dispose of acid waste properly. Collect all acid digestions, waste solutions, and expired reagent solutions in waste containers. When the acid waste containers are full, a designated acid waste handler transfers the waste to the acid neutralization tank.

Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability for this or an equivalent procedure.


Initially, each employee performing this digestion procedure must work with an experienced employee for a period of time until they can independently set up batches and perform the necessary steps outlined in this procedure. Proficiency is measured through documentation of the critical steps in this procedure, over checking of data as well as an IDOC.

The IDOC and the DOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Refer to 1-P-QM-QMA-9015390, for specific requirements. A DOC is performed annually and is maintained in the analyst's training records.

Sample Collection, Preservation, and Handling:

Samples are collected in plastic containers and preserved to a pH of <2 with HNO₃. (Samples to be analyzed for soluble metals requiring filtration at the lab must be submitted unpreserved. The sample is run through a 0.45-micron filter within 5 days of receipt and then preserved.) The pH is checked upon receipt and adjusted as necessary by Sample Support; samples that are pH adjusted at the lab must not be digested for a minimum of 24 hours. If samples fail to maintain a pH of <2 the Client Service Representative is notified for further direction. Samples are stored at 0° - 6°C, but not frozen, prior to digestion. Samples must be digested within 6 months of collection. Digested samples are stored in plastic at room temperature and have a 6 month holding time.

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Apparatus and Equipment:

1. Polypropylene containers (digestion vessels) – certified clean and Class A equivalent
2. Watch glasses or reflux caps
3. 50–mL graduated cylinders or other appropriate graduated cylinders if necessary
4. 50–mL volumetric flasks or other appropriate Class A volumetric flasks if necessary
5. 250-mL beakers or other appropriate beakers
6. Hotblocks or hot plates, adjustable and capable of maintaining a temperature of 90° to 95°C

Reagents and Standards:

For reagent preparation, shelf life, and storage conditions, see Form 1-P-QM-FOR-9009182. .


Nitric acid, HNO₃ – Fisher, Trace Metal Grade, or equivalent. Store at room temperature and re-evaluate annually.

NOTE: It is acceptable to prepare solutions using multiples of indicated volumes if exact ratios are maintained.

Calibration:

Not applicable to this method.

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Procedure:

This SOP has been set up to outline the procedures for both hotblock and hot plate digestions (see below). Choose the procedure that corresponds to the sample heating technique being used for sample digestion.

A. Hotblock

NOTE: When insoluble matter is present in the digested sample, allow it to settle by gravity or filter prior to introduction to the instrument. If any samples are filtered, the prep blank and LCS must also be filtered.


NOTE: For soluble metals analysis, filter unpreserved sample through 0.45-micron filter paper. Adjust the filtered sample to pH <2 with nitric acid preserving solution. Measure the volume of sample, as stated in this procedure, and digest as normal. The prep blank and spiked LCS must also be prepared with filtered water.

NOTE: If the sample contains high solids, use a smaller aliquot of the sample and bring sample to final volume as stated in this procedure. Make appropriate acid, reagent, and spike volume adjustments based on sample final volume.

1. Shake sample well. Transfer 50 mL of well mixed sample to a 68-mL digestion vessel. After the sample has been poured, add the spiking solution. For sample batch spiking procedures see form 1-P-QM-FOR-9009182. For sample batch quality control requirements see Analysis #6142, 6123, 6125, 10801, 6126, 6127, 6129, 6128, 6132, 6131, 6133, 6134, 6140, 6136, 6137, 6138, 6143, 6139, 6135, 6124, 6141, 6146, 6144, 6147, 6145, ...

NOTE: For leachate samples, use the appropriate extraction fluid for the PBW and LCS. The extraction fluids are as follows: TCLP, SPLP, STLC, ASTM, Filtration, and Elutriate.

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2. Add 1.5 mL of HNO₃. Place the vessel in the hotblock at 90° to 95°C, and cautiously evaporate to low volume (about 5 mL), making certain that the sample does not boil and that no portion of the bottom of the digestion vessel is allowed to go dry.
3. Cool the digestion vessel and add another 1.5–mL portion of HNO₃.
4. Cover the digestion vessel with a reflux cap and return to the hotblock. Increase the temperature of the hotblock so that gentle reflux action occurs.

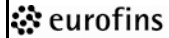
NOTE: If a sample is allowed to go to dryness, low recoveries result. If this occurs, discard the sample and re-prepare in a new batch.

5. Continue heating (refluxing), adding additional acid as necessary, until the digestion is complete (generally indicated when the digestate is light in color or does not change in appearance with continued refluxing).
6. When digestion is complete, uncover the digestion vessel and evaporate to low volume (about 3 mL). Do not allow any portion of the bottom of the digestion vessel to go dry.
7. Remove the digestion vessel and add approximately 5 mL of reagent water, mix, and continue warming for 10 to 15 minutes to allow additional solubilization of any residue to occur.
8. Allow to cool. Adjust volume to the 50-mL mark on the digestion vessel with reagent water and mix. Seal vessel with screw cap.
9. The sample is now ready for analysis.

B. Hot Plates

NOTE: When insoluble matter is present in the digested sample, allow it to settle by gravity or filter prior to introduction to the instrument. If any samples are filtered, the prep blank and LCS must also be filtered.

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NOTE: For soluble metals analysis, filter unpreserved sample through 0.45-micron filter paper. Adjust the filtered sample to pH <2 with nitric acid preserving solution. Measure the volume of sample, as stated in this procedure, and digest as normal. The prep blank and spiked LCS must also be prepared with filtered reagent water.


NOTE: If the sample contains high solids, use a smaller aliquot of the sample and bring sample to final volume as stated in this procedure. Make appropriate acid, reagent, and spike volume adjustments based on sample final volume.

1. Shake sample well. Use a 50mL graduated cylinder to transfer 50 mL of well mixed sample into a 250mL beaker. After the sample has been poured, add the spiking solution. For sample batch spiking procedures see form 1-P-QM-FOR-9009182. For sample batch quality control requirements see Analysis #6142, 6123, 6125, 10801, 6126, 6127, 6129, 6128, 6132, 6131, 6133, 6134, 6140, 6136, 6137, 6138, 6143, 6139, 6135, 6124, 6141, 6146, 6144, 6147, 6145, ...

NOTE: For leachate samples, use the appropriate extraction fluid for the PBW and LCS. The extraction fluid are as follows: TCLP, SPLP, STLC, ASTM, Filtration, and Elutriate.

2. Add 1.5 mL of HNO₃. Place the beaker on a hot plate and cautiously evaporate to low volume (about 5 mL), making certain that the sample does not boil and that no portion of the bottom of the beaker is allowed to go dry.
3. Cool the beaker and add another 1.5-mL portion of HNO₃.
4. Cover the beaker with a watch glass and return to the hot plate. Increase the temperature of the hot plate so that gentle reflux action occurs.

NOTE: If a sample is allowed to go to dryness, low recoveries result. If this occurs, discard the sample and reprepare in a new batch.


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5. Continue heating (refluxing), adding additional acid as necessary, until the digestion is complete (generally indicated when the digestate is light in color or does not change in appearance with continued refluxing).
6. When digestion is complete, uncover the beaker and evaporate to low volume (about 3 mL). Do not allow any portion of the bottom of the beaker to go dry.
7. Remove the beaker and add approximately 5 mL of reagent water, mix, and continue warming the beaker for 10 to 15 minutes to allow additional solubilization of any residue to occur.
8. Allow to cool. Transfer the solution to a 50–mL volumetric flask. Adjust volume to the 50 mL mark with reagent water and mix.
9. Transfer to a polypropylene bottle.
10. The sample is now ready for analysis.

Block Digestor Instructions:

1. Turn block digester on by pressing rocker switch located on the cord.
2. Wait about 8 seconds until controller display indicates current block temperature.
3. PRESS and hold STAR (*) key.
4. The display shows the Set Point Temperature.
5. The digits can be changed to the desired value by pressing the up and down arrow keys while holding the (*) key.
6. Confirm Control Point temperature is set to the block temperature that provides 90° to 95°C.

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NOTE: See HotBlock Control Point Temperature Logbook to obtain control point temperature setting for the HotBlock being used for digestion. If necessary, adjust Control Point temperature to the proper setting.

NOTE: Polypropylene containers must not be heated above 130°C.

Calculations:

Not applicable to this procedure.

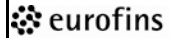
Statistical Information/Method Performance:

Not applicable to this method. See analysis procedure.

Quality Assurance/Quality Control:

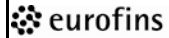
A method blank, sample duplicate, sample matrix spike, sample matrix spike duplicate, and laboratory control sample must be performed with every digestion batch (20 samples or less). Each piece of batch QC is digested following the procedure in this SOP.

For sample batch quality control requirements see Analysis #6142, 6123, 6125, 10801, 6126, 6127, 6129, 6128, 6132, 6131, 6133, 6134, 6140, 6136, 6137, 6138, 6143, 6139, 6135, 6124, 6141, 6146, 6144, 6147, 6145, ...

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Eurofins Document Reference	1-P-QM-WI -9015161	Revision	18
Effective Date	Aug 28, 2014	Status	Effective
Historical/Local Document Number	Analysis DOD - 5711, 10638		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

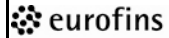
Prepared by	Debra Bryan
Reviewed and Approved by	Robert Strocko;Review;Tuesday, August 12, 2014 2:34:04 PM EDT Kathryn Brungard;Approval;Thursday, August 14, 2014 9:42:25 AM EDT

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Revision Log:

Revision: 18		Effective Date:	This version
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Document Title	Clarification	Removed Fish from the title so that the word Tissue is not limited to only fish.	
Sample Collection, Preservation, and Handling	No longer applicable. Laboratory is not supporting CLP work.	Deleted holding time of 26 days for CLP	
Procedure 2	Clarification	Removed Fish from the tissue section and included or other tissue samples are used.	
Procedure 6	Clarification	Added the word about. To read: ...adding about 5 ml of aqua regia	
Purpose	Clarification	Removed the word fish so that the word tissue is not limited to only fish.	

Revision: 17		Effective Date:	May 23, 2014
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Reagents and Standards D.2	Correction	Changed expiration date to 1 week from preparation date.	
Block Digestor Instructions	Reflect current procedure	Deleted control point temperature adjustment for control panel grey buttons	

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Reference:

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 7471A Modified, September 1994.
2. Test Methods for Evaluating Solid Wastes, SW-846 Method 7471B, February 2007
3. *Chemical Hygiene Plan*, current version.

Cross Reference:

Document	Document Title
Analysis #0259, 0159	Mercury in Aqueous, Solid and Tissue Samples by Cold Vapor AA
1-P-QM-FOR-9008921	Working Instructions for Preparation of Mercury Solutions and Standards


Purpose:

This digestion procedure is used to prepare soil, sediment, sludge, oil, and tissue samples for measurement of mercury by atomic absorption cold vapor technique following SW-846 protocol.

Scope:

This method is approved for measuring total mercury (organic and inorganic) in soils, sediments, bottom deposits, sludge-type materials, and concrete. All samples must be subjected to an appropriate dissolution step prior to analysis. If this dissolution procedure is not sufficient to dissolve a specific matrix type or sample, then this method is not applicable for that matrix. Samples that require additional homogenization are addressed on a case-by-case basis and homogenized by the Sample Support Group (Department 6055).

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Basic Principles:

Samples are digested with aqua regia and potassium permanganate to oxidize mercury compounds to mercuric ions and eliminate possible interference from sulfide. Samples high in chlorides require additional permanganate. At the time of analysis, excess permanganate is reduced with sodium chloride/hydroxylamine hydrochloride. Mercuric ions are reduced to mercury metal using stannous chloride. Mercury measurement is performed using mercury cold vapor technique.


Reference Modifications:

To increase efficiency, polypropylene containers are used in place of BOD bottles. Prior to analysis (after excess potassium permanganate is reduced with sodium chloride/hydroxylamine hydrochloride solution) samples are adjusted to 100 mL in volumetric flasks. This allows aliquots to be taken as required for analysis; aliquots cannot be taken when BOD bottles are used. No impact on the quality of the data generated using this modification has been observed.


Definitions:

1. ACS – American Chemical Society
2. Calibration Blanks – includes ICBs and CCBs
3. CCB – Continuing Calibration Blank
4. CCV – Continuing Calibration Verification
5. D – Sample Duplicate
6. DOC – Demonstration of Capability
7. Dummy tubes - purchased weighted tubes filled with ballast
8. ICB – Initial Calibration Blank

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9. ICV – Initial Calibration Verification
10. IDOC – Initial Demonstration of Capability
11. LCS/LCSD – Laboratory Control Sample/ Laboratory Control Sample Duplicate
12. LCSW– Laboratory Control Sample Water
13. LLENS - the computer program that integrates a PC with an analytical balance to collect data directly from the balance. The program organizes the data and transmits the readings to the LIMS.
14. LIMS – Laboratory Information Management Systems
15. ELLE Sample ID – unique 7-digit number assigned to a client sample.
16. LOQ – Limit of Quantitation
17. MDL – Method Detection Limit
18. MS (R) – Matrix Spike
19. MSD (M) – Matrix spike duplicate
20. PB/PBW–Preparation Blank/ Preparation Blank Water
21. QC – Quality Control
22. Method Blank - equivalent to a Preparation Blank. A designated sample designed to monitor for sample contamination during the analysis process. A volume of reagent laboratory water is typically used to monitor water sample analysis, while solids blanks consist of a purified solid matrix or just the reagents used in the test. The blank demonstrates that no artifacts were introduced during the analysis process.

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23. SOP- Standard Operating Procedure

24. U or US – unspiked background sample

Interferences:

Not applicable to this procedure.

Safety Precautions and Waste Handling:

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Preparing samples for inorganic analysis involves working with concentrated acids and other chemicals which are dangerous if not handled carefully:


Nitric acid (HNO₃) – This acid can cause skin burns. Add nitric acid to samples in a hood or use the designated dispensing equipment to avoid exposure to toxic fumes.

Hydrochloric acid (HCl) – This acid can cause skin burns. Never mix HCl with concentrated H₂SO₄ to avoid a violent reaction. Always use in a fume hood or use the designated dispensing equipment.

When diluting strong acids, never add water to acid; always add acid to water.

Store concentrated acids in the prep room acid lockers. Only acids are to be stored in these lockers. (Store solvents in the flammable liquid storage cabinet.) Some concentrated acids are kept in the acid reagent bottles on prep room counters. Fill reagent bottles in an operating fume hood using caution to avoid spills.

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Perform acid digestions in hoods that are turned on and have active alarms. Notify a supervisor immediately if the hood is malfunctioning or the alarm sounds.

Samples that contain dust may be hazardous. Open in a fume hood.

When a hazardous flag is added indicating possible cyanide, special precautions are required to avoid exposure to hydrogen cyanide gas. Contact your supervisor prior to adding acid. Always open these samples and add the acid in a hood.

Use spill pillows to absorb large acid spills (small spills are cleaned with wet paper towels.) Use SPILL-X-A powder or equivalent to neutralize any remaining acid and then rinse the area thoroughly with water. Spill pillows and SPILL-X-A are stored on the prep room shelf.

Dispose of acid waste properly. Collect all acid digestions, waste solutions, and expired reagent solutions in waste containers. When the acid waste containers are full, a designated acid waste handler transfers the waste to the acid neutralization tank.


Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability (DOC) for this or an equivalent procedure.

Initially, each employee performing this digestion procedure must work with an experienced employee for a period of time until they can independently set up batches and perform the necessary steps outlined in this procedure. Proficiency is measured through documentation of the critical steps in this procedure, over checking of data as well as an IDOC.

The IDOC and the DOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation.

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Sample Collection, Preservation, and Handling:

Samples are collected in either glass or plastic containers with no preservatives. They must be stored at 0 to 6°C, not frozen and digested and analyzed within 28 days of collection.

Digested samples are stored in plastic containers at room temperature. Store samples, standards, and digested samples separately.

Apparatus and Equipment:

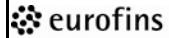
1. Polypropylene containers (digestion vessels) - Certified clean and Class A equivalent
2. Balance, capable of reading 0.1 mg
3. Polypropylene covers, (digestion vessel covers)
4. Chemware Ultra-Pure PTFE boiling stones, or equivalent
5. Environmental Express Hotblock (block digester), adjustable and capable of maintaining a temperature of $95^{\circ} \pm 1^{\circ}\text{C}$
6. Computer and software LLENS (Lancaster Laboratories Electronic Notebook System)

Reagents and Standards:

For reagent preparation, shelf life, and storage conditions, see form
1-P-QM-FOR-9008921

- A. Store all standards and reagents in polyethylene bottles at room temperature. Label the bottle with the solution name, lot number, date prepared, the expiration date, the initials of the person preparing the solution, and the storage conditions.

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B. Standard/ spiking concentration and reagent vendors are subject to change without notification.


C. Reagents, use the following or equivalent:

1. Hydrochloric acid, HCl, 36.5% to 38.0%, Fisher Trace Metal Grade reagent, 1.194 g/mL or equivalent. Store in glass container at room temperature. Follow manufacturer's expiration date.
2. Nitric acid, 70.0% to 71.0% HNO₃, Fisher Trace Metal Grade reagent, 1.428 g/mL or equivalent. Store in glass container at room temperature. Follow manufacturer's expiration date.
3. Potassium permanganate, KMNO₄, Baker Analyzed reagent, ACS, or equivalent. Store in glass container at room temperature. Follow manufacturer's expiration date.
4. Sodium chloride, NaCl, J.T. Baker, Certified ACS, or equivalent. Store in plastic container at room temperature. Follow manufacturer's expiration date.
5. Hydroxylamine hydrochloride, NH₂OH•HCl, J.T. Baker, Certified ACS, or equivalent. Store in plastic container at room temperature. Follow manufacturer's expiration date.
6. 1000 mg/L Hg standard solution, Baker analyzed reagent, or equivalent. Stored in plastic container at room temperature. Follow manufacturer's expiration date.
7. Reagent Water

D. Prepare all standards and spikes solutions following Form 1-P-QM-FOR-9008921.

1. Hg intermediate standard (10 mg/L). Stored in glass container at room temperature. Expires 6 months from date of preparation.

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2. Hg intermediate standard (1.0 mg/L). Stored in plastic container at room temperature. Expires 1 week from date of preparation.

E. Prepare all General solutions following Form 1-P-QM-FOR-9008921.

1. Potassium permanganate solution (5%). Stored in glass container at room temperature. Expires 6 months from date of preparation.
2. Aqua regia. Prepare immediately before use.
3. Sodium chloride/hydroxylamine hydrochloride solution. Stored in glass container at room temperature. Expires 6 months from date of preparation.

F. Adjust all additions according to final solution volume if larger or smaller volumes are needed. Thoroughly mix the solution after diluting to volume.


Calibration:

Not applicable to this procedure.

Procedure:

1. Turn block digester on and allow block to reach the Control Point setting that provides $95^{\circ} \pm 1^{\circ}\text{C}$ sample temperature. (The block temperature setting is not necessarily the sample temperature.) See below for Block Digester instructions.
2. Weigh three 0.2000-g aliquots taken from three different areas (combined 0.6000 to 0.6500 g to the nearest 0.0001 g) of a well mixed, as-received sample into a polypropylene digestion vessel. Add 0.6000g to 0.6499g of Chemware Ultra-Pure PTFE boiling stones to the vessel for the method blank and LCS. Enter the blank weight as 0.6000 to 100.0000 final volume and the LCS weight as 1.0000 to 100.0000 final volume in the LLENS.

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NOTE: For samples of liquid consistency, increase weight to 1 g (1.0000 to 1.0500 g).

NOTE: For oil samples weigh 0.2000g to 0.2500g (to the nearest 0.0001 g) of sample and add 0.2000g to 0.2499g of Teflon Chips to the blank and LCS container. Enter the blank weight as 0.2000 to 100.0000 final volume and the LCS weight as 1.0000 to 100.0000 final volume in the LLENS.

NOTE: When fish tissues, or other tissue samples are digested by this method, spike the LCS, LCSD in the same manner as the R, and M (Refer Form 1-P-QM-FOR-9008921). Digest tissue samples in their own batch.

3. See Quality Assurance/Quality Control section for required batch Quality Control.
4. See Form 1-P-QM-FOR-9008921 for instructions on preparing batch Quality Control. All spiking must be performed prior to starting the digestion procedure.
5. See Form 11-P-QM-FOR-9008921 for concentration levels of batch Quality Control.
6. Add about 5 mL reagent water and about 5 mL of aqua regia solution.
7. Place sample containers in block digester and heat approximately 2 minutes.
8. Remove sample containers from block and allow to cool.

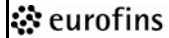
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9. Add 50 mL of reagent water and 15 mL of 5% KMnO₄ solution and mix. Add additional portions of 5% KMnO₄ solution (in 5-mL increments, up to as much as 25mL), if necessary, until the purple color persists for at least 15 minutes. Add the same amount of KMnO₄ solution to entire digestion batch. If the maximum amount of 25mL of 5% KMnO₄ solution was added and the purple color did not persist for at least 15 minutes, then contact group leader, further dilutions are required. A comment must be placed on the batch sheet documenting the reason for the dilution.
10. Transfer sample containers to block digester.
11. Place a calibrated thermometer in batch blank container.
12. Put a polypropylene cover on each container.
13. When the thermometer indicates 95° ± 1°C, continue heating for 30 minutes.
14. Remove sample containers from digestion block and allow to cool. Seal container with screw cap.
15. The sample is now ready for analysis.

Block Digester Instructions:

1. Turn block digester on by pressing rocker switch located on the cord.
2. Wait about 8 seconds until controller display indicates current block temperature.
3. PRESS and hold STAR (*) key.
4. The display shows the Set Point Temperature.
5. The digits can be changed to the desired value by pressing the up and down arrow keys while holding the (*) key.

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6. Confirm Control Point temperature is set to the block temperature that provides $95^{\circ} \pm 1^{\circ}\text{C}$ sample temperature.

NOTE: See HotBlock Control Point Temperature Logbook to obtain control point temperature setting for the HotBlock being used for digestion. If necessary, adjust Control Point temperature to the proper setting.

Calculations:

Not applicable to this procedure.

Statistical Information/Method Performance:

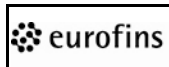
Not applicable to this method. See analysis method.

Quality Assurance/Quality Control:

Each digestion batch (up to 20 samples) must contain a method blank, LCS and either an US, D, MS, MSD or an LCS/LCSD.

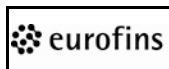
For sample batch quality control requirements see Analysis #0259, 0159.

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Eurofins Document Reference	1-P-QM-WI -9015160	Revision	22
Effective Date	Aug 21, 2014	Status	Effective
Historical/Local Document Number	Analysis DOD - 5708, 10637		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

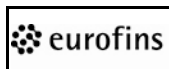
Prepared by	Debra Bryan
Reviewed and Approved by	Robert Strocko;Review;Thursday, August 7, 2014 8:55:25 AM EDT Kathryn Brungard;Approval;Thursday, August 7, 2014 11:48:56 AM EDT

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Revision Log:

Revision: 22		Effective Date:	This version
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Document Title	Clarification	Removed Fish from the title so that the word Tissue is not limited to only Fish.	
Procedure	Clarification	Removed the word fish from tissue section and included or other tissue samples are used.	

Revision: 21		Effective Date:	Mar 17, 2014
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Cross Reference	Reflect current procedure	Added reference Analysis #6142, 6123, 6125, 10801...	
Scope	Clarification	Reworded section.	
Sample Collection, Preservation and Handling	Reflect current procedure	Changed sample storage temperature to 0° to 6°C, but not frozen.	
Reagents and Standards	Reflect current procedure	Added reference to 1-P-QM-FOR-9009182.	
Procedure	Reflect current procedure	Add boiling stones to the batch blank and LCS for the fish samples.	
Block Digestor Instructions	Reflect current procedure	Hold and press the star key.	
Quality Assurance/Quality Control	No longer used	Deleted test pertaining to the control panel grey buttons.	
	Reflect current procedure	Added reference to ICP/MS Analysis #6142, 6123, 6125, 10801, for batch requirements.	

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Reference:

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 3050B, December 1996.
2. *Chemical Hygiene Plan*, current version.

Cross Reference:

Document	Document Title
Analysis #6142, 6123, 6125, 10801, 6126, 6127, 6129, 6128, 6132, 6131, 6133, 6134, 6140, 6136, 6137, 6138, 6143, 6139, 6135, 6124, 6141, 6146, 6144, 6147, 6145, ...	Metals by Inductively Coupled Plasma Mass Spectrometry for SW-846 Methods 6020/6020A (aqueous, solid, tissue), CLP 5.2 (aqueous, solid, tissue) and EPA 200.8 (aqueous)
Analysis #6966, 1643, 6935, 7914, 6946, 6947, 1650, 6949, 6952, 6951, 6953, 1654, 1662, 1656, 1657, 6958, 6960, 1667, 6961, 10145, 6955, 6944, 6936, 6969, 7968, ...	Metals by Inductively Coupled Plasma Atomic Emissions Spectroscopy for SW-846 Methods 6010A/B/C (aqueous, solid, tissue), CLP 2.1(water/solid/tissue), CLP 4.0(water/solid/tissue), CLP 5.2 (water/solid/tissue) and EPA 200.7(aqueous)
1-P-QM-FOR-9009182	Working Instructions for Prep Solutions and Standards

Purpose:

This digestion procedure is for the preparation of solid samples for analysis by ICP and ICP/MS following SW-846 protocol.

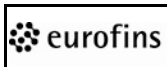
Scope:

This method is used for preparation of metals in solid samples for analysis by ICP and ICP/MS.

Basic Principles:

A representative sample is digested with repeated additions of nitric acid (HNO₃) and hydrogen peroxide (H₂O₂). Hydrochloric acid (HCl) is added to the initial digestate and the sample is refluxed. The resultant digestate is diluted and analyzed.

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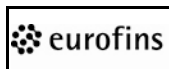
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This method is not a total digestion technique for most samples; it is a very strong acid digestion that dissolves almost all elements that could become “environmentally available.” By design, elements bound in silicate structures are not normally dissolved by this procedure.

Definitions:

1. ACS – American Chemical Society
2. D – Sample Duplicate
3. DOC – Demonstration of Capability
4. IDOC – Initial Demonstration of Capability
5. LCS/LCSD – Laboratory Control Sample/ Laboratory Control Sample Duplicate
6. LCSW– Laboratory Control Sample Water
7. LLENS - the computer program that integrates a PC with an analytical balance to collect data directly from the balance. The program organizes the data and transmits the readings to the LIMS.
8. LIMS – Laboratory Information Management Systems
9. LLI Sample ID – unique 7-digit number assigned to a client sample.
10. LOQ – Limit of Quantitation
11. MDL – Method Detection Limit
12. MS (R) – Matrix Spike
13. MSD (M) – Matrix spike duplicate

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14. PB/PBW–Preparation Blank/ Preparation Blank Water
15. QC – Quality Control
16. Method Blank - equivalent to a Preparation Blank. A designated sample designed to monitor for sample contamination during the analysis process. A volume of reagent laboratory water is typically used to monitor water sample analysis, while solids blanks consist of a purified solid matrix or just the reagents used in the test. The blank demonstrates that no artifacts were introduced during the analysis process.
17. SOP- Standard Operating Procedure
18. U or US – unspiked background sample

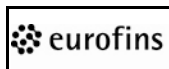
Interferences:

When analyzing sample by ICP-MS using this digestion procedure we follow the instrument manufacturer's guidelines to eliminate polyatomic interferences typically caused by Chlorine. The process we follow involves the use of a collision/reaction cell on the ICP-MS. Below is a description of how the collision/reaction cell works.

Reaction Process - The primary method of interference removal is through a reaction event. When using a reaction gas, either the target interference is more reactive than the target analyte, leading to preferential removal of the interferent or (less commonly) the target analyte is more reactive and is converted to a new species at a different mass which is free from any existing or newly-formed overlap

Collision Process - The primary method of interference removal is through a non-reactive event. This process of interference removal is kinetic energy discrimination (KED). Energy Discrimination is most commonly used with an inert gas, which means the interference removal process is not affected by reactions in the cell.

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Safety Precautions and Waste Handling:

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Preparing samples for inorganic analysis involves working with concentrated acids and other chemicals which are dangerous if not handled carefully:

Nitric acid (HNO₃) – This acid can cause skin burns. Add nitric acid to samples in a hood or use the designated dispensing equipment to avoid exposure to toxic fumes.

Hydrochloric acid (HCl) – This acid can cause skin burns. Never mix HCl with concentrated H₂SO₄ to avoid a violent reaction. Always use in a fume hood or use the designated dispensing equipment.

Hydrogen peroxide (H₂O₂) - This is a strong oxidizing agent and causes severe burns. Avoid contact with skin.

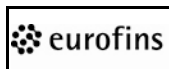
When diluting strong acids, never add water to acid; always add acid to water.

Store concentrated acids in the prep room acid lockers. Only acids are to be stored in these lockers. (Store solvents in the flammable liquid storage cabinet.) Some concentrated acids are kept in the acid reagent bottles on prep room counters. Fill reagent bottles in an operating fume hood using caution to avoid spills.

Perform acid digestions in hoods that are turned on and have active alarms. Notify a supervisor immediately if the hood is malfunctioning or the alarm sounds.

Samples that contain dust may be hazardous. Open in a fume hood.

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When a hazardous flag is added indicating possible cyanide, special precautions are required to avoid exposure to hydrogen cyanide gas. Contact your supervisor prior to adding acid. Always open these samples and add the acid in a hood.

Use spill pillows to absorb large acid spills (small spills are cleaned with wet paper towels.) Use SPILL-X-A powder or equivalent to neutralize any remaining acid and then rinse the area thoroughly with water. Spill pillows and SPILL-X-A are stored on the prep room shelf.

Dispose of acid waste properly. Collect all acid digestions, waste solutions, and expired reagent solutions in waste containers. When the acid waste containers are full, a designated acid waste handler transfers the waste to the acid neutralization tank.

Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability (DOC).

Initially, each employee performing this digestion procedure must work with an experienced employee for a period of time until they can independently set up batches and perform the necessary steps outlined in this procedure. Proficiency is measured through documentation of the critical steps in this procedure, over checking of data as well as an IDOC.

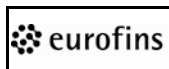
The IDOC and the DOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation.

Sample Collection, Preservation, and Handling:

Solid samples require no chemical preservation.

Samples must be submitted in glass or plastic containers and stored at 0° to 6°C, but not frozen, prior to digestion. Samples must be digested within 6 months (180 days) of sample collection.

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Digested samples are stored in polypropylene bottles at room temperature.

Apparatus and Equipment:

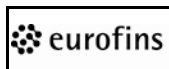
1. Polypropylene containers and covers (digestion vessels) - certified clean and Class A equivalent
2. Whatman No. 41 filter paper or equivalent
3. Funnels
4. Environmental Express HotBlock (block digester) - adjustable and capable of maintaining a temperature of 90 to 95°C
5. Balance capable of reading 0.01 g
6. Chemware Ultra-Pure PTFE boiling stones, or equivalent.
7. Computer and software LLENS (Lancaster Laboratories Electronic Notebook System)

Reagents and Standards:

For reagent preparation, shelf life, and storage conditions, see Form 1-P-QM-FOR-9009182.

1. Nitric acid (HNO_3) – Fisher, Trace Metal Grade, or equivalent. Store at room temperature. Re-evaluate annually.
2. Nitric acid (1:1) – Add 500 mL of HNO_3 to 500 mL of reagent water. Store in polypropylene at room temperature. Expires 6 months from date of preparation. (Different volumes are acceptable but ratios must stay the same.)

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3. Hydrogen peroxide, 30% (H₂O₂) – Fisher, Certified ACS or equivalent. Store at room temperature. Re-evaluate annually.
4. Hydrochloric acid (HCl) – Baker Instra-Analyzed, or equivalent. Store at room temperature. Re-evaluate annually.

NOTE: It is acceptable to prepare using multiples of indicated weights and volumes if ratios are maintained.

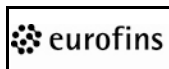
Calibration:

Not applicable.

Procedure:

1. Turn block digestor on and allow block to reach the Control Point setting that provides 90° to 95°C sample temperature. (The block temperature setting is not necessarily the sample temperature.) See below for **Block Digestor Instructions** section.
2. Weigh 1.00 to 1.05 g (to the nearest 0.01 g) of a well mixed sample into a polypropylene digestion vessel. (If the sample is watery use 5.00 to 5.05 grams for analysis. Additional information on non-standard matrices is found at the end of the procedure section.) Add 1.00 to 1.49 g of Chemware Ultra-Pure PTFE boiling stones to the digestion vessel for the blank and LCS. Enter the blank and LCS weight as 1.0000 to 100.0000 final volume in the LLENS. For sample batch spiking procedures see 1-P-QM-FOR-9009182. All spiking must be performed prior to starting the digestion procedure.
3. Add 10 mL of (1:1) HNO₃, swirl to mix, and cover with a polypropylene cover.
4. Place sample vessel in block digestor. Heat (reflux) the sample at 90° to 95°C for 10 to 15 minutes without boiling.
5. Remove vessel from digestion block and allow sample to cool.

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6. Add 5 mL of concentrated HNO₃. Replace cover, return vessel to digestion block and heat for 30 minutes.

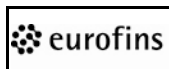
NOTE: If brown fumes are generated (indicating oxidation of the sample by HNO₃) continue the process of adding 5 mL HNO₃ and heating until no brown fumes are given off by the sample. This indicates that the reaction with HNO₃ is complete. Add the same amount of HNO₃ to the entire digestion batch.

7. With cover on, heat at 90° to 95°C without boiling for 2 hours. Maintain a covering of solution over the bottom of the vessel at all times (add reagent water if necessary).
8. Remove vessel from digestion block and allow sample to cool.
9. Add 2 mL of reagent water and 3 mL of 30% H₂O₂. With cover on, return vessel to digestion block and heat until effervescence subsides. Care must be taken to ensure that losses do not occur due to excessively vigorous effervescence.
10. Continue to add 30% H₂O₂ in 1-mL aliquots with warming until the effervescence is minimal or until the general sample appearance is unchanged.

NOTE: Do not add more than a total of 10 mL 30% H₂O₂.

11. With cover on, continue heating the acid-peroxide digestate at 90° to 95°C without boiling for 2 hours. Maintain a covering of solution over the bottom of the vessel at all times (add reagent water if necessary).
12. Remove sample vessel from digestion block and allow to cool.
13. Add 10 mL of HCl. With the cover on, return vessel to digestion block and heat at 90° to 95°C for 15 minutes.

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14. Remove sample vessel from digestion block.
15. If floating particulate is evident after digestion, the sample must be filtered.
 - a. Filter through Whatman No. 41 filter paper into a polypropylene container.
 - b. Wash sample vessel, residue, and paper thoroughly with reagent water.
 - c. If any samples are filtered, the prep blank and LCS must also be filtered.
16. Adjust volume to the 100mL mark on the digestion vessel with reagent water and mix. Seal vessel with a screw cap. The sample is now ready for analysis.

NOTE: When special limits of quantitation are required by the client, use more sample weight.

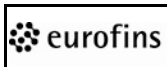
For wipe samples:

When wipes are digested by this method, one blank media each must be used for the batch preparation blank, the laboratory control sample (LCS), and the laboratory control sample duplicate (LCSD). Refer to Form 1-P-QM-FOR-9009182 for the spiking of the LCS and LCSD. Digest wipes in their own batch. Use reagent water to rinse any particulate matter from the wipe container into the vessel containing the wipe before digesting. If brown fumes are evolved during wipe sample digestion, perform only two 5 mL HNO₃ additions with 30-minute refluxing each; add the same amount of HNO₃ to the entire batch. Proceed with digestion.

For tissue samples:

When fish tissues, or other tissue samples are digested by this method, refer to Form 1-P-QM-FOR-9009182 for the spiking of the LCS, LCSD (if needed), R (matrix spike), and M (matrix spike duplicate). Add 1.00 to 1.49 g of Chemware Ultra-Pure PTFE

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boiling stones to the digestion vessel for the blank and LCS. Digest tissue samples in their own batch.

Block Digestor Instructions:

1. Turn block digestor on by pressing rocker switch located on the cord.
2. Wait about 8 seconds until controller display indicates current block temperature.
3. PRESS and hold STAR (*) key.
4. The display shows Control Point temperature.
5. The digits can be changed to the desired value by pressing the up and down arrow keys while holding the (*) key.
6. Confirm Control Point temperature is set to the block temperature that provides 90° to 95°C.

NOTE: See HotBlock Control Point Temperature Logbook to obtain control point temperature setting for the HotBlock being used. If necessary, adjust Control Point temperature to the proper setting as instructed below.

NOTE: Polypropylene containers must not be heated above 130°C.

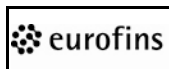
Calculations:

Not applicable

Statistical Information/Method Performance:

Not applicable to this procedure. See analysis method.

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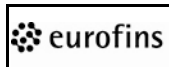
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Quality Assurance/Quality Control:

For sample batch spiking instructions see form 1-P-QM-FOR-9009182. Refer to ICP section when prepping ICP analysis. Refer to ICP/MS section when prepping ICP/MS analysis. Prepare a method blank, sample duplicate, sample matrix spike, sample matrix spike duplicate, and laboratory control sample with every digestion batch (20 samples or less). Each piece of batch QC is digested following the procedure in this SOP. If any samples are filtered the prep blank and LCS must also be filtered.

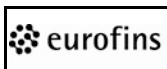
Refer to ICP Analysis #6966, 1643, 6935, 7914, 6946, 6947, 1650, 6949, 6952, 6951, 6953, 1654, 1662, 1656, 1657, 6958, 6960, 1667, 6961, 10145, 6955, 6944, 6936, 6969, 7968, ... for sample batch quality control requirements, acceptance criteria and corrective action.

Refer to ICP/MS Analysis #6142, 6123, 6125, 10801, 6126, 6127, 6129, 6128, 6132, 6131, 6133, 6134, 6140, 6136, 6137, 6138, 6143, 6139, 6135, 6124, 6141, 6146, 6144, 6147, 6145, ... for sample batch quality control requirements, acceptance criteria and corrective action.

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Eurofins Document Reference	1-P-QM-WI -9015158	Revision	12
Effective Date	Aug 20, 2015	Status	Effective
Historical/Local Document Number	Analysis DOD - 10401		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

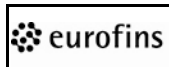
Prepared by	Lisa Reinert
Reviewed and Approved by	Susan Goshert;Review;Thursday, August 6, 2015 10:29:29 AM EDT Barbara Reedy;Approval;Thursday, August 6, 2015 11:13:35 AM EDT

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Revision Log:

Revision: 12		Effective Date:	This version
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Scope	Reflects current LOQs and target compounds.	Updated to current LOQs. Removed compounds that are not qualified (3,5-dichlorobenzoic acid, Acifluorfen, and Bentazon	
Reagents and Standards	Reflects current standards	Updated DCAA SS stock, Herbicide intermediate, ICV intermediate, surrogate stock. Removed Hexachlorophene/Picloram intermediate. Added MS Hexachlorophene to be a separate standard.	
Statistical Information/Method Performance	Clarification	Added information about the full MDL study	
Quality Assurance/Quality Control	Enhancement	Added information on evaluating the internal standard.	

Revision: 11		Effective Date:	Jul 31, 2014
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Document Title	Enhancement	Remove analysis of and added instrument: Chlorinated Herbicides by Method 8151A in Solids by GC-ECD	
Historical/Local Document number	Deactivated scan in LIMS	Removed 5592	
Throughout Document	Reflect re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers	
Sample Collection, Preservation, and Handling	Reflects current industry standard	Updated refrigeration conditions from 4° ± 2°C	
Apparatus and Equipment	Reflects current instrumentation	Updated GC and column types	
Reagents and Standards	Reflects current standards and standard prep	Updated Spike amounts in making IBLK, added hexachlorophene to ICV stock Added information on the electronic standard database	
Calibration	Reflects current practices	Removed level 7 ICAL standard from sequence	
Quality Assurance/Quality Control	Reflects current analysis scans	Removed reference to Table 1	
Appendix I	Enhancement	Added CT RCP criteria.	

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Reference:

1. *Test Methods for Evaluating Solid Waste*, SW-846 Method 8151A, December 1996.
2. State of Connecticut Department of Environmental Protection,
Recommended Reasonable Confidence Protocols for Chlorinated Herbicides
by SW-846 8151, version 2.0 July 2006.
3. *Chemical Hygiene Plan*, current version.

Cross Reference:

Document	Document Title
Analysis #4181	Extraction of Chlorinated Herbicides in a Soil Matrix
1-P-QM-PRO-9015477	Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
1-P-QM-PRO-9015493	QC Data Acceptability and Corrective Action
1-P-QM-PRO-9015494	Interpretation of Chromatographic Data
1-P-QM-PRO-9015496	Monitoring QC Data Acceptance Limits
1-P-QM-PRO-9015498	Setting Up Single Component Initial Calibrations
1-P-QM-PRO-9015501	Common Equations Used During Chromatographic Analyses
1-P-QM-QMA-9015390	Demonstrations of Capability
1-P-QM-QMA-9017309	Determining Method Detection Limits and Limits of Quantitation

Scope:

This method is used for identifying and quantitating the following chlorinated herbicides in soils, sediments, and solids.

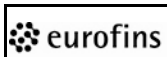
Compound	Limit of Quantitation (µg/kg)	
2,4 – D	36	
2,4 – DB	17	
2,4 - DP (Dichloroprop)	18	
2,4,5 – T	1.7	
2,4,5 - TP (Silvex)	1.7	
Dalapon	90	
Dicamba	12	
Dinoseb	24	
Hexachlorophene	24	Special request required
MCPA	2500	
MCPP (Mecoprop)	2500	
Pentachlorophenol	1.7	
Picloram	40	Special request required

Limits of Quantitation (LOQs) are based on annual statistical evaluation of laboratory data and are subject to change. The current Method Detection Limits (MDLs) and LOQs are maintained in the LIMS.

See Analysis #4181 for the extraction preparation.

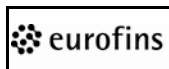
Basic Principles:

The compounds of interest are extracted with 1:1 methylene chloride:acetone from an acidified portion of soil (pH less than 2) using sonication. The extract is hydrolyzed and interfering compounds like chlorinated hydrocarbons and phthalates are removed by a solvent wash. After acidifying the extract once more, the compounds are extracted with ethyl ether and are converted to their methyl esters using diazomethane as the derivatizing agent. The methyl esters are determined using gas chromatography with an electron capture detector. A florisil cleanup is performed to eliminate matrix interferences that introduce large, unresolvable peaks in the chromatogram. A dilution is required if interferences such as chlorinated acids and phenols are present. Refer to 1-P-QM-PRO-9015477 for more details on this cleanup procedure.

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Definitions:

1. Analytical Batch – A group of field and Quality Control (QC) samples of the same matrix, extracted together under the same conditions and period of time, using the same lot(s) of chemicals.
2. Continuing Calibration Verification (CCV) – A mid-level standard used to verify that the analytical response is reliable, and has not changed significantly from the current Initial Calibration curve (ICAL). The verification of the ICAL that is required during the course of analyses at periodic intervals.
3. Initial Calibration Verification (ICV) - Second source calibration verification. A standard obtained or prepared from a source independent of the source of standards for the ICAL. Used to verify the integrity of the standards used for initial calibration.
4. Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) – A sample of known composition analyzed with each batch of samples to demonstrate laboratory accuracy. The samples either naturally contain the analytes of interest or are clean samples fortified with known concentrations. Used to demonstrate laboratory accuracy. A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test.
5. Matrix Spike/Matrix Spike Duplicate (MS/MSD) – A sample created by fortifying a second aliquot of a water or soil sample with some or all of the analytes of interest. The concentration added is known and compared to the amount recovered to determine percent recovery. Matrix spike recoveries provide information about the accuracy of the method in light of the matrix analyzed. A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test.

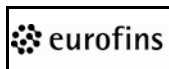
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6. Method Blanks – A designated sample designed to monitor for sample contamination during the analysis process. A volume of deionized laboratory water is typically used to monitor water sample analysis, while solids blanks consist of a purified solid matrix or just the reagents used in the test. The blank demonstrates that no artifacts were introduced during the analysis process.
7. Surrogates – Organic compounds which are similar to the analytes of interest but are not naturally occurring in environmental samples. Surrogates are spiked into all standards and every field and QC sample prior to extraction and analysis to provide information regarding the effects of the sample matrix.
8. Internal Standard – Analytes, which are chemically similar to the analytes of interest, but are not naturally occurring in environmental samples. Internal standards are added to all standards and every field and QC sample after extraction but prior to analysis. Comparison of the response of the internal standard is used in the quantitation of target analytes. Internal standard response also provides a check for changes in the instrument response.

Interferences:

An electron capture detector is very sensitive to compounds that contain halogens and responds to many other compounds and materials including oxygenated organics, unsaturated organics, and elemental sulfur. Plastic must not be used during the extraction or analysis to prevent phthalate contamination. Glassware must be scrupulously cleaned. All of these interferents can introduce large, unresolvable peaks into the chromatogram. Florisil cleanup is used to reduce other organics which can interfere (polar compounds). Additionally, the extraction incorporates a solvent wash step to remove potential interfering organic compounds.

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Safety Precautions and Waste Handling:

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Gloves, lab coats, and safety glasses must be worn when preparing standards. Safety glasses must be worn around the GC where solvents and extracts are handled.

All GC vials are disposed of in the designated waste container in the lab, then subsequently lab packed for final disposal. All solvent waste is placed in designated containers in the lab, then emptied into the lab-wide waste facility.

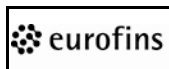
Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each analyst performing instrumental analysis must work with an experienced analyst for a period of time until they can independently calibrate the instrument, use the chromatography data system to set up sequences, perform the calculations, interpret chromatograms, perform instrument maintenance, and enter data into the LIMS. Proficiency is measured through documented audits of the tasks listed and over checking of data as well as an Initial Demonstration of Capability (IDOC).

The IDOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four laboratory control samples, one blind sample, or one ICAL with ICVs and/or CCVs. Refer to 1-P-QM-QMA-9015390 for more guidance on these options.

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Sample Collection, Preservation and Handling:

Unpreserved samples must be collected in wide-mouth glass jars with PTFE-lined lids and stored at 0° to 6°C, not frozen. The holding time is 14 days from collection to extraction. The extracts must be stored at -10° to -15°C and analyzed within 40 days of extraction.

Apparatus and Equipment:

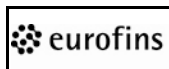
1. HP7890 gas chromatograph fitted with electron capture detector, or equivalent
2. Columns:
 - a. Phenomenex ZB-XLB 30 m × 0.32 mm × 0.25 µm
 - b. Phenomenex ZB-35 30 m × 0.32 mm × 0.25 µm
3. Integrating system such as ChromPerfect from Justice Innovations or equivalent
4. Various sizes of Class A volumetric pipettes, flasks, and syringes.

Reagents and Standards:

A. Reagents

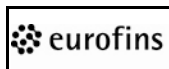
1. Hexane, pesticide grade for autosampler vials. Stored at room temperature.
2. UPC (ultra pure carrier) nitrogen for detector make up
3. UPC helium for carrier gas
4. UPC hydrogen, bottled or from a generator

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B. Standards

1. Unopened ampules are stored according to the manufacturer's instructions and are stable until the expiration date provided by the manufacturer.
2. All standards are prepared using Class-A volumetric flasks, pipettes, and syringes.
3. All standards are stored in labeled vials or flasks in a freezer at -10° to -15°C.
4. Herb stock – Acid herbicide stock for calibration standards: Accustandard catalog #S-12214-R5 in methanol (concentrations vary per compound).
5. DBOFB stock – 4,4'-dibromooctafluorobiphenyl Ultra PPS-170 at 1000 µg/mL used as internal standard.
6. DBOFB Intermediate – Dilute 1.0 mL of DBOFB stock into 50 mL of acetone. This solution is stable for 6 months.
7. Working DBOFB IS diluting solution – Dilute 5.0 mL of the DBOFB intermediate into 100 mL of hexane. This solution is used to make sample dilutions. This solution is stable for 6 months.
8. DCAA SS stock – 2,4 dichlorophenylacetic acid (DCAA) non-methylated stock. Ultra PPS-162 at 5000 µg/mL.
9. Herbicide intermediate – Dilute 1.0 mL of acid herbicide stock, 0.02 mL of hexachlorophene stock, 0.04 mL of picloram stock, and 0.02 mL of DCAA SS stock into 10 mL of ethyl ether. This solution is methylated following procedure outlined in Analysis #4181 prior to making the calibration standards. This solution is stable for 6 months.

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10. MS stocks:

- a. Herbicide mix in the acid form for the matrix spiking solution: Ultra cat #HBM-8150A in methanol (concentrations vary per compound).
- b. PCP stock – Accustandard cat #APP-9-176-D-20X at 2000 µg/mL in methylene chloride.
- c. Dinoseb fortification stock – Restek cat #32251 at 1,000 µg/ml in methanol.
- d. Picloram stock – Restek cat #32265 at 1,000 µg/ml in methanol.
- e. Hexachlorophene stock – Restek cat #EPA-1125 at 1,000 µg/ml in acetone.

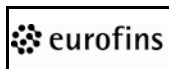
11. Hexachlorophene stock – Restek cat #31811 at 2,000 µg/ml in methylene chloride.

12. Picloram stock – Restek cat #32265 at 1,000 µg/ml in methanol

13. ICV Stocks:

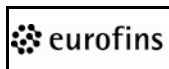
- a. Acid herbicide mix - Supelco cat # 46861-U in methanol (concentrations vary per compound)
- b. Hexachlorophene – Accustandard cat #APP-9-116 at 100 µg/l in methanol

14. ICV Intermediate – Dilute 1 mL of acid herbicide stock, 0.5 mL of hexachlorophene stock, and 0.02 mL of DCAA SS stock into 10 mL. This solution is methylated following procedure outlined in Analysis #4181 prior to making the working standard.

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15. Surrogate Stock (SS) – Chem Service, cat# S-10536B5-5m containing 2,4-Dichlorophenylacetic acid (DCAA) in acetone.
16. Prepare working standards using the electronic standard database as a guide.
 - a. In the database, choose the category (i.e. working spike, surrogate, intermediate, etc) and the required standard.
 - b. The database contains the following information: solution description (ex. HERB 1), parent solution name, aliquot used, final volume, solvent used, concentration of each compound in the solution, and expiration date. The working standards have an expiration date of 6 months.
 - c. The calibration scheme begins at or near the reporting limit through a 40 fold of the initial calibration level.
17. Prepare the spiking solutions using the prep scheme in the table below:

Standard Name	Parent Solution	Aliquot (mL)	Final Vol (mL)	Solvent	Description	Expiration Date
MS	Herb mix Stock	2.5	100	Acetone or Methanol	Herb Spike	6 months
	PCP Stock	0.05				
	Dinoseb Fortification Stock	0.3				
	Picloram Stock	0.25				
MS	Hexachlorophene Stock	0.03	25	Methanol	Hexachlorophene	6 months
IS	DBOFB Stock	1	50	Acetone	Internal Std	6 months
IBLK	SS Stock	0.88	200	Hexane	Instrument Blank Std.	6 months
	DBOFB stock	0.20				

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GC Instrument Conditions:

Instrument setup (Primary and Confirmation):

Detector:	ECD
Detector Temperature:	300°C
Makeup Gas:	N2 at 30 mL/min for Varian ECDs, 55 mL/min for HP ECDs
Injection Size:	2 µL, direct injection
Injector Temperature:	250°C
Oven Temperature:	50°C, hold 0.5 min, 25°C/min to 100°C, 12°C/min to 310°C, hold 2 min
Carrier:	Hydrogen at 10 psi (Helium is a substitute.)

The conditions listed above are optimum but are changed to improve the linearity, sensitivity, and chromatography on each GC system. A Merlin microseal can be used in place of a traditional septum.

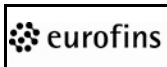
Calibration:

1. Prior to starting a new calibration, change the septum on the GC allow the detector to stabilize. Fill the autosampler rinse vials with clean solvent or replace vials themselves if they appear to be dirty.

2. Prepare a sequence as follows:

1. Conditioner
2. IBLK
3. Herb Level 1
4. Herb Level 2
5. Herb Level 3
6. Herb Level 4
7. Herb Level 5
8. Herb level 6 (optional)
9. MDHEX
10. ICHBX
11. Blank
12. LCS
13. 1234567
14. 1234567ms
15. 1234567msd
16. – 20. Continue with samples
21. Herb Level 3
22. – 31. Ten samples
32. Herb Level 3

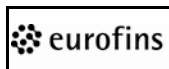
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Continue running groups of 10 samples followed by an Herb level 3 standard between sample groups.

3. The conditioner injection is usually a standard or sample that has already been injected.
 - a. Any number of conditioners can be used prior to the start of the run – one is shown here as an example.
 - b. It is used to prime the system and is best utilized when the GC has not been running and there is a gap in time prior to starting a set of injections.
 - c. Hexane blanks are run to allow the GC to go through some temperature program runs and/or to check the cleanliness of the system when needed.
4. The instrument blank (IBLK) is injected after the conditioners but before the initial calibration.
 - a. It is used to determine that the instrument is free of background noise or contamination.
 - b. IBLK may also be run with the continuing calibration standards – this is optional, but is frequently requested for projects.
5. Initial Calibration (ICAL)
 - a. The system is calibrated using a minimum of five concentration levels.
 - b. An internal standard calibration is used with average response factor (AVGRF) for all analytes where the %RSD is $\leq 20\%$.

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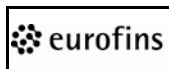
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- (1) If the average of the %RSDs of all compounds in the initial calibration standard is $\leq 20\%$, the AVGRF is used for all compounds in the ICAL when needed.
 - (2) Alternatively, when these criteria are not met, a calibration curve must be used.
- c. When using a calibration curve, a linear fit must be tried first.
- (1) Use the linear fit if the correlation coefficient is >0.99 .
 - (2) However, if the correlation coefficient is <0.99 , a quadratic fit must be tried. A 6-point calibration must be run to use quadratic.
- d. For either curve type, extrapolate or force zero is not allowed.
- e. See 1-P-QM-PRO-9015498 (SOP-PP-031) for details on using Chrom Perfect for setting up single component calibration files.
- f. Ensure all peaks in the standard are labeled properly and the scaling of the plot is such that concentrations at the MDL exhibit a peak about 2 to 3 mm in height.
- g. Be sure all peaks on the MDHEX standard are integrated by the data system.

6. Initial Calibration Verification (ICV)

- a. Verification of the calibration curve is performed using the ICV mixtures injected directly after the full ICAL.
- b. The % difference (%D) of the concentrations for each analyte must be within $\pm 15\% D$ of the nominal concentration for the curve to be used for sample analysis.

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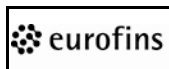
7. Continuing Calibration Verification (CCV)

- a. A CCV standard is analyzed after every ten injections using the level 3 calibration standard.
- b. The CCV between samples must exhibit a response at $\pm 15\%D$ for each compound, or the average of the $\%Ds$ must be within $\pm 15\%$ for the standard to be compliant on at least one of the two columns used for analysis.
- c. The concentration calculated for the CCV injection is compared to the nominal concentration.
- d. Samples must be bracketed with compliant standards.
 - (1) Exception: If, however, the standard following a sample is outside the $\pm 15\%$ but exhibits increasing response, the samples before it do not have to be reinjected if the target analytes are not detected.
 - (2) If confirmation of target analytes is needed, then the second column should meet the 15% CCV criteria, as well as all ICAL criteria.

8. If an instrument blank (IBLK) is injected after the CCV, it must be evaluated as a water matrix against the water MDL/LOQs.

- a. The IBLK must not have any target compounds above the reporting limits.
- b. If a target analyte is detected in the IBLK, any associated samples with a detection for that same target must be evaluated.

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- (1) Unless the concentration in the sample is more than 10x the IBLK value, the sample must be reinjected after another compliant IBLK.
- (2) Instrument maintenance, like baking the system or injection port maintenance is usually necessary to clean up the instrument.

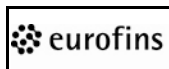
9. Retention time (RT)

- a. RT windows are established as 3× the standard deviation determined over a 72-hour period, or at no less than ± 0.03 min, applied to the mid-point initial calibration standard.
- b. If the RTs for a CCV fall outside the windows, update the midpoint RT using that standard.
 - (1) Save this under an appropriate name to indicate an update has occurred.
 - (2) All subsequent continuing standards run within a 24-hour period must fall within this window.
 - (3) RTs cannot be updated more than once per day.
 - (4) If RTs are not consistent, the cause must be investigated and corrective action taken.

Procedure:

1. Retention times of peaks in the samples are compared to the standard RT windows.
 - a. Peaks that are present on both columns are quantitated and the high value is reported unless there are chromatograph anomalies.
 - b. See 1-P-QM-PRO-9015494 (SOP-PP-011).

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2. Samples that contain levels of analytes above the highest level calibration standard must be diluted and reanalyzed.

When preparing dilutions, add sufficient internal standard to maintain the same 100-µg/L final concentration.

3. If data is reported using the grand mean for the ICAL or CCV, the following comment(s) will be added to the report:
 - a. 1571 – The % difference for the calibration verification standard is outside the ± criteria for the analyte(s) listed below. Since the average of the % difference values meets the criteria, the results are reported.
 - b. 1572 - The % relative standard Deviation for the initial calibration or the analyte(s) listed below is above the 20% criteria. Since the average of the RSD values for all calibrated compounds meets the criteria, the average response factor calculation was used.
 - c. **NOTE:** Use of the average of the %Ds (grand mean) is not permitted for samples from South Carolina and may not be approved for specific client projects.

Calculations:

$$Sample Conc. (\mu g/kg) = Extract Conc. \times \frac{DF \times FV}{IW} \times Conc. Internal Standard$$

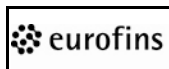
Where:

FV = Final volume = 100 mL

IW = Initial weight = 10 g

DF = Dilution factor

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1. Linear curve

$$ExtractConc.(\mu g/L) = \frac{\frac{PeakHeight}{InternalStandardHeight} - Y - intercept}{slope}$$

2. Average response factor (AVG RF)

The calculation performed by AVG RF is the same as above except the extract concentration is calculated as follows:

Where:

$$ExtractConc.(\mu g/L) = \frac{\left(\frac{Peak\ height}{internal\ standard\ height} \right)}{AVG\ RF}$$

Where:

$$AVG\ RF = (RF\ Calib\ 1 + RF\ Calib\ 2 + \dots + RF\ Calib\ 5) / 5$$

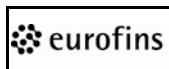
$$RF = \frac{StandardPeakHeight}{InternalPeakHeight} / \frac{StandardConcentration(mg/L)}{Conc.InternalStandard}$$

Also see 1-P-QM-PRO-9015501 (SOP-PP-040) for more details on calculations regarding the calibration.

Statistical Information/Method Performance:

The QC acceptance limits for LCS, MS/MSD and surrogates are established according to 1-P-QM-PRO-9015496 (SOP-PP-025).

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Generate reporting limits including method detection limits (MDLs) and limits of quantitation (LOQs) according to 1-P-QM-QMA-9017309 (LOM-SOP-ES-203). MDLs are determined by taking seven replicates through the entire extraction and analysis procedure. The full study is initially run on each instrument used for the analysis. The results are tabulated using an Excel spreadsheet. Results from all instruments are compared and pooled together to determine the reporting MDL. NELAC allows for an annual verification of the MDL in lieu of a full annual MDL study. Copies of the studies are maintained by the department manager. Updates to the LIMS are made as need by the QA department and only as directed by the manager. The department database is updated via a download from the LIMS.

Quality Assurance/Quality Control:

A sodium sulfate blank and LCS are analyzed with each group of samples. MS and MSD are analyzed with each batch of 20 samples as long as there is ample volume. An LCSD must be performed if an MS/MSD cannot be done.

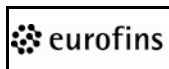
The spiking solutions contain all analytes of interest. A surrogate standard of 2,4-dichlorophenyl acetic acid (DCAA) is added to each sample, blank, and spike to monitor the efficiency of the extraction and the operation of the autoinjector. An internal standard is added to each sample, blank, and spike. The internal standard (DBOFB) response for each sample and QC is evaluated by comparing the response in the sample to the response of the nearest check standard. Since there is no criteria listed in the method, an advisory window of 50 – 150 is used.

If more than 20 samples are prepared in a day, then an additional batch with QC must be extracted. If any client, agency or state has more stringent QC or batch requirements, these must be followed instead.

1-P-QM-PRO-9015493 (SOP-PP-002) outlines the QC acceptability criteria and corrective action.

See Appendix I for the specific CT RCP criteria.

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Appendix I – CT RCP Requirements

No use of grand mean for initial and continuing calibration evaluation.

If any sample needs a comment about out of spec data, comment 2510 must be put on the sample first, followed by our comment, so that the RCP form generates properly from the LIMS.

Comment about any raised limits (does not need precursor comment)

Need instrument blanks after every CCV set.


If there is >40% difference between column A and B, a comment must be placed on the analytical report. There are two comments for this: 1570 says the higher result was reported, 1569 says the lower result was reported. Use these on the analytical report as they apply.

The LCS recoveries must be between 40 -140%.

The MS/MSD recoveries must be between 40-140% with the RPD \leq 30%.

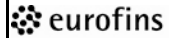
The surrogate recovery must fall between 30 – 150%.

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Eurofins Document Reference	1-P-QM-WI -9015133	Revision	16
Effective Date	Dec 3, 2014	Status	Effective
Historical/Local Document Number	Analysis DOD - 1848, 10635		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

Prepared by	Debra Bryan
Reviewed and Approved by	Robert Strocko;Review;Wednesday, November 19, 2014 1:11:31 PM EST Barbara Reedy;Approval;Wednesday, November 19, 2014 1:15:26 PM EST

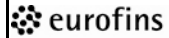
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Revision Log:

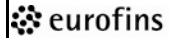
Revision: 16		Effective Date: This version
Section	Justification	Changes
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version
Historical/Local Document Number	No longer part of current procedure	Removed 5720
Reference	No longer part of current procedure	Removed CLP ILM02.1, ILM04.0, ILM05.2
Scope	No longer part of current procedure	Removed reference to CLP
Apparatus and Equipment	Reflect current procedure	Included DEENA to item 6.
Procedure A	No longer part of current procedure	Removed Analysis 5720 (CLP) entire section
Procedure B	Clarification	NOTE: Reworded text pertaining to the preparation of the PB and LCS for soluble metals analysis
	No longer part of current procedure	Removed Analysis 5720 (CLP)
Procedure C	Reflect current procedure	Included analysis 10635 (SW-846)
Procedure C.2	Reflect current procedure	Added DEENA temperature 90° to 95°C
Procedure C.5	Updated to current procedure	Replaced DI water with reagent water.
Quality Assurance/Quality Control	No longer part of current procedure	Removed reference to CLP digestion 5720 batch.

Revision: 15		Effective Date: Nov 27, 2013
Section	Justification	Changes
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version
Throughout Document	Reflect re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers
Sample Collection, Preservation, and Handling	Process change	Changed sample storage temperature from 4° ± 2°C to 0° to 6° C but not frozen, prior to digestion.
Procedure A	Reflect current procedure	Added text, to NOTE, pertaining to the blank and LCS must also be filtered if any samples are filtered due to insoluble matter present in the digested sample. Added NOTE, pertaining to using a smaller aliquot of the sample and bring sample to final volume, if contains high solids Added NOTE, pertaining to filtering unpreserved sample and preparing the blank and spiked LCS using filtered reagent water, for soluble metals analysis
Procedure A.1.a	Clarification	Added text pertaining to adding spike solution, after the sample has been poured.
Procedure A.2.a	Clarification	Added text pertaining to adding spike solution, after the sample has been poured.
Procedure A.2.a	Reflect current procedure	Added reference to Analysis 6966, 1643..... Deleted reference to SOP SOP-IO-014
Procedure A.2	Reflect current procedure	Added 2 nd NOTE pertaining to Lab filtering.

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Revision: 15	Effective Date: Nov 27, 2013
Procedure B	Reflect current procedure Added text, to NOTE, pertaining to the blank and LCS must also be filtered if any samples are filtered due to insoluble matter present in the digested sample. Added NOTE, pertaining to filtering unpreserved sample and preparing the blank and spiked LCS using filtered reagent water, for soluble metals analysis Added NOTE, pertaining to using a smaller aliquot of the sample and bring sample to final volume, if contains high solids.
Procedure B.1.a	Clarification Added text pertaining to adding spike solution, after the sample has been poured.
Procedure B.2	Reflect current procedure Added NOTE pertaining to Lab filtering.
Procedure B.2.a	Clarification Added text pertaining to adding spike solution, after the sample has been poured.
Procedure C	New equipment in use Added entire section pertaining to DEENA Auto-digester.
Procedure C	Reflect current procedure Added NOTE, pertaining to using a smaller aliquot of the sample and bring sample to final volume, if contains high solids. Added NOTE, pertaining to filtering sample, prep blank, and LCS if insoluble matter is present in the digested sample, or allow to settle by gravity. Added NOTE, pertaining to filtering unpreserved sample and preparing the blank and spiked LCS using filtered reagent water, for soluble metals analysis
Block Digester Instruction	Reflect current procedure Clarified instruction steps. Deleted text pertaining to the difference between sample temperature and display temperature.
Quality Assurance/Quality Control	Reflect current procedure Added reference to SOP 6966, 1643...for batch quality control requirements.

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Reference:

1. *Test Methods for Evaluating Solid Waste*, SW-846 Method 3005A, July 1992
2. *Chemical Hygiene Plan*, current version

Cross Reference:

Document	Document Title
Analysis #6966, 1643, 6935, 7914, 6946, 6947, 1650, 6949, 6952, 6951, 6953, 1654, 1662, 1656, 1657, 6958, 6960, 1667, 6961, 10145, 6955, 6944, 6936, 6969, 7968, ...	Metals by Inductively Coupled Plasma Atomic Emissions Spectroscopy for SW-846 Methods 6010A/B/C (aqueous, solid, tissue), CLP 2.1(water/solid/tissue), CLP 4.0(water/solid/tissue), CLP 5.2 (water/solid/tissue) and EPA 200.7(aqueous)
1-P-QM-FOR-9009182	Working Instructions for Prep Solutions and Standards
1-P-QM-QMA-9015390	Demonstrations of Capability

Scope:

This acid digestion procedure is used by the Metals Department of the Environmental Sciences Division at Lancaster Laboratories to prepare wastewater, surface water, and groundwater samples for measurement of total recoverable metals by inductively coupled plasma optical emission spectroscopy (ICP-OES) following SW-846 protocol.

This method is used whenever SW-846 Method 3010 is not requested or required for total metals.

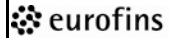
Basic Principles:

Samples are heated with nitric and hydrochloric acids with a substantial reduction in volume during digestion to dissolve metals.

Reference Modifications:

1. A 50-mL sample aliquot and final volume is used instead of 100 mL to improve digestion throughput, conserve sample usage, and limit waste generation. Because all reagents are also adjusted so that concentrations are equivalent to a 100-mL aliquot, there is no impact on the data.

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2. Ribbed watch glasses or reflux caps are not used during evaporation; samples are heated without watch glasses in non-metallic hoods to speed evaporation. No contamination trends have been observed in prep blanks evaporated without using watch glasses.
3. Samples are heated at 90° to 95°C on hotplates or Hotblocks, not 92° to 95°C as stated in ILMO4.0; hotplates cannot be maintained within 3°C range.

Definitions:

1. ACS – American Chemical Society
2. D – Sample Duplicate
3. DOC – Demonstration of Capability
4. IDOC – Initial Demonstration of Capability
5. LCS/LCSD – Laboratory Control Sample/ Laboratory Control Sample Duplicate
6. LCSW– Laboratory Control Sample Water
7. LLENS - the computer program that integrates a PC with an analytical balance to collect data directly from the balance. The program organizes the data and transmits the readings to the LIMS.
8. LIMS – Laboratory Information Management Systems
9. LLI Sample ID – unique 7-digit number assigned to a client sample.
10. LOQ – Limit of Quantitation
11. MDL – Method Detection Limit

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12. MS (R) – Matrix Spike
13. MSD (M) – Matrix spike duplicate
14. PB/PBW–Preparation Blank/ Preparation Blank Water
15. QC – Quality Control
16. Method Blank - equivalent to a Preparation Blank. A designated sample designed to monitor for sample contamination during the analysis process. A volume of reagent laboratory water is typically used to monitor water sample analysis, while solids blanks consist of a purified solid matrix or just the reagents used in the test. The blank demonstrates that no artifacts were introduced during the analysis process.
17. SOP- Standard Operating Procedure
18. U or US – unspiked background sample

Interferences:

Not applicable to this procedure


Safety Precautions and Waste Handling:

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Preparing samples for inorganic analysis involves working with concentrated acids and other chemicals which are dangerous if not handled carefully:

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Nitric acid (HNO₃) – This acid can cause skin burns. Add nitric acid to samples in a hood to avoid exposure to toxic fumes or use the designated dispensing equipment.

Hydrochloric acid (HCl) – This acid can cause skin burns. Never mix HCl with concentrated H₂SO₄ to avoid a violent reaction. Always use in a fume hood or use the designated dispensing equipment.

When diluting strong acids, never add water to acid; always add acid to water.

Store concentrated acids in the prep room acid lockers. Only acids are to be stored in these lockers. (Store solvents in the flammable liquid storage cabinet.) Some concentrated acids are kept in the acid reagent bottles on prep room counters. Fill reagent bottles in an operating fume hood using caution to avoid spills.

Perform acid digestions in hoods that are turned on and have active alarms. Notify a supervisor immediately if the hood is malfunctioning or the alarm sounds.


Samples that contain dust may be hazardous. Open in a fume hood.

When a hazardous flag is added indicating possible cyanide, special precautions are required to avoid exposure to hydrogen cyanide gas. Contact your supervisor prior to adding acid. Always open these samples and add the acid in a hood.

Use spill pillows to absorb large acid spills (small spills are cleaned with wet paper towels.) Use SPILL-X-A powder or equivalent to neutralize any remaining acid and then rinse the area thoroughly with water. Spill pillows and SPILL-X-A are stored on the prep room shelf.

Dispose of acid waste properly. Collect all acid digestions, waste solutions, and expired reagent solutions in waste containers. When the acid waste containers are full, a designated acid waste handler transfers the waste to the acid neutralization tank.

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Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability for this or an equivalent procedure.

Initially, each employee performing this digestion procedure must work with an experienced employee for a period of time until they can independently set up batches and perform the necessary steps outlined in this procedure. Proficiency is measured through documentation of the critical steps in this procedure, over checking of data as well as an IDOC.

The IDOC and the DOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Refer to 1-P-QM-QMA-9015390, for specific requirements. A DOC is performed annually and is maintained in the analyst's training records.

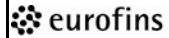
Sample Collection, Preservation, and Handling:

Samples are collected in plastic containers and preserved to a pH of <2 with HNO₃. (Samples to be analyzed for soluble metals requiring filtration at the lab must be submitted unpreserved. The sample is run through a 0.45 micron filter within 5 days of receipt and then preserved.) The pH is checked upon receipt and adjusted as necessary by Sample Support; samples that are pH adjusted at the lab must not be digested for a minimum of 24 hours. If samples fail to maintain a pH of < 2 the Client Service Representative is notified for further direction. Samples are stored at 0° to 6°C, but not frozen, prior to digestion. Samples must be digested within 6 months of collection. Digested samples are stored in plastic at room temperature and have a 6 month holding time.

Apparatus and Equipment:

1. Polypropylene containers (digestion vessels) – certified clean and Class A equivalent

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2. 250-mL beakers, 400-mL beakers (or other volumes as appropriate)
3. 100-mL graduated cylinders (or other volumes as appropriate)
4. 100-mL Class A volumetric flasks (or other volumes as appropriate)
5. 125-mL Nalgene bottles (or other volumes as appropriate)
6. Hot plates, Hotblocks, or DEENA, adjustable and capable of maintaining a temperature of 90° to 95°C

Reagents and Standards:

For reagent preparation, shelf life, and storage conditions, see Form 1-P-QM-FOR-9009182.

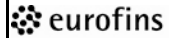
1. Nitric acid, HNO₃ - Fisher, Trace Metal Grade, or equivalent. Store at room temperature and reevaluate annually.
2. Hydrochloric acid, HCl - Fisher, Trace Metals Grade, or equivalent. Store at room temperature and reevaluate annually.
3. Nitric acid (1:1) – Add 500 mL of HNO₃ to 500 mL of reagent water. Store at room temperature. Expires in 6 months.
4. Hydrochloric acid (1:1) – Add 500 mL of HCl to 500 mL of reagent water. Store at room temperature. Expires in 6 months.

NOTE: It is acceptable to prepare solutions using multiples of indicated volumes if exact ratios are maintained.

Calibration:

Not applicable to this method.

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Procedure:

This SOP has been set up to outline the procedures for hotblock, hot plate, and auto-digester (see below). Choose the procedure that corresponds to the sample heating technique being used for sample digestion.

A. Hotblocks

NOTE: It is acceptable to reduce the volume of sample being analyzed as long as the sample reagent ratios are maintained.

NOTE: If the sample contains high solids, use a smaller aliquot of the sample and bring sample to final volume as stated in this procedure. Make appropriate acid, reagent, and spike volume adjustments based on sample final volume.

NOTE: When insoluble matter is present after digestion, allow it to settle by gravity or filter prior to introduction to the instrument. If any samples are filtered, the prep blank and LCS must also be filtered.


NOTE: For soluble metals analysis, filter unpreserved sample through 0.45-micron filter paper. Adjust the filtered sample to pH <2 with nitric acid preserving solution. Measure the volume of sample, as stated in this procedure, and digest as normal. The prep blank and spiked LCS must also be prepared with filtered reagent water.

See Hotblock Control Point Temperature Logbook to obtain control point temperature setting for the Hotblock being used for digestion. If necessary, adjust control point temperature to the proper setting as instructed below.

Analyses 1848 and 10635 (SW-846):

NOTE: The procedures for analysis 1848 and 10635 are equivalent as outlined below. Analysis 10635 is used only for SW-846 Update IV. When entering the batch number in the LIMS the "1" is omitted (i.e. use YYDDD0635###, where YY is the year, DDD is the julian day, and ### is the digest number).

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1. Shake sample well. Transfer 50-mL of well-mixed sample into a 68-mL digestion vessel. After the sample has been poured, add the spiking solution. For sample batch spiking procedures see form 1-P-QM-FOR-9009182. For sample batch quality control requirements see SOP Analysis #6966, 1643, 6935, 7914, 6946, 6947, 1650, 6949, 6952, 6951, 6953, 1654, 1662, 1656, 1657, 6958, 6960, 1667, 6961, 10145, 6955, 6944, 6936, 6969, 7968, ...
2. Add 2 mL of (1:1) HNO₃ and 5 mL of (1:1) HCl.
3. Heat the solution in a Hotblock at about 90° to 95°C until sample volume is reduced to between 15 and 20 mL, making certain the sample does not boil.
4. Allow to cool.
5. Adjust volume to the 50-mL mark on the digestion vessel with reagent water, cap and mix.
6. The sample is now ready for analysis.

B. Hot Plates:


NOTE: If boron (B) is requested on a sample, use Teflon vessels.

NOTE: It is acceptable to reduce the volume of sample being analyzed as long as the sample reagent ratios are maintained.

NOTE: When insoluble matter is present in the digested sample, allow it to settle by gravity or filter prior to introduction to the instrument. If any samples are filtered, the prep blank and LCS must also be filtered.

NOTE: For soluble metals analysis, filter unpreserved sample through 0.45-micron filter paper. Adjust the filtered sample to pH <2 with nitric acid preserving solution. Measure the volume of sample, as stated in this procedure, and digest as normal. The prep blank and spiked LCS must also be prepared with filtered reagent water.

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NOTE: If the sample contains high solids, use a smaller aliquot of the sample and bring sample to final volume as stated in this procedure. Make appropriate acid, reagent, and spike volume adjustments based on sample final volume.


Analyses 1848 and 10635 (SW-846):

1. Shake sample well. Using a 50-mL graduated cylinder, transfer 50 mL of well-mixed sample into a 250-mL beaker. After the sample has been poured, add the spiking solution. For sample batch spiking procedures see form 1-P-QM-FOR-9009182. For sample batch quality control requirements see SOP Analysis #6966, 1643, 6935, 7914, 6946, 6947, 1650, 6949, 6952, 6951, 6953, 1654, 1662, 1656, 1657, 6958, 6960, 1667, 6961, 10145, 6955, 6944, 6936, 6969, 7968, ...
2. Add 2 mL of (1:1) HNO₃ and 5 mL of (1:1) HCl.
3. Heat the solution on a hot plate at 90° to 95°C until sample volume is reduced to between 15 and 20 mL, making certain the sample does not boil.
4. Allow to cool.
5. Transfer the solution to a 50-mL volumetric flask. Adjust volume to the 50-mL mark with reagent water and mix.
6. Transfer the solution to a 125-mL Nalgene container and cap.
7. The sample is now ready for analysis.

C. DEENA Auto-digester

NOTE: If the sample contains high solids, use a smaller aliquot of the sample and bring sample to final volume as stated in this procedure. Make appropriate acid, reagent, and spike volume adjustments based on sample final volume.

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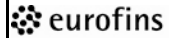
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NOTE: When insoluble matter is present after digestion, allow it to settle by gravity or filter prior to introduction to the instrument. If any samples are filtered, the prep blank and LCS must also be filtered.

NOTE: For soluble metals analysis, filter unpreserved sample through 0.45-micron filter paper. Adjust the filtered sample to pH <2 with nitric acid preserving solution. Measure the volume of sample, as stated in this procedure, and digest as normal. The prep blank and spiked LCS must also be prepared with filtered reagent water.

Analysis 1848 and 10635 (SW-846):

1. Shake sample well. Transfer 50-mL of well mixed sample into a 68-mL digestion vessel. After the sample has been poured, add the spiking solution. For sample batch spiking procedures see form 1-P-QM-FOR-9009182. For sample batch quality control requirements see. SOP Analysis #6966, 1643, 6935, 7914, 6946, 6947, 1650, 6949, 6952, 6951, 6953, 1654, 1662, 1656, 1657, 6958, 6960, 1667, 6961, 10145, 6955, 6944, 6936, 6969, 7968, ...
2. Verify the DEENA temperature is 90° to 95°C
3. Place samples into 20 position sample trays starting in position one. Place the trays into the DEENA.
4. Open the DEENA software. Click the Rack Definition button and input the total number of samples to be run.
5. Make sure all reagents have sufficient volume and that the transfer tubes are in the appropriate reagent. Make sure the waste beaker is clean and has 5-10 mL of reagent water in it.
6. Press the Green triangle (GO) button.

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Block Digester Instructions:

1. Turn block digester on by pressing rocker switch located on the cord.
2. Wait about 8 seconds until controller display indicates current block temperature.
3. PRESS and hold STAR (*) key.
4. The display shows the Set Point Temperature.
5. The digits can be changed to the desired value by pressing the up and down arrows keys while holding the (*) key.
6. Confirm Control Point temperature is set to the block temperature that provides 90° to 95°C.

NOTE: See HotBlock Control Point Temperature Logbook to obtain control point temperature setting for the HotBlock being used for digestion. If necessary, adjust Control Point temperature to the proper setting.

NOTE: Polypropylene containers must not be heated above 130°C.

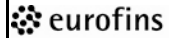
Calculations:

Not applicable to this procedure.

Statistical Information/Method Performance:

Not applicable to this procedure.

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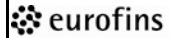
Quality Assurance/Quality Control:

A method blank, sample duplicate, sample matrix spike, sample matrix spike duplicate, and laboratory control sample must be performed for every SW-846 digestion batch (analysis 1848 or 10635). A batch is 20 samples or less.

A method blank, sample duplicate, sample matrix spike, and laboratory control sample must be performed every CLP digestion batch (analysis 5720). A batch is 20 samples or less.

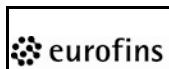
Each piece of batch QC is digested following the procedures in this SOP.

For sample batch quality control requirements see Analysis #6966, 1643, 6935, 7914, 6946, 6947, 1650, 6949, 6952, 6951, 6953, 1654, 1662, 1656, 1657, 6958, 6960, 1667, 6961, 10145, 6955, 6944, 6936, 6969, 7968, ...

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Eurofins Document Reference	1-P-QM-WI -9015132	Revision	16
Effective Date	Jan 20, 2015	Status	Effective
Historical/Local Document Number	Analysis DOD - 1637, 1638, 1700, 1725, 1726, 2765, 2766, 5550, 5551, 10599, 12989		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

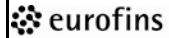
Prepared by	Laura Krieger
Reviewed and Approved by	Kenneth Boley;Review;Monday, January 5, 2015 8:58:40 AM EST Christiane Sweigart;Approval;Tuesday, January 6, 2015 7:28:37 AM EST

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Revision Log:

Revision: 16		Effective Date:	This version
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Cross Reference	Missing information	Added 1-P-QM-PRO-9015465	
Scope	Reflects current practice	Removed the inactive analysis 1700	
Reagents and Standards B.2	Missing information	Added expiration date of surrogate solutions	
Reagents and Standards B.3.C	Correction	Changed amount of 2-component from 80 µL to 200 µL Changed amount of methanol from 8 mL to 20 mL	
Preparation of Glassware	Missing information	Added reference to 1-P-QM-PRO-9015465	
Table I	Clarity	Specified "calibration std" for the TFT used in ICAL prep	

Revision: 15		Effective Date:	Sep 16, 2013
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Revision Log (Previous Version)	Correction	Changed analysis number from 129898 to 12989 in <i>Historical/Local Document Number</i> entry for version 14	
Reference 4.	Reflects current references	Added reference to EPA SW-846 Method 8015D and renumbered accordingly	

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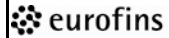
Reference:

1. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 8015B, December 1996.
2. *Test Methods for Evaluating Solid Wastes*, SW-846, Method 8015B Modified, December 1996.
3. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 8015C, February 2007.
4. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 8015D, Rev. 4, June 2003.
5. OA-1 GRO (SW-846 8015B).
6. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 5035, November 2004.
7. Missouri/Iowa Method OA-1, 1993.
8. *Chemical Hygiene Plan*, current version.

Cross Reference:

Document	Document Title
Analysis #1150, 6170, 11968, 11969	Preparation of Soil and Solid Samples for GC Volatile Analyses
Analysis #8389, 8390, 6130, 6117, 6174, 7578, 7320	Preparation of Soils for Volatile Analysis by EPA SW-846 Method 5035
1-P-QM-PRO-9015465	Glassware Cleaning
1-P-QM-PRO-9015470	Preparation and Analysis of Cleaning Blanks for GC and GC/MS Volatiles
1-P-QM-PRO-9015491	Statistical Calculations Used in the Analysis of Samples by EPA Methodology
1-P-QM-QMA-9015390	Demonstrations of Capability
1-P-QM-QMA-9017309	Determining Method Detection Limits and Limits of Quantitation

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Scope:

This method is based on a purge and trap, gas chromatography (GC) procedure and is used to determine the concentration of gasoline range organics (GRO) in soil.


Generally, this corresponds to an alkane range of approximately C6 through C12. The carbon range can be modified to comply with differing regulatory needs.

The following is a list of the various analysis numbers used to report GRO using SW846 8015B method with the exception of analysis 10599 which uses SW846 8015C. OA-1 uses the 1637, 1638 analyses and is run identically to 8015B:

Analysis Number	Description	Range	Retention Time Marker – Start of Range	Retention Time Marker – End of Range	Reporting Limit mg/kg
1637	GRO	C6 – C10	2-methylpentane	1,2,4-trimethylbenzene	1
1638	GRO, used with BTEX scan	C6 – C10	2-methylpentane	1,2,4-trimethylbenzene	1
1725	GRO – Northern CA	C6 - C12	n-hexane	Naphthalene	1
1726	GRO – Northern CA, with BTEX	C6 - C12	n-hexane	Naphthalene	1
2765	GRO – Louisiana	C6 – C10	n-hexane	n-decane	1
2766	GRO – Louisiana, with BTEX	C6 – C10	n-hexane	n-decane	1
5550	GRO – Southern CA, with BTEX	C5 – C12	First discernable peak after the methanol/solvent front (calibration standard)	Last discernable peak in the chromatogram (Naphthalene)	1
5551	GRO – Southern CA	C5 – C12	First discernable peak after the methanol/solvent front (calibration standard)	Last discernable peak in the chromatogram (Naphthalene)	1
10599	GRO	C6 – C10	2-methylpentane	1,2,4-trimethylbenzene	1
12989	Fractionated GRO	C5 – C12	First discernable peak after the methanol/solvent front (calibration standard)	Last discernable peak in the chromatogram (Naphthalene)	1
		C5 – C6	First discernable peak after the methanol/solvent front (calibration standard)	n-hexane	1
		>C6 – C8	n-hexane	n-octane	1
		>C8 – C10	n-octane	n-decane	1
		>C10 – C12	n-decane	Naphthalene	1

This method can be run in series with a photoionization detector (PID) to analyze for BTEX and oxygenates using SW846 Method 8020 or 8021.

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Basic Principles:

Soil samples are dispersed in methanol, refer to Analysis #1150, 6170, 6130, and 6117 for specifics, to dissolve volatile organic constituents. A portion of this methanol extract is diluted into reagent water and analyzed by purge and trap gas chromatography. Detection is achieved by a flame ionization detector (FID). Quantitation is performed by comparing the area of all chromatographic peaks (including resolved and unresolved components) eluting between the retention times for the start and stop of the hydrocarbon range in the sample to the total area over that same range in a gasoline standard.

Interferences:

High levels of solvents or petroleum products may contain volatile compounds that may elute within the retention time of the GRO.


Samples can become contaminated by diffusion of volatiles through the sample vial septum. A trip blank carried through sampling, storage and handling can act as a check of such contamination.

Contamination by carryover can occur whenever high-level and low-level samples are analyzed sequentially. To reduce carryover, the sample syringe and/or purge vessel must be rinsed between samples with reagent water. Whenever a highly concentrated sample is analyzed, it must be followed by a instrument blank to check for cross-contamination.

The trap and other parts of the system are subject to contamination. Frequent bake-out and purging of the system may be required.

Each chromatogram is reviewed for interference. If an interfering peak is observed either just prior to or immediately after the surrogate peak or the contamination level in the sample causes the integrator to improperly set the baseline, manual integration may be needed.

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Safety Precautions and Waste Handling:

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.


The toxicity of all compounds used in this method has not been established. However, several of the compounds are considered carcinogens. Each compound must be treated as a potential health hazard. The major route of exposure is inhalation during the handling of any stock standards while preparing secondary dilution standards. Therefore, these stocks must be prepared in a fume hood to eliminate the risk of inhaling the vapors. Information concerning the known toxicity, properties, or any special handling precautions can be found in the material safety data sheets (MSDS) available from the Safety Officer. Safety glasses and lab coats are required as personal protective wear.

The solvents utilized in this procedure are disposed of in a solvent waste container. Expired standards in methanol are disposed of as hazardous waste. All working solutions prepared in reagent water are flushed down the sink with tap water. Methanolic extracts of samples are returned to the sample storage area for future disposal. Soil sample extracts are collected and disposed of as solvent waste.

Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC).

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Initially, each analyst performing instrumental analysis must work with an experienced analyst for a period of time until they can independently calibrate the instrument, use the chromatography data system to set up sequences, perform the calculations, interpret chromatograms, perform instrument maintenance, and enter data into the LIMS. Proficiency is measured through documented audits of the tasks listed and over checking of data as well as an Initial Demonstration of Capability (IDOC). Refer to 1-P-QM-QMA-9015390 for specific requirements. Demonstration of Capability is performed annually and is maintained in the analyst's training records.

Sample Collection, Preservation, and Handling:


Samples are to be collected using the recommended sampling protocol in EPA SW-846, Method 5030A and 5035B. Samples are refrigerated at 0° to 6°C, not frozen, and must be analyzed within 14 days of collection.

Samples are prepped using a 1:1 ratio of soil to methanol in accordance to Analysis #1150, 6170, or Analysis #8389, 8390, 6130, 6117, 6174, 7578, 7320.

Apparatus and Equipment:

1. Gas chromatograph – Hewlett Packard 5890 or equivalent suitable for purge and trap sample introduction
2. Detector – FID (in series with a PID if BTEX constituents are to be analyzed along with GRO)
3. GC column – DB VRX GC column, 75m × 0.45 mm × 2.55 um, or equivalent, (capable of resolving early-eluting constituents from the solvent front and ethylbenzene from *m/p*-xylene when BTEX is performed in series)
4. Purge and trap concentrator (P&T) – O.I. Analytical Model 4560 or equivalent with the following specifications. The purging chamber (sparge) is designed to accept 25 mL of sample with a water column that is at least 12 cm deep. The gaseous headspace of the chamber must be <15-mL total volume.

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5. Autosampler – OI Analytical model 4551, 4552, or equivalent
6. Syringes – 5-mL and 25-mL Luer-Lok gastight syringe
7. Microsyringe – various sizes from 10 to 1000-µL gastight syringes
8. Glassware
 - a. Class-A Volumetric flasks with ground-glass stopper
 - b. Vials, 1.5 –mL, 15-mL, and 40 mL screw cap, with Teflon™/silicone septa
9. Stainless-steel spatula
10. Mettler top-loading balance, or equivalent, capable of accurately weighing to the nearest 0.01 g
11. Integrating system such as Chrom Perfect® by Justice Laboratory Software, or equivalent. Chrom Perfect® is a data system capable of storing and reintegrating chromatographic data and determining peak areas using a forced baseline, area summation, baseline projection, and performing baseline compensation as required.

Reagents and Standards:

A. Reagents

1. Reagent water – Reagent water is defined as water in which an interferent is not observed at or above the reporting limit for parameters of interest. In general, the reagent water supplied at the taps in the laboratory meets this criterion. If the reagent water does not meet the requirements, see your supervisor for further instructions. Reagent water must be used to prepare all sample dilutions and working standards.

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2. Methanol, P&T grade or equivalent, is used to extract all solid samples for analysis and to prepare all secondary dilution standards required for this method. Store at room temperature.

B. Standards

1. Stock standards

- a. All stock standards are obtained from vendors and must contain paperwork indicating: expiration date of solution, components included, and their concentrations within the solution. The vendor must present this information, as well as an indication of component's purity, for traceability issues.
- b. All stocks are stored in an explosion-proof freezer at -10° to -15°C until the expiration date indicated by the vendor.
- c. Gasoline Calibration Stock Standard– Gasoline standard from Restek Corporation or equivalent. Restek Cat # 30237, concentration certified at 5500-ppm.
- d. 15,000-ppm TFT surrogate stock standard – This standard is utilized to prepare a multi-level surrogate calibration that is required by many methods. Restek Cat # 54357.
- e. Matrix Spike Stock Standard – Gasoline standard from Supelco or equivalent. Cat # 47516-U concentration certified at 20,000-ppm. (Alternatively, Restek Cat # 30205, concentration at 50,000-ppm)
- f. Surrogate Stock Standard – This stock is purchased in two versions: 2-component and 1-component.

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- (1) 2-component surrogate –Restek Cat # 58097 is utilized for all continuing calibration verification (CCV) standards. Refer to the following list for each component and its concentration in this standard:

<u>Component</u>	<u>Concentration (ppm)</u>
1-Chloro-3-fluorobenzene (1C3FB)	12,500
α,α,α-Trifluorotoluene (TFT)	12,500

- (2) 1-component surrogate –Restek Cat # 58098 is utilized for all sample, blanks, Laboratory Control Standard (LCS), Matrix Spike (MS), Matrix Spike Duplicate (MSD), and calibration injections. Refer to the following concentration in this standard:


<u>Component</u>	<u>Concentration (ppm)</u>
1C3FB	12,500

TFT is utilized as a surrogate on the FID. However, TFT is introduced to the sample during the methanol extraction (see analyses 1150, 6170, 6130, and 6117). 1C3FB is utilized as the internal standard on the PID.

- g. Custom GRO Retention Time (RT) Marker Stock – Restek cat # 563807, contains 2-methylpentane, C6 (n-hexane), toluene, 1,2,4-TMB, C10 (n-decane), and naphthalene.
- h. Fractionation RT Marker Stock – Restek cat # 30451, using as C8 RT marker during Analysis # 12989 only.

2. Secondary dilution standards (intermediates)

- a. Secondary dilution standards are stored in an explosion-proof freezer at -10° to -15°C in Teflon-lined screw-capped vials and expire in 30 days. The TFT surrogate intermediates expire in 6 months

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b. 550-ppm gasoline calibration standard B

Prepare by diluting 1.0 mL of gasoline calibration stock standard to a final volume of 10 mL in methanol.

c. 55-ppm gasoline calibration standard A

Prepare by diluting 500 µL of gasoline calibration standard B to a final volume of 5 mL in methanol.

d. 75-ppm TFT calibration Standard

Prepare by diluting 50 µL of TFT stock standard to a final volume of 10 mL in methanol.

e. 2000-ppm Gasoline Spike Intermediate

Prepare by diluting 1.0 mL of gasoline matrix spike stock to a final volume of 10 mL in methanol.

f. 75-ppm Surrogate intermediate standard (either 1- or 2-component stock standard)

Prepare by diluting 300 µL of surrogate stock to a final volume of 50 mL in methanol.


g. 750-ppm TFT Intermediate for Methanol Preserves/Extraction

Prepare by diluting 500 µL of TFT stock to a final volume of 10 mL in methanol.

h. 750-ppb TFT Methanol Extraction Solution

- (1) Prepare by diluting 2 mL of TFT Intermediate for methanol Preserves to a final volume of 2000 mL in methanol.

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- (2) This final methanol extraction solution is then analyzed on a GC system by taking 2 mL of this standard, with 20 µL of 1-component surrogate, and add to reagent water to a final volume of 50 mL.
- (3) After analyzing the surrogate recovery is then reviewed against the statistically derived surrogate recovery windows. If the % recovery is within the acceptable windows, the solution is then used to extract blanks, LCS, and samples. If the % recovery is outside of acceptable windows, the solution is discarded and reprepared.

i. RT Marker Intermediate


Prepare by diluting 1 mL of RT stock to a final volume of 10 mL in methanol. This has an expiration date of 6 months from opening of ampule.

j. Fractionation RT marker intermediate

Prepare by diluting 1 mL of fractionation RT stock to final volume of 10 mL in methanol. This has an expiration date of 6 months from opening of ampule.


3. Working standards

- a. Aqueous standards, made from the secondary dilutions, are stored at 0° to 6°C, not frozen, prepared each day of use, and expire in 24 hours unless otherwise noted. They are transferred into 40mL vials for analysis without headspace.

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- b. Calibration Standards—All calibration standards are prepared in 50-mL volumetric flasks, by diluting the appropriate volume of the methanolic working standard with 20 μ L 1-Component Surrogate and 2 mL methanol. (See Table I for volumes used for initial calibration standard preparation and for values of each calibration level.)
- c. Method Detection Limit (MDL) – Add 8 μ L of the gasoline calibration standard B and 200 μ L of 2-Component Surrogate, into a 500-mL volumetric flask. Add 20 mL methanol and bring to a volume with reagent water yielding the MDL standard concentration at approximately 22 ppb.
- d. Initial Calibration Verification (ICV) – Add 22 μ L of gasoline spike intermediate and 40 μ L of 2-Component Surrogate into a 100-mL volumetric flask. Add 4 mL of methanol and bring to volume with reagent water yielding the ICV concentration at approximately 440 ppb.
- e. Continuing Calibration Verification (CCV) standards
 - (1) Add 80 μ L of gasoline standard and 80 μ L of 2-Component surrogate into a 200-mL volumetric flask. Add 8 mL methanol and bring up to volume with reagent water yielding the CCV at approximately 220 ppb.
 - (2) The CCV concentration can vary based on set client requirements (refer to project notes).
- f. RT Marker
 - (1) Add 100 μ L of the marker intermediate and 80 μ L of 2 component surrogate into a 200-mL volumetric flask. Add 8 mL methanol and bring up to volume with reagent water.
 - (2) The retention time marker working standards expire in 14 days from the prep date.

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g. C8 Marker

- (1) Add 100 µL of the fractionation RT marker intermediate and 80 µL of 2 component surrogate into a 200-mL volumetric flask. Add 8 mL methanol and bring up to volume with reagent water.
- (2) The expiration date is 14 days from the prep date.

Preparation of Glassware:

All glassware is cleaned according to 1-P-QM-PRO-9015465.

Instrument Operating Conditions:


Below are the suggested operating conditions for the autosamplers, purge and traps, and gas chromatograph.

1. O.I. 4551 autosampler or Archon autosampler

Cool flow and chiller temperature	4°C
Rinses between samples	2
Needle depth	85% (OI only)

2. O.I. 4560 Concentrator or Tekmar LSC3000

Sample volume	25 mL
Purge	11 minutes at ambient temperature
Purge gas	He/N2 at ~40 mL/min
Sorbent trap	Tenax trap or equivalent
Desorb	Preheat to 180°C; desorb at 180°C for 4 min
Bake	10 minutes at 180°C

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3. HP 5890 II Gas Chromatograph

Injector	Low dead volume injector – 220°C
Detector	FID at 250°C
GC oven	Start at 40°C and hold for 0.5 min; Ramp at 15°C/min to 140°C; Ramp at 5°C/min to 160°C; Ramp at 30°C/min to 250°C and hold for 5 min.

NOTE: Alternate parameters may be utilized, to optimize the chromatography. All QC criteria must be met, as well as maintaining proper separation and sensitivity.


4. FID gases

Column and make-up (He)	30 ± 2 mL/min
H ₂ gas	35 ± 2 mL/min
Air	160 ± 5 mL/min

NOTE: Flows can be altered in order to optimize detector response.

Calibration:

- A. Prior to calibration or analyzing samples utilizing the autosampler, make sure that the following is complete:
 1. The autosampler is programmed and functioning properly.
 2. Set the P&T and GC to the conditions specified under the Instrument Conditions section of this method. Program autosampler to start and end on the appropriate vials, then press “START.”

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B. Retention Time Window

1. The gasoline range begins 0.1 minutes before the peak apex of marker compound for the start of the range, and ends 0.1 minute past the peak apex of marker compound for the end of the range. The retention times are determined by analyzing a retention time marker standard before every initial calibration and batch
2. Retention Time (RT) windows are established for the retention time marker hydrocarbons and surrogate by using ± 3 standard deviation from the mean retention time for three standards injected over a 72-hour period. These marker hydrocarbons are used to determine the starting and stopping points for the GRO range to be quantitated. If the RTs for the continuing GRO standard fall outside the RT windows, update the hydrocarbon(s) midpoint retention times using that standard, the window stays the same. Also update the start and stop times used for the GRO range using the same standard. If RTs are not consistent, the cause must be investigated and corrective action taken.

C. Initial Calibration

1. The 5-point calibration (see Table I) is analyzed with gasoline concentrations ranging from approximately 27.5 to 1100 ppb (dependent on gasoline stock standard concentration). The surrogate concentration must also increase with increasing standard concentration.
2. Calibration is performed using the external standard method for FID detection.
 - a. A calibration factor (CF) is calculated for each calibration level. See calculation section of this procedure.
 - b. Area contributed by the surrogates is not included in the total gasoline area.

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3. The percent relative standard deviation (%RSD) of the calibration factor must be $\leq 20\%$ to assume linearity through the origin and use the average calibration factor (AVGCF) for quantitation. For OA-1, the correlation coefficient must be 0.995 or greater.
4. If the %RSD is $>20\%$, a linear or quadratic calibration may be used in place of the average calibration factor as long as the correlation coefficient is greater than 0.99. At least 6 calibration levels must be utilized for a quadratic fit.
5. An ICV standard is also analyzed and must meet the same criteria established by the method. This criteria is $\pm 15\%$ difference for all scans except scan #10599 where the criteria is $\pm 20\%$.
6. An MDL standard must be analyzed with every initial calibration. GRO must be visible for the standard to be acceptable
7. Instrument Blanks (IBLK) are analyzed to ensure the analytical system is free of contamination. Additional clean up blanks can be run as needed based on system performance.


D. Continuing Calibration Verification (CCV)

1. Prepare and analyze a CCV to ensure that the instrument is functioning correctly and that the calibration is valid.
2. The calibration curve is verified every 12 hours (or every ten field samples when run with PID in series, or if a client requires this frequency).

A field sample is defined as any client submitted sample, matrix spike, or matrix spike duplicate sample. Blanks, LCS, and batch MS/MSD are NOT considered field samples.

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3. The CCV standard criteria established by the method is $\pm 15\%$ difference for the calculated concentration versus the nominal concentration for all scans except Analysis #10599 where the criteria is $\pm 20\%$.
4. Samples must be bracketed by acceptable CCVs, otherwise samples must be reanalyzed.
5. If the bracketing CCV fails requirements with a positive trend and GRO was below the reporting limit in the samples, then no re-analysis is required.
6. If the recovery of the GRO concentration is outside of the acceptable range, the CCV is repeated with freshly made standards.
 - a. If the GRO concentration is within the acceptable range on the repeat, the standard is acceptable.
 - b. If the freshly made CCVs fails and the problem appears to be instrument related, proper maintenance must be performed on the instrument that corrects the problem.
 - (1) Having failed two previous CCVs, a series of two freshly made CCVs must now be analyzed and both must be within the acceptance criteria before continuing with sample analysis.
 - (2) The samples associated with the failed standards must be repeated after passing CCVs.
 - c. If the GRO concentration is still outside the acceptable range on the repeats, the system is recalibrated.
 - d. All data must have an in-specification CCVs preceding it to be considered valid. If one CCV fails, but the second one passes, the samples still need to be repeated under the passing CCV.

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Procedure:

A. Prior to analyzing samples utilizing the autosampler, make sure that the following is complete:

1. The autosampler is programmed and functioning properly.
2. Set the P&T and GC to the conditions specified under the Instrument Conditions section of this method. Program autosampler to start and end on the appropriate vials, then press "START."
3. If the system has not been calibrated, then calibrate the system (refer back to the calibration section).


B. Samples are analyzed by adding 2 mL of the sample's methanolic extract to reagent water and 20 µL of 1-component surrogate) in a 50-mL volumetric flask. Bring up to volume with reagent water. Pour into a 40-mL vial for sampling via the autosampler.

1. TFT surrogate is introduced to the sample during the methanol extraction (refer to Analyses #1150, 6170, 6130, and 6117).
2. If the prescreen of the extract indicates high levels of organics, a dilution must be made. When preparing dilutions, a constant amount of methanol (i.e., 1:25) must be maintained.

Example: If a sample is to be analyzed at a dilution factor (df) of 250, 200 µL of the sample's extract and 1.8 mL of methanol are injected into reagent water in the 50-mL volumetric flask with 20 µL of 1-Component Surrogate.

C. Prepare a batch sequence. A batch can consist of up to 20 field samples and must contain a method blank, a laboratory control spike, and either a matrix spike/matrix spike duplicate when sufficient sample is available, or a laboratory control spike duplicate.

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- D. Samples must be bracketed by acceptable check standards, otherwise samples must be reanalyzed.
- E. The total peak area (excluding the surrogate area) between the defined start and stop of the GRO range is used to calculate the concentration of GRO.
- F. If the concentration of the analyte recovered in the sample exceeds the concentration of the highest level of the calibration, the sample must be repeated at a higher dilution.
- G. The analyst must determine if carryover is present after an analysis of a sample containing high levels of analytes. It may be necessary to analyze a instrument blank to ascertain that all analytes are below the method detection limit. If they are not, the instrument blank is repeated until the system is acceptable. Refer to 1-P-QM-PRO-9015470, for more instruction on this.

Calculations:

The peak area summation of the entire gasoline pattern, excluding any surrogates and retention time markers, calculated with the dilution factor and the calibration factor will establish the concentration of GRO in the sample.


1. Calculation of GRO in a sample:

$$Conc (ppm) = \frac{Ar}{CF} \times \frac{Vt}{Wt} \times DF$$

Where:

- Ar = Area for the GRO in the sample
- CF = Calibration factor
- DF = Dilution factor (default of 25)
- Wt = Weight of sample in extraction (default 10 g)
- Vt = Total volume of MeOH during extraction (default 10 mL)

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2. Calibration Factor (CF)

$$CF = \frac{Total\ Area}{Concentration\ (\mu g / L)}$$

3. The RPD is calculated as follows:

$$RPD = \frac{MS\ Concentration - MSD\ Concentration}{\left[\frac{MS\ Concentration + MSD\ Concentration}{2} \right]} \times 100$$


4. Refer to 1-P-QM-PRO-9015491, for further details on calculations.

Statistical Information/Method Performance:


Generate method detection limits (MDLs) and limits of quantitation (LOQs) according to 1-P-QM-QMA-9017309. Perform an MDL study on each instrument used for the analysis. Determine the MDL by taking seven spiked replicates through the entire extraction and analysis procedure. Compare and pool results to determine the final reporting MDL. The department supervisor maintains annual study data. The department supervisor requests that a QA Specialist update to the LIMS as needed. Update the department database via a download from the LIMS.

Quality Assurance/Quality Control:

- A. Each batch (up to 20 samples) must contain a method blank, LCS, and either an unspiked background sample (BKG)/MS/MSD or an LCS/LCSD.
 1. Method Blank – The method blank is analyzed once per 24 hours and is examined for possible contamination. All compounds must be less than the reporting limit of the project. If the blank values exceed these values, corrective action must be taken and the method blank reanalyzed until the criteria are met.

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- a. Prepare by adding 10 grams of clean sand into a 40-mL vial and extracting it with 10 mL of TFT for Methanol Extraction.
 - b. Then take 2 mL of this extract with 20 µL of 1-component surrogate and add to reagent water to a final volume of 50 mL.
 - c. The solution is then poured into 40-mL vials with screw-top Teflon-lined septa for use in the autosampler.
2. Surrogates – α,α,α -trifluorotoluene is the reported surrogate. Surrogate recovery is acceptable if the percent recovery is within the statistically derived windows. Lower recoveries are expected in diluted samples. If the surrogate recovery falls outside the acceptance window, re-extract the sample (if possible) and/or repeat the analysis. If the repeat is out of specification, report the original results and comment about the effect of the matrix on the surrogate. If the surrogate is within specifications on the repeat analysis, report the results from the repeat analysis.
3. MS and MSD—For each set of 20 field samples, extract one in triplicate, spiking the duplicate and triplicate with 55 µL of gasoline spike intermediate into sample extract. These are then diluted and analyzed as a normal sample. Approximate concentration of this standard is 11 mg/kg.
- a. Results of the MS/MSD are compared to the QC limits that are statistically derived.
 - b. The maximum RPD (relative percent difference) allowed between the MS and MSD is 30%.
 - c. If any of the MS/MSD criteria fails, then a LCS is used to verify that the system is within specifications

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4. LCS/ LCSD is prepared by adding 10 grams of clean sand to a 40-mL vial and adding 10 mL of TFT for methanol extraction. Spike the extraction with 55 µL of gasoline spike intermediate. Then take 2 mL of this extract with 20 µL of 1-Component Surrogate and add reagent water to a final volume of 50 mL. Approximate concentration of this standard is 440 µg/kg.

- a. If the LCS does not meet criteria, corrective action must be taken, including repeating the batch.

Corrective action may include instrument maintenance, re-analysis of samples, or data qualification.

- b. If sufficient sample is not available to perform a MS/MSD, then a LCS/LCSD are analyzed and must meet QC criteria.


B. QC limits for surrogates, LCS/LCSD, and MS/MSD are established through statistical analysis of historical data. The limits are evaluated every 6 months and updated as needed. The limits are maintained in the LIMS for the relevant analysis numbers.

Table I
Calibration Standards

Cal Level	Amt. Gasoline Std (µL)	Amt. TFT Calibration Std (µL)	Gas Conc. (µg/kg)*	TFT Conc. (µg/kg)
1	25 (A)	5	27.5	7.5
2	100 (A)	10	110	15
3	20 (B)	20	220	30
4	50 (B)	30	550	45
5	100 (B)	40	1110	60


Calibration Standards prepared in 50 mL volumetric flasks.

* Based upon 5500-ppm gasoline stock and a 15,000-ppm TFT stock.

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Eurofins Document Reference	1-P-QM-WI -9015121	Revision	4
Effective Date	Feb 28, 2013	Status	Effective
Historical/Local Document Number	Analysis DOD - 11012, 10465, 10466, 10470, 10471, 11912		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		


Prepared by	Heidi Roberts
Reviewed and Approved by	Richard Karam;Review;Thursday, February 28, 2013 11:12:40 AM EST Kathryn Brungard;Approval;Thursday, February 28, 2013 11:37:24 AM EST

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Revision Log:

Revision: 4		Effective Date:	This version
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Historical/Local Document Number	New Parallax scan	Added prep 11912	
Throughout Document	Reflect re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers	
Basic Principles	Correction of an omission Enhancement	Added base portion. Clarified pH adjustment to <2	
Reagents and Standards 2.	Reflects current reagents	Added 10N Sodium Hydroxide	
Procedure G.	Correction of an omission	Added discussion on the base portion.	
Procedure O.	Reflects current practices	Clarified that both acid & base portions are added to the same KD for concentration.	
Procedure P.	Correction of an omission of information	Clarified acid portion	
Procedure Q-V	Enhancement	Re-lettered steps	

Revision: 03		Effective Date:	Nov 14, 2012
Section	Justification	Changes	
Revision Log	Formatting requirement per LOM-SOP-LAB-201	Removed revision logs up to the previous version	
Header	New Parallax numbers Enhancement	Added prep numbers 10465, 10466. Removed "SIM" from SOP number.	
Basic Principles	Reflect current procedure	Added Statement about procedural changes to use a reduced sample aliquot added.	
Reagents and Standards	Additional scan that are covered by this procedure	Added analysis numbers 0039, 10010, 10262, 10137 & 11305.	
Procedure F.1 & F.2	Enhancement	Clarified spiking requirements.	
Procedure F.5.	Additional scan that are covered by this procedure	Added analysis numbers 0039, 10010, 10262, 10137 & 11305.	
Quality Assurance/Quality Control	Clarification	Removed unnecessary wording.	

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Reference:

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 3510C, December 1996.
2. *Chemical Hygiene Plan*, Eurofins Lancaster Laboratories, Inc., current version.

Cross Reference:

Document	Document Title
Analysis #6570	The Determination of Semivolatiles by Large Volume Injection (LVI) Gas Chromatography/Mass Spectrometry (GC/MS)
Analysis #8357, 2858, 0038, 0039, 10010, 10137, 10138, 10722, 10725	The Determination of Semivolatiles by Selected Ion Monitoring (SIM) Gas Chromatography/Mass Spectrometry (GC/MS)
Analysis #10242, 10262, 11305, 11597	Determination of Parent and Alkyl Substituted Polynuclear Aromatic Hydrocarbons (PAHs), Alkanes and Geochemical Biomarkers by Gas Chromatography/Mass Spectrometry (GC/MS-SIM)
1-P-QM-PRO-9015452	Semivolatile Spiking and Calibration Standards
1-P-QM-PRO-9015475	Glassware Cleaning for Organic Extractions
1-P-QM-PRO-9015490	Organic Extraction Standards Storage and Handling


Scope:

This method is for the extraction of semivolatile organic compounds at low ppb to low ppm levels in water and wastewater matrices that are not prone to emulsions. High levels of organic compounds and/or extreme alkalinity or acidity in the sample often interfere with normal detection limits.

Basic Principles:

A portion of sample is placed into a separatory funnel. Surrogate standards are added to each sample to monitor recovery. The pH of the sample is adjusted to >11 and the sample is serially extracted with methylene chloride. The pH of the sample is then adjusted to <2 and the sample is extracted with methylene chloride. The solvent fractions are combined, and the extract is dried and concentrated.

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Procedural changes to use a reduced sample aliquot while maintaining the default reporting limits are permitted as long as the reagent aliquots are reduced proportionally and a quad study is performed and on file.

Reference Modifications:


Surrogate and matrix spiking solutions are not added before the transfer to the separatory funnel for several reasons:

1. Samples must be poured from the amber bottles to determine the matrix and volume of sample to use for each extraction.
2. Many sample bottles have no headspace and there is no room to add surrogate to the sample in the bottle.
3. Due to the volume of samples extracted, a separate graduated cylinder for each sample is unrealistic.
4. To maintain consistency with all extractions, no samples are spiked in the bottle or graduated cylinders.

Definitions:

1. LCS – Laboratory Control Sample
2. LCSD – Laboratory Control Sample Duplicate
3. MS – Matrix Spike
4. MSD – Matrix Spike Duplicate

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Interferences:

Impurities in solvents, reagents, glassware, or other hardware used in sample processing lead to interferences with the method. All glassware must be rinsed with solvent before use. A method blank is performed with each batch of sample to demonstrate that the extraction system is free of contaminants.

Safety Precautions and Waste Handling:

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined. Each chemical compound must be treated as a potential health hazard. Exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as fume hoods, lab coats, safety glasses, and gloves.


Extracts are concentrated on a steam bath; caution must be exercised while working around this apparatus.

All solvent waste generated from this preparation must be collected for recycling (if applicable) or disposed of in the designated containers. These are transferred to the lab-wide disposal facility. Any solid waste material (disposable pipettes, broken glassware, pH paper) is disposed of in the normal solid waste collection containers.

Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the technicians training records.

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Initially, each technician performing the extraction must work with an experienced employee for a period of time until they can independently perform the extraction. Proficiency is measured through a documented Initial Demonstration of Capability (IDOC).

The IDOC and the DOC consists of four laboratory control samples (or alternatively, one blind sample for the DOC) that is carried through all steps of the extraction and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation.


Sample Collection, Preservation and Handling:

Samples are collected in glass bottles with PTFE-lined lids and stored at $4^{\circ} \pm 2^{\circ}\text{C}$ prior to extraction. Samples must be extracted within 7 days of sample collection. The extract is stored in an amber autosampler vial in the freezer (-10 to -15°C) for up to 40 days prior to analysis.

Apparatus and Equipment:

1. 2-L separatory funnel for extracting organic components from an aqueous matrix
2. Kuderna-Danish (K-D) assembly with appropriate ampule for extracting the solvent used during the extraction
3. Water bath – VWR/LLI Model #1127 or equivalent
4. Graduated cylinders – Class A, assorted sizes
5. Pipettes – Class A, assorted sizes
6. Pipettes – Disposable
7. Solvent pumps – Brinkman, adjustable

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8. Balance – Capable of weighing to 0.01 g
9. Automatic shaker – Capable of holding 2 L separatory funnels
10. Centrifuge – Beckman GS-6 or equivalent
11. Sodium sulfate columns
12. Micro-snyder columns
13. Wash bottles – Teflon
14. Amber autosampler vials
15. Teflon boiling chips

Reagents and Standards:

1. Methylene chloride (CH_2Cl_2) – Pesticide grade or equivalent. Store at room temperature for up to one year.
2. 10N Sodium hydroxide (NaOH) – Lab chem or equivalent. Store at room temperature for up to one year.
3. Sulfuric acid – ACS grade or equivalent, concentrated. Store at room temperature for up to 1 year.
4. Sodium sulfate (Na_2SO_4) – Granular anhydrous reagent grade or equivalent. Bake at 400°C for a minimum of 4 hours in a shallow pan prior to use to remove organic contaminants. After baking, store in a glass jar at room temperature for up to 1 year.
5. All QC standards added during extraction process are prepared by Organic Extractions using instructions generated by the standards database. Detailed instructions can be found in the corresponding analytical analyses 0039, 8357, 6570, 10010, 10262, 10137, 11305 and 11913.

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Preparation of Glassware:

See 1-P-QM-PRO-9015475 (SOP-OE-001).


Calibration:

Not applicable to this procedure.

Procedure:

- A. If the sample bottle is a 1-L bottle and is not a quality control sample (BG, MS, MSD), mark the water level on the outside of the sample bottle in order to later determine the sample volume.
 1. Shake the bottle vigorously.
 2. Pour the sample into a 2-L separatory funnel.
 3. Record any comments about the sample on the extraction sheet.
- B. If the sample bottle is larger than 1-L or the sample is a quality control sample, exactly 1 L of sample is extracted.
 1. Shake the sample bottle vigorously.
 2. Use a clean graduated cylinder to measure the necessary volume of sample and pour it into a 2-L separatory funnel.
 3. Record the sample volume and any comments about the sample on the extraction log.
 4. Use a wash bottle to rinse the graduated cylinder with methylene chloride and add the rinseate to the separatory funnel.

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- C. **NOTE:** Reduced volume of sample is only used with prior approval of the client or if the matrix of the sample does not allow the extraction to proceed using full volume. The sample must then be diluted to 1 L.
- D. The method blank, LCS, and LCSD (if applicable) are prepared using 1 L of non-deionized reagent water (tap water) measured into the separatory funnel.
- E. The background, MS, and MSD are prepared on three separate aliquots of a field sample.
- F. Surrogates and Spiking Solutions


1. Surrogates

- a. Analysis 0039, 8357, 10262, 10137, 11305, & 11913 - Add 1.0 mL BNA surrogate to all samples, blanks, and spikes.
- b. Analysis 6570 – Add 1.0 mL of PAH LVI SIM surrogate to all samples, blanks, and spikes.
- c. Analysis 10010 – Add 1.0 mL of client specified SIM Surrogate to all samples.
- d. Note: Be certain the standard drips directly into the sample without touching the glass side of the separatory funnel to avoid poor recoveries.

2. Spiking solutions


- a. Analysis 0039, 8357, 10137 and 11913 - Add 1.0 mL of SIM spiking solution to the LCS, LCSD if applicable, MS, and MSD.
- b. Analysis 6570 – Add 1.0 mL of PAH LIV SIM spiking solution to the LCS, LCSD if applicable, MS, and MSD.

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- c. Analysis 10010 – Add 1.0mL of SIM spiking solution to the LCS, LCSD if applicable MS, and MSD. Spike a separate LCS, LCSD with 1.0 mL of client specified SIM spiking solution
 - d. Analysis 10262 – Add 1.0mL of Alkyl PAH spike to the LCS, LCSD, if applicable MS, and MSD.
 - e. Analysis 11305 – Add 1.0 mL of DPnB spiking solution to LCS, LCSD if applicable, MS and MSD.
 - f. If the sample requires additional semivolatile compounds, 1.0 mL of 1 ppm spike of this compound is added at this time.
 - g. See analysis 0039, 8357, 6570, 10010, 10262, 10137, 11305 & 11913 for spike details.
3. See 1-P-QM-PRO-9015452 (SOP-EX-001) for preparation of spikes and standards.
 4. See 1-P-QM-PRO-9015490 (SOP-OE-017) for storage and handling of spikes.
- G. Add 10N sodium hydroxide to each sample, Method Blank, LCS/LCSD to adjust the pH to >11. (Note: If samples are entered for 8357, 6570, 10262, 11305, or 11913 proceed to Procedure P.)
- H. Determine the volume of sample used for extraction:
1. If the original sample bottle is empty:
 - a. Use a solvent pump to measure 60 mL of methylene chloride and rinse the sample bottle.
 - b. Transfer the solvent to the separatory funnel.

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- c. Fill the bottle to the marked level with non-deionized reagent water (tap water) and pour into a graduated cylinder to determine the initial volume.
2. Alternatively, tare the empty sample bottle on the balance.
 - a. Fill the bottle with non-deionized reagent water (tap water) to the marked line and place the bottle back onto the balance.
 - b. Round the weight to a whole number. This is the volume of sample used for extraction.
 3. If the sample container is not empty, use a solvent pump to measure 60 mL of methylene chloride and add the solvent directly to the separatory funnel.
- I. Cap the funnel, invert, and vent immediately.
 - J. Handshake and vent frequently until the pressure is stable.
 - K. Place the sample on the automatic shaker and shake at the designated speed for 2 minutes with the stopcocks closed.
- NOTE:** Shaker speeds vary greatly between instruments; the proper setting is marked on each.
- L. Place the separatory funnel on the rack and allow it to sit undisturbed for 10 minutes.
- This allows the organic and aqueous layers to separate. If an emulsion forms and is >1/3 of the volume of the solvent layer, mechanical techniques such as stirring and centrifugation must be employed to complete the separation.
- M. Drain the solvent layer into a metal beaker and pour it through approximately 10 cm of sodium sulfate into a K-D apparatus containing a Teflon-boiling chip.

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- N. Use a solvent pump to add 60 mL of methylene chloride to the separatory funnel and repeat Procedure steps I through M, venting only as necessary.
- O. Again, use a solvent pump to add 60 mL of methylene chloride to the separatory funnel and repeat Procedure steps I through M, venting only as necessary. The acid extract is also added to this KD.
- P. Add sulfuric acid with a disposable pipette to adjust the sample pH to <2. Using three 60-mL aliquots of methylene chloride, serially extract the sample as described in Procedure I. through M.
1. Rinse metal beaker with approximately 20 mL of methylene chloride.
 2. Pour the solvent into the sodium sulfate column.
- Q. Use a wash bottle to rinse the sodium sulfate column with approximately 20 mL of methylene chloride.
- R. Attach a 3-ball Snyder column to the K-D, wet with solvent, and concentrate the extract to approximately 1-mL on a steam bath at 80° to 90°C.
- This steam bath temperature ensures concentration in a reasonable length of time.
- S. Allow the sample to cool for 10 minutes.
- T. Microsnyder the sample to slightly below 1 mL.
- U. Bring the combined extract to 1.0 mL using methylene chloride.
- V. Determine the final volume by placing the extract into an amber autosampler vial and comparing the level in the vial to a reference vial containing the exact targeted final volume. Add methylene chloride to the extract with a disposable pipette until exactly the same level is in both vials.

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	Lancaster Laboratories	Document Title: Separatory Funnel Extraction Procedure for the Determination of Base-Neutrals and Acid Extractables by SIM in a Wastewater Matrix	Eurofins Document Reference: 1-P-QM-WI -9015121
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If too much solvent is added to the sample vial, remove the extract from the vial and concentrate it by microsyndering to slightly less than the targeted final volume and rebottle.

1. Cap securely and store in the freezer.
2. Record the final volume in the extraction log.

Calculations:

See analysis method.

Statistical Information/Method Performance:

See analysis method.

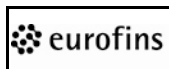
Quality Assurance/Quality Control:

A batch is defined as the samples to be extracted on any given day but not to exceed 20 field samples. If more than 20 samples are prepared in a day, an additional batch must be prepared.

For each batch of samples extracted, a blank, an LCS, an MS, and MSD must be extracted. If insufficient volume of sample is available for MS/MSD, then an LCSD must be prepared instead. Also, if the batch contains only field or equipment blank samples, the LCS/LCSD QC pairing must be used.

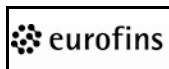
If any client, state, or agency has more stringent QC or batch requirements, these must be followed instead.

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Eurofins Document Reference	1-P-QM-WI -9015120	Revision	4
Effective Date	Sep 29, 2014	Status	Effective
Historical/Local Document Number	Analysis DOD - 10942, 11509, 11210		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

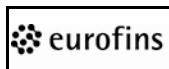
Prepared by	Heidi Roberts
Reviewed and Approved by	Susan Goshert;Review;Friday, September 19, 2014 4:35:24 PM EDT Richard Karam;Review;Friday, September 26, 2014 10:20:53 AM EDT Kathryn Brungard;Approval;Friday, September 26, 2014 1:47:13 PM EDT

 Lancaster Laboratories Environmental	Document Title: Microwave Extraction Method 3546 for DRO and Saturated Hydrocarbons in a Solid Matrix	Eurofins Document Reference: 1-P-QM-WI -9015120
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Revision Log:

Revision: 4		Effective Date:	This version
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Throughout Document	Reflect re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers	
Document Title	Enhancement	Include method	
Historical/Local Document Number	LIMS scan that relates to this procedure	Added prep number 11210	
Cross Reference	Referenced within the procedure	Added Analysis #2176 and #11681	
Sample Collection, Preservation, and Handling	Reflects current industry standards	Updated refrigeration conditions from 4° ± 2°C.	
Reagents and Standards 2.	Clarification	Re-worded the baking time of sodium sulfate to read as “a minimum of 4 hours”	
Procedure 2.	Ensures that weights are not targeted	Range for weigh out of samples has been broadened.	
Procedure 11	Enhancement	Added information on temperature of microwave and documentation	
Procedure 25.	Enhancement	Added 10 g column cleanup step	
Procedure 26.	Enhancement	Added quick silica gel cleanup step	

Revision: 03		Effective Date:	Feb 16, 2011
Section	Justification	Changes	
Revision Log	Formatting requirements per LOM-SOP-LAB-201	Removed revision logs up to the previous version.	
Entire document	No longer applicable	Removed all reference to waste dilution, preparation of oils, oil matrix, and made a separate procedure (Analysis #11657)	

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Reference:

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 3546, February 2007.
2. MARS Operation Manual, Revision 2, February 2006.
3. *Chemical Hygiene Plan*, current version.

Cross Reference:

Document	Document Title
Analysis #2176	Quick Silica Gel Cleanup for Hydrocarbons by GC in Soil and Water Matrices
Analysis #2487	Food and Tissue Preparation
Analysis #1104, 2222, 5868, 6901, 6902, 8270, 8345, 10941, 12831	TPH-DRO by 8015B in Solids using GC-FID (Diesel Range Organics)
Analysis #11507, 11554	Total Saturated Hydrocarbons by Method 8015C in Waters and Solids using GC/FID
Analysis #11599, 11600	Alumina Column Cleanup of Solids
Analysis #11681	10g Silica Gel Cleanup for Hydrocarbons by GC in Soil and Water Matrices
1-P-QM-PRO-9015475	Glassware Cleaning for Organic Extractions
1-P-QM-PRO-9015490	Organic Extraction Standards Storage and Handling

Scope:

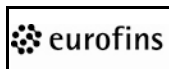
This document describes the proper extraction of solid samples using microwave technology by SW-846 Method 3546.

Basic Principles:

A portion of solid sample to be analyzed is placed in an extraction vessel. Surrogate standards are added to each sample to monitor recovery. The vessel is then loaded into the instrument and extracted. The organic compounds present in the soil dissolve in the solvent, which is then removed. The sample is then concentrated and bottled.

For some analyses, the extract may get an alumina column cleanup or a silica gel cleanup.

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Reference Modifications:

A stainless-steel beaker is used instead of a centrifuge bottle in the Procedure Step 2. This modification has been made because the centrifuge bottle has a higher chance of cross contaminating samples.

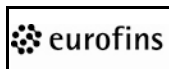
Definitions:

1. Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) – A sample of known composition analyzed with each batch of samples to demonstrate laboratory accuracy. The samples either naturally contain the analytes of interest or are clean samples fortified with known concentrations. Used to demonstrate laboratory accuracy. A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test.
2. Matrix spike/matrix spike duplicate (MS/MSD) – A sample created by fortifying a second aliquot of a water or soil sample with some or all of the analytes of interest. The concentration added is known and compared to the amount recovered to determine percent recovery. Matrix spike recoveries provide information about the accuracy of the method in light of the matrix analyzed. A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test.
3. Surrogates – Organic compounds which are similar to the analytes of interest but are not naturally occurring in environmental samples. Surrogates are spiked into all standards and every field and QC sample prior to extraction and analysis to provide information regarding the effects of the sample matrix.

Interferences:

Method interferences may be caused by impurities in solvents, reagents, glassware, or other hardware used in sample processing. All glassware is rinsed with solvent before use and a method blank is performed with each batch of sample to demonstrate that the extraction system is free of contaminants.

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Safety Precautions and Waste Handling:

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined; however, each chemical compound must be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as fume hoods, lab coats, safety glasses, and gloves.

Since the extracts are concentrated on a steam bath, caution must be exercised while working around this apparatus.

All solvent waste generated from this preparation must be collected for recycling (if applicable) or must be disposed of in the designated containers. These are then to be transferred to the lab-wide disposal facility.

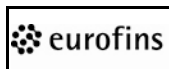
Any solid waste material (disposable pipettes, broken glassware, pH paper) must be disposed of in the normal solid waste collection containers.

Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each technician performing these techniques must work with an experienced technician for a period of time until they can independently perform the procedure. Proficiency is measured through an Initial Demonstration of Capability (IDOC).

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The IDOC and the DOC consists of four laboratory control spikes (or alternatively, one blind sample for the DOC) that are carried through all steps of the procedure and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation.

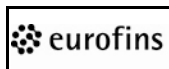
Sample Collection, Preservation, and Handling:

Samples are collected in wide-mouth glass jars with PTFE-lined lids and stored under refrigeration at 0° to 6° C, not frozen, prior to extraction. Samples must be extracted within 14 days of collection except samples from New Jersey, which must be extracted within 7 days. Sample extracts are stored frozen until analysis.

Apparatus and Equipment:

1. MARS Xpress – CEM Corp. or equivalent
2. Kuderna-Danish (K-D) assembly with appropriate ampule for concentrating the solvent used during concentration
3. Steam bath – VWR/LLI Model #1127 or equivalent
4. N-Evap with nitrogen supply
5. Beakers – Stainless steel, assorted sizes
6. Pipettes – Class A, assorted sizes
7. Graduated cylinders – Class A, assorted sizes
8. Pipettes – Disposable
9. Balance – Capable of weighing to 0.01 g
10. Teflon™ – wash bottles

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11. Vials – Assorted sizes
12. Teflon™ – boiling chips
13. Forceps
14. Scoop
15. TurboVap II concentration workstation w/appropriate concentration tubes – Zymark or equivalent
16. Funnels – stainless steel or Teflon™
17. Extraction vessels
18. Frits – Various
19. Sodium Sulfate Columns

Reagents and Standards:

1. Methylene Chloride (CH₂Cl₂) – Fisher Optima grade or equivalent, stored in a FisherPak at room temperature for up to one year after receipt.
2. Sodium Sulfate (Na₂SO₄) – Reagent grade or equivalent. Baked at 400°C for a minimum of four hours in a shallow pan to remove contaminants. Store in a glass jar for up to 1 year after baking at room temperature.

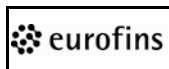
Calibration:

Not applicable to this procedure.

Preparation of Glassware:

See 1-P-QM-PRO-9015475 procedure.

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Procedure:

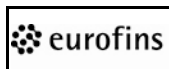
1. All tissues must be processed by Analysis #2487 prior to extraction.
2. Weigh out 30 - 30.5 g of sample into a stainless steel beaker.
 - a. If the volume of sample available is limited or the sample has a very strong fuel odor, use 10 g of sample.
 - b. Alternate weights may be required to meet certain limits. If over 30 g is to be used, divide the sample among multiple vessels and combine the extracts.
 - c. The background, MS, MSD and/or duplicate (Dup) are performed on three separate aliquots of a field sample.
3. Add 5 g of sodium sulfate to each sample and mix. If the sample has a high water content or is a clay-like soil, then add an additional 10 g of sodium sulfate. Mix the sodium sulfate and sample until a free-flowing consistency is reached.
4. The Blank, LCS, and LCSD (if applicable) are prepared by filling a Teflon extraction vessel with 35 g of sodium sulfate.

Record 30 g on the extraction log.

NOTE: In the extraction, 5 g of Na₂SO₄ is added to 30 g of sample. Therefore 35 g of Na₂SO₄ is used in the QC to keep the volumes equivalent.

5. Place each sample into its clearly marked corresponding extraction vessel. A funnel is be used to prevent spillage and loss of sample.

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6. Using volumetric pipettes, add surrogate standards and spiking solutions. See Analysis #1104, 2222, 5868, 6901, 6902, 8270, 8345, 10941, 12831 or Analysis #11507, 11554 for further spike details.

a. Surrogates

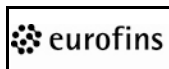
- (1) Analysis 11507 - 1.0 mL of Client specified surrogate is added to all samples, blanks, and spikes.
- (2) For all other analyses - 1.0 mL of TPH surrogate is added to all samples, blanks, and spikes.

b. Spiking solutions

- (1) Analysis 11507 – 1.0 mL of Client specified spike is added to the LCS, LCDS if applicable, and MS samples.
- (2) For all other analyses – 1.0 mL TPH spiking solution is added to the LCS, LCSD if applicable, and MS samples.

NOTE: See 1-P-QM-PRO-9015490 (SOP-OE-017) for storage and handling of spikes.

7. Add 30 mL of Methylene chloride to each vessel.
8. Cap each vessel according to manufacturer's guidelines.
9. Invert each vessel to ensure mixing of sample and solvent.
10. Place the vessels into the carousel. When all samples are loaded, place the carousel into the microwave.
11. Run Program “LL Soils”. See Table 1 for Instrument conditions. Verify that the run reached 100°C and document on the batchlog.

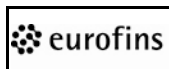
 <div>Lancaster Laboratories Environmental</div>	<p>Document Title: Microwave Extraction Method 3546 for DRO and Saturated Hydrocarbons in a Solid Matrix</p>	<p>Eurofins Document Reference: 1-P-QM-WI -9015120</p>
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12. Uncap the cooled vessel.
13. Pour the extract and sample into a column filled with approximately 10cm of sodium sulfate on top of a Kuderna-Danish (K-D) assembly containing a Teflon™-boiling chip.
14. Rinse the vessel with 10-20 mL of Methylene Chloride from a wash bottle.
15. Place a 3-Ball Snyder column on the K-D set-up,
16. Wet the column with Methylene Chloride
17. Concentrate over a steam bath set at 80° to 90°C until the approximate volume is 3 mL.

NOTE: This steam bath temperature ensures concentration in a reasonable length of time.

18. Allow to cool for 10 minutes.
 - a. For analysis 11507
 - (1) Microsnyder the sample to just under 1mL.
 - (2) The samples are cleaned up using Analysis #11599, 11600.
 - b. For all other analyses, proceed to Procedure Step 19.
19. N-Evap the sample, if necessary, to just below 5 mL.
20. Use a disposable pipette to transfer the extract to a 5-mL volumetric flask.
21. Rinse the ampule with a small quantity of methylene chloride and use this rinseate to bring the final volume of the extract to 5 mL with methylene chloride.

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22. Record the final volume in the extraction log.
23. Use a disposable pipette to bottle an aliquot of the extract in a clear, labeled, crimp-top auto sampler vial. Place the remaining extract into a clear, labeled screw-cap vial.
24. If the extract has a strong petroleum odor, prepare a DF10 of the extract. Bottle this extract as in Procedure Step 23 above. Be certain these vials are labeled DF10.
25. If the sample is scheduled for 10 g column cleanup, place extract in the GPC freezer and refer to Analysis #11681.
26. If the sample is scheduled for quick Silica Gel, refer to Analysis #2176

Calculations:

See analysis method.

Statistical Information/Method Performance:

See analysis method.

Quality Assurance/Quality Control:

Each extraction batch of solids (up to 20 samples) must contain a method blank, an LCS, an MS, and a Dup. If sufficient sample is not available to extract the MS and DUP, an LCSD must be extracted instead.

A batch is defined as the samples to be extracted on any given day but not to exceed 20 field samples. If more than 20 samples are prepared in a day, an additional batch must be prepared. If any client, agency, or state has more stringent QC or batch requirements, these must be followed instead. See the analysis method for specifics on compounds in the spiking solution.

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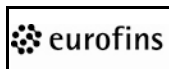
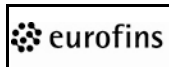
 <div>Lancaster Laboratories Environmental</div>	Document Title: Microwave Extraction Method 3546 for DRO and Saturated Hydrocarbons in a Solid Matrix	Eurofins Document Reference: 1-P-QM-WI -9015120
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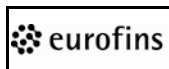
Table I

Power: 1600W
Ramp Temperature: 100°C
Ramp Time: 30 minutes
Hold Time: 10 minutes
Cool Down Time: 20 minutes

 Lancaster Laboratories Environmental	Document Title: Client Specific - Determination of Inorganic Anions by Ion Chromatography (Department of Defense)	Eurofins Document Reference: 1-P-QM-WI -9015115
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Eurofins Document Reference	1-P-QM-WI -9015115	Revision	4
Effective Date	Sep 8, 2014	Status	Effective
Historical/Local Document Number	Analysis DOD - 10697, 10698, 10699, 10700, 10701, 10702, 10703		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

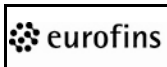
Prepared by	Nicole Veety
Reviewed and Approved by	Erik Frederiksen;Review;Monday, September 8, 2014 1:05:42 PM EDT Barbara Reedy;Approval;Monday, September 8, 2014 1:33:34 PM EDT

 Lancaster Laboratories Environmental	Document Title: Client Specific - Determination of Inorganic Anions by Ion Chromatography (Department of Defense)	Eurofins Document Reference: 1-P-QM-WI -9015115
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Revision Log:

Revision: 4		Effective Date:	This version
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Throughout Document	Reflects re-identification of documents in EtQ Method Update	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers Updated temperature to 0° to 6°C not frozen.	
Cross Reference	Method Update	Consistency throughout SOP's	
Table I and Table II	Deleted Instrumentation	Deleted the Dionex 320 and 500 systems no longer in use.	
References	Method Update	Added QSM 5.0.	

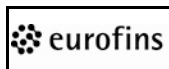
Revision: 03		Effective Date:	Oct 17, 2012
Section	Justification	Changes	
Revision Log	Formatting requirement per LOM-SOP-LAB-201	Removed revision logs up to the previous version	
References	Reflect current procedure	Deleted obsolete instruments Added new instrumentation	
Cross Reference	SOP-IC-010 was made no longer in use	Deleted SOP-IC-010	
Quality Control Standards	Reflect current procedure	Deleted #5 Independent QC Standard is no longer needed for calibration and renumbered section accordingly	
Procedure 9	Reflect current procedure	Deleted reference to Ind. QC Std.	
Quality Assurance/Quality Control	Reflect current procedure	Deleted #4 Ind. QC Std. requirements and renumbered section accordingly	

 Lancaster Laboratories Environmental	Document Title: Client Specific - Determination of Inorganic Anions by Ion Chromatography (Department of Defense)	Eurofins Document Reference: 1-P-QM-WI -9015115
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References:

1. Method 300.0, *EPA Methods for Chemical Analysis of Water and Wastes*, EPA 600, Revision 2.1, 1993.
2. Method 4110, *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, 1998, pp. 4-2 to 4-6.
3. Department of Defense *Quality Systems Manual for Environmental Laboratories*, Version 5.0, July 2013.
4. ICS-1100, *Chromatography System Operator's Manual*, Dionex Corporation, Document No. 065289, Revision 01, March 2009.
5. ICS-1000, *Chromatography System Operator's Manual*, Dionex Corporation, Document No.031879, Revision 02, September 2005.
6. Chromeleon®, *Chromatography Management System*, Tutorial and User Manual 6.70, Dionex Corporation, April 2005.
7. *Installation Instructions and Troubleshooting Guide for the Ionpac AG14 Guard Column and AS14 Analytical Column*, Dionex Corporation, Document No. 031199, Revision 04, December 10, 1998.
8. *Installation Instructions and Troubleshooting Guide for the Anion Self-Regenerating Suppressor (ASRS-ULTRA)*, Dionex Corporation, Revision 04, Document No. 031367, April 8, 1999.
9. *Chemical Hygiene Plan*, current version.

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 Lancaster Laboratories Environmental	Document Title: Client Specific - Determination of Inorganic Anions by Ion Chromatography (Department of Defense)	Eurofins Document Reference: 1-P-QM-WI -9015115
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Cross Reference:

Document	Document Title
1-P-QM-PRO-9015459	Quality Control for Auto-Analyzer Analyses Performed in Instrumental Water Quality
1-P-QM-QMA-9017309	Determining Method Detection Limits and Limits of Quantitation
1-P-QM-QMA-9017313	Establishing Control Limits
1-P-QM-QMA-9017328	Reagents and Standards

Scope:

This is a client-specific document and is NOT available for general laboratory use.

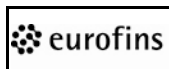
This method covers the determination of the following inorganic anions in reagent water, drinking water, surface water, wastewater, and groundwater using an ion chromatography system: bromide, chloride, fluoride, nitrate-N, nitrite-N, orthophosphate, and sulfate. The limits of quantitation and method detection limits are found in the analysis information file.

For EW samples: values of 10.50 mg/L or > for NO₃, 1.0 mg/L or > for NO₂, and 4.0 mg/L or > for fluoride are MCL violations and must be reported to the client within 1 hour of analysis. These must also be reported to the PA DEP within 24 hours of analysis.

Basic Principles:

A small volume of sample is introduced into an ion chromatograph. The anions of interest are separated and measured, using a system comprised of a guard column, separator column, suppressor, and conductivity detector. Separations are due to differences in the equilibrium distribution of sample components between the mobile phase (eluent) and stationary phase (column exchange resin). Retention times for various anions depend on several factors such as ionic charge, ionic size, pH, resin type, eluent concentration, and flow rate.

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Interferences:

Interferences occur when substances with retention times that are similar to and overlap those of the anion of interest are present. Often, large amounts of an anion interfere with the peak resolution of an adjacent anion. Sample dilution is used to solve most interference problems.

Potential sources of interference which lead to false readings or elevated baselines are contaminated reagents, glassware, or other sample-processing apparatus. Samples containing particulate matter >0.45 microns require filtration to prevent damage to instrument columns and flow systems. If any samples on a batch are filtered, the corresponding PBW and LCSW must also be filtered.

Known coelution is caused by carbonate and other small organic anions such as acetate and formate. At certain fluoride concentrations or in certain sample matrices, this interference is not significant. It is the analyst's responsibility to perform a spike in any sample matrix that has interferences potentially affecting the fluoride determination. If repeatability and accuracy are not obtained in the sample matrix, it is recommended that this method not be used for fluoride.

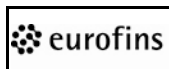
All samples designated EW must be checked and treated for chlorine prior to analysis. To check for chlorine, add a few drops of orthotolidine to an aliquot of the sample. If chlorine is present, a yellow color is seen. These samples are then treated by adding a few drops of sodium thiosulfate to the portion of sample being analyzed. The nitrate holding time for unpreserved and chlorinated samples is 48 hours instead of 14 days.

Safety Precautions and Waste Handling:

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

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Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability

A DOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the acceptance criteria for the LCS. Documentation is in each individual's training records.

Sample Collection, Preservation, and Handling:

Samples must be collected in unpreserved, clean glass or polyethylene containers. (Samples for fluoride must be collected in polyethylene.) Samples must be stored at 0° to 6°C not frozen. The holding time for samples is 28 days except for samples requiring orthophosphate, nitrate nitrogen and/or nitrite nitrogen analysis. Samples requiring one or more of these analyses must be run within 48 hours of collection.

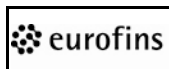
Waters – Samples with particulate matter >0.45 microns must be filtered before analysis. The corresponding LCSW and PBW of filtered samples on a batch must also be filtered.

Blanks and GLP samples must initially be run at a dilution factor of one. Most other samples are initially analyzed at a dilution factor of five, which increases the reporting limits by a factor of five. The analyst must increase this dilution factor further (if necessary) to obtain raw results that are less than the most concentrated calibration curve standard for the anion(s) of interest.

Highly alkaline or highly acidic samples must be neutralized before injection. Often, sample dilution is used in lieu of neutralization.

If appropriate, samples are prescreened for chloride and sulfate. For sulfate, add approximately 0.2 to 0.3 g of BaCl₂ using a measuring spoon (1 scoop) to one culture tube of sample. The amount of sulfate in the sample is estimated based upon the resulting turbidity.

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For prescreening chloride, add 2 mL of mercuric thiocyanate solution, and 1 mL of ferric ion solution to one culture tube of sample. The amount of chloride in the sample is estimated based upon the intensity of the resulting orange color.

Apparatus and Equipment:

1. Dionex system ICS-1000 or ICS-1100 Ion Chromatograph
2. Automatic sampler
3. Anion guard column, 4 × 50 mm, Dionex AG14, or equivalent
4. Anion analytical column, 4 × 250 mm, Dionex AS14, or equivalent
5. Anion suppressor, Dionex anion self-regenerating suppressor, ASRS-Ultra, or equivalent
6. Conductivity cell detector
7. Analytical balance, capable of accurately weighing to 0.0001 g
8. Acid Washed glassware

Computer Hardware and Software:

1. PC, with Windows NT (or equivalent)
2. Hard disk, monitor, keyboard, mouse, and printer
3. Chromeleon® software, Version 6.70 (or newer), Dionex Corporation, 2005
4. Lancaster Laboratories' LIMS system with IDAT

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Instrument/Equipment Maintenance and Troubleshooting:

Refer to the Maintenance Manual for equipment maintenance and documentation. For troubleshooting issues see senior department member or supervisor.

Reagents and Standards:

NOTE: All chemicals used must be ACS reagent grade unless otherwise noted. See 1-P-QM-QMA-9017328 for the appropriate labeling and documentation of reagents and standards. It is acceptable to use different volumes or weights in the preparation of reagents or standards as long as the ratios remain equivalent.

1. Concentrated eluent solutions, 0.5 M NaHCO₃ and 0.5 M Na₂CO₃

Sodium bicarbonate (NaHCO ₃)	42.00 ± 0.05 g
Sodium carbonate (Na ₂ CO ₃)	53.00 ± 0.05 g

- a. Prepare separate stocks for each component by dissolving each reagent listed above in reagent water and diluting to 1 L in a volumetric flask.
 - b. Store stock solutions at 0° to 6°C not frozen.
 - c. Solutions are stable for 30 days when stored in amber glass bottles.
2. Working eluent for AS14 column, 1.0 mM NaHCO₃/3.5 mM Na₂CO₃
 - a. Combine 32 mL of sodium bicarbonate concentrated eluent and 112 mL of sodium carbonate concentrated eluent.
 - b. Dilute the solution to 16 L with reagent water.
 - c. Solution is stable for 7 days at room temperature stored in a plastic container.

Calibration Standards:

1. Stock standards for calibration

Sodium fluoride (NaF)	2.2100 g
Sodium chloride (NaCl)	1.6485 g
Sodium nitrite(NaNO ₂)	4.9257 g
Potassium bromide (KBr)	1.4893 g
Potassium nitrate(KNO ₃)	7.2179 g
Sodium sulfate(Na ₂ SO ₄)	1.4787 g
Potassium Phosphate (KH ₂ PO ₄)	4.3937 g

Dry each of the above compounds at 105°C ± 5°C for 30 minutes (± 5 minutes). Weigh each compound to ± 0.0003 g.

Cal Standard 1 is composed of F, NO₂-N, and NO₃-N. Weigh out and quantitatively transfer each compound into a 1000-mL volumetric flask.

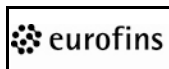
Cal Standard 2 is composed of Cl⁻. Weigh out and quantitatively transfer into a 1000-mL volumetric flask.

Cal Standard 3 is composed of Br and PO₄. Weigh out and quantitatively transfer into a 1000-mL volumetric flask.

Cal Standard 4 is composed of SO₄. Weigh out and quantitatively transfer into a 1000-mL volumetric flask.

Dilute to volume with reagent water. The concentration of each of the standard solutions is 1000 mg/L. Store at 0° to 6°C not frozen. The solutions are stable for 30 days.

NOTE: Salt standards that are stored in a dessicator must be covered with parafilm, not ground glass stoppers.

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NOTE: As an alternative, these anion standards are available for purchase with a concentration of 1000 mg/L each. Store purchased standards at room temperature. See label for expiration date.

2. Detection limit standard

- a. Using a volumetric pipette, add 1.0 mL of the Cal Standard 1, 4.0 mL of the Cal Standard 2, 5.0 mL of the Cal Standard 3, and 10 mL of the Cal Standard 4 to a 100-mL volumetric.
- b. Dilute to volume with reagent water. This standard is 10 mg/L with respect to F, NO₂-N, and NO₃-N, 40 mg/L with respect to Cl, 50 mg/L with respect to Br and PO₄, and 100 mg/L with respect to SO₄.
- c. Prepare fresh each time the instrument is recalibrated.

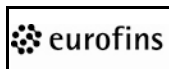
NOTE: If using the purchased standards, pipette the above specified volume of each of the anions contained in the various calibration standards.

3. Intermediate calibration standard

- a. Using a volumetric pipette, add 1.0 mL of the Cal Standard 1, 2.0 mL of the Cal Standard 2, 5.0 mL of the Cal Standard 3, and 5.0 mL of the Cal Standard 4 to a 100-mL volumetric.
- b. Dilute to volume with reagent water. This standard is 10 mg/L with respect to F, NO₂-N, and NO₃-N, 20 mg/L with respect to Cl, and 50 mg/L with respect to Br, PO₄, and SO₄.
- c. Prepare fresh each time the instrument is recalibrated.

NOTE: If using the purchased standards, pipette the above specified volume of each of the anions contained in the various calibration standards.

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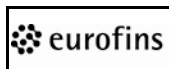
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4. Working calibration standards and continuing calibration verification (CCV)

- a. Pipette the specified volume of the appropriate calibration standard into a volumetric flask.
- b. Dilute to volume with reagent water.
- c. Prepare fresh daily according to the table below:

				Mg/L - Anions			
	Std	Std Volume (mL)	Final Volume (mL)	F, NO ₂ , NO ₃	Cl	Br, PO ₄	SO ₄
Cal 1	Det. Limit Std	1.0	100	0.1	0.4	0.5	1.0
Cal 2	Int. Cal Standard	4.0	100	0.4	0.8	2.0	2.0
Cal 3	Int. Cal Standard	10.0	100	1.0	2.0	5.0	5.0
Cal 4	Int. Cal Standard	20.0	100	2.0	4.0	10.0	10.0
Cal 5	Int. Cal Standard	30.0	100	3.0	6.0	15.0	15.0
CCV	Int. Cal Standard	30.0	200	1.5	3.0	7.5	7.5

NOTE: A reagent water blank is analyzed prior to the calibration and must contain no anions of interest. Therefore all anions must be < the MDL or re-calibration must occur.

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Quality Control Standards:

1. Stock standards for quality control

- a. Prepare as stock standards for calibration using reagents from a different manufacturer. Bromide, phosphate and sulfate are combined together as QC Standard 3. The concentrations for the anions are the same as the concentrations listed for stock standards for calibration.
- b. Standard solution is stable for 30 days.
- c. Store at 0° to 6°C not frozen in amber glass containers.

NOTE: As an alternative, these anion standards are available to purchase separately with a concentration of 1000 mg/L each. Store purchased standards at room temperature. See label for expiration date.

2. Intermediate quality control standard

- a. Using a volumetric pipette, add 0.5 mL of the QC Standard 1, 1.0 mL of the QC Standard 2, and 2.5 mL of the QC Standard 3 to a 50-mL volumetric.
- b. Dilute to volume with reagent water.
- c. This standard is 10 mg/L with respect to F, NO₂-N, and NO₃-N, 20 mg/L with respect to Cl, and 50 mg/L with respect to Br, PO₄, and SO₄.
- d. Must be prepared daily.

NOTE: If using the purchased standards, pipette the above specified volume of each of the anions contained in the various calibration standards.

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3. Working control standards

Initial calibration verification (ICV) and Laboratory control standard (LCSW):

- a. Pipette 15 mL of the intermediate quality control standard into a 100-mL volumetric flask, which contains about 80-mL reagent water.
- b. Dilute to volume with reagent water.
- c. Must be prepared daily.
- d. True values of this standard are:

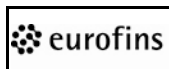
F, NO ₂ -N, NO ₃ -N	1.5 mg/L
Cl	3.0 mg/L
Br, PO ₄ , SO ₄	7.5 mg/L

4. Continuing calibration standards (CCV)

- a. Pipette 30 mL of the intermediate calibration standard into a 200-mL volumetric flask, which contains about 80-mL reagent water.
- b. Dilute to volume with reagent water.
- c. Must be prepared daily.
- d. The True Values of this standard are:

F, NO ₂ -N, NO ₃ -N	1.5 mg/L
Cl	3.0 mg/L
Br, PO ₄ , SO ₄	7.5 mg/L

5. Orthotolidine - Purchased. See label for expiration date. Store at room temperature.

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6. Sodium Thiosulfate - Purchased. See label for expiration date. Store at room temperature.
7. BaCl₂ (anhydrous) – Purchased. Store at room temperature. See label for expiration date.
8. Ferric Ion Solution – Purchased from Hach. Store at room temperature. See label for expiration date.
9. Mercuric Thiocyanate Solution – Purchased from Hach. Store at room temperature. See label for expiration date.

Calibration:

Refer to Procedure 9.

Procedure:

NOTE: ALL glassware used for samples and/or standards requiring orthophosphate as P analysis must be acid washed.

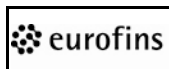
1. Check chromatography setup for proper installation according to the following flow diagram:

Anion Self-Regenerating Suppression

injection valve → guard column → anion column → ASRS suppressor
→ conductivity cell → ASRS suppressor → waste

2. Check working eluent reservoirs. If levels are getting low, replenish as needed.

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3. Start up the ion chromatograph using Table I as a guide.

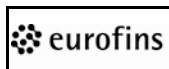
NOTE: Prime the analytical pump before turning on if the system has not been used for a few days or if the working eluent has been changed.

4. Do not begin any injections until the pressure of the system has equilibrated and the conductivity reading has stabilized.
5. Using Chromeleon®, set up the ion chromatograph with the method, program file, and sequence files to be used. Refer to the *Chromeleon® User's Guides* for more detailed instructions on the use of the software.
 - a. A new sequence table is started with each daily batch of samples. The daily sequence table is identified with a six-digit number containing the following information:

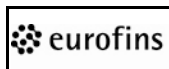
<u>RUN#</u>	<u>03</u>	<u>360</u>	<u>x</u>
	yr		
	Julian day		

Where x is the system #

- b. A program file is identified as the template as this information does not change from the sequence under which the system was calibrated. Calibrations last for up to one month.
 - c. All data files are saved in the sequence with which they are run.
6. Inject aliquots of reagent water until a stable baseline results.
7. Prepare standards and sample dilutions.

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8. The dilution factor must be entered for each sequence file. For solids, the sample weight is entered into the volume column. The dilution factor for solids is calculated by multiplying the final volume of the extract (typically 50-mL) by the dilution performed.
9. When calibrating the system, use a blank and the working calibration standards. Follow the calibration standards with the following run QC: ICV, ICB.
10. Samples are injected. A CCV and CCB are required after every 10 injections.
11. All injections must be documented with the following:
 - a. Sample name
 - b. Dilution factor
 - c. Batch number
 - d. Method used
 - e. Data file
 - f. Sample weight (g) - enter in volume column (if applicable)
 - g. Final volume (mL) - enter in dilution column and multiply by dilution factor (if applicable)

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Calculations:

This analytical method has been validated using peak areas for quantitation. The calibration fit is linear, equally weights all calibration points, and ignores zero. The equation of the line is $y = K_0 + K_1x$, where y = the area, K_1 = the slope, x = the concentration, and K_0 = the y intercept. Chromeleon® software performs the above determinations each time the calibration is updated. After the calibration is completed, Chromeleon® determines x (concentration) using the above equation. For the waters report format, Chromeleon® automatically multiplies this result by the dilution factor that has been entered by the analyst. For the solids report format, Chromeleon® performs the calculation using the analyst's inputted values for sample weight in grams and dilution factor. (The value entered in the dilution factor column is the volume extracted [normally 50 milliliters] \times any dilution made by the analyst).

Statistical Information/Method Performance:

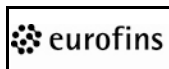
1. The method detection limit (MDL) or Detection Limit (DL) must be determined every 6 months by following the procedure outlined in 1-P-QM-QMA-9017309.
2. The quality control acceptance windows must be generated annually by following the procedure outlined in 1-P-QM-QMA-9017313.
3. The limit of detection (LOD) must be determined quarterly for analysis. It is 2-4X the DL.

The result obtained for the LOD must be less than or equal to the concentration of the Limit of Quantitation (LOQ).

Quality Assurance/Quality Control:

Check standards are used to establish retention times at the beginning of each calibration. The tolerance assigned to each retention time is $\pm 10\%$.

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For waters:

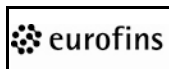
1. Calibration

- a. The ion chromatography system must be recalibrated at least monthly, or whenever the calibration verification requirements of $\pm 10\%$ are not met.
- b. For each analyte of interest, a blank and calibration standards at 5-concentration levels must be used to calibrate the instrument.

- (1) The concentrations for cal 1 must recover within 50% of the true value. The concentrations for this cal are equal to the reporting limit for each anion.
- (2) The calibration curves for the anion(s) of interest must have a correlation coefficient (r) of ≥ 0.9975 for the curve to be valid.

NOTE: Chromeleon® returns an r^2 value for the correlation coefficient. The square root of this value is the “r” value, which is used to evaluate the curve.

- c. The linearity of the calibration range must be verified every 6 months or whenever a significant change in instrument response is observed or expected. A minimum of 3 calibration standards must be analyzed. The results of these standards must not deviate from the true values by $>10\%$. If this criterion is not met, linearity must be re-established. The values of the three standards are taken from the calculated values of the standards used for the calibration curve.

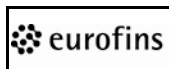
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2. An ICV standard must be analyzed after every calibration. An acceptable result is within 10% of the true value for all analytes. If this criterion is not met for any anion(s) of interest, the cause for the out-of-spec condition must be determined if possible. Corrective action must be taken and the ICV reanalyzed. Upon reanalysis, if the acceptance criterion still is not met for the anion(s) of interest, the instrument must be recalibrated. If the acceptance criterion is met, the analysis is in control. Any samples affected by the original out-of-spec ICV must be repeated. All corrective action taken must be documented. Refer to 1-P-QM-PRO-9015459.

3. An ICB must be analyzed after every calibration. An acceptable result is a result < ½ the RL for the anion(s) of interest. If this criterion is not met for the anion(s) of interest, the cause for the out-of-spec condition must be determined if possible. Corrective action must be taken and the ICB reanalyzed. Upon reanalysis, if the acceptance criterion still is not met for the anion(s) of interest, the instrument must be recalibrated. If the acceptance criterion is met, the analysis is in control. Any samples affected by the original out-of-spec ICB must be repeated. All corrective action taken must be documented. Refer to 1-P-QM-PRO-9015459.

4. Samples must be analyzed in batches not exceeding 20 samples per batch.

5. Sample results must not exceed the concentration of the highest standard. If a sample result falls above this value, the sample is diluted and run again. The sample result for any diluted sample must be >10% of the concentration of the highest standard for it to be considered acceptable data.

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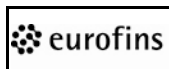
6. A batch blank (PBS, or PBW) must be analyzed for the anion(s) of interest in every batch. An acceptable result is a result $< \frac{1}{2}$ the LOQ for the anion(s) of interest. If this criterion is not met, the cause for the out-of-spec condition must be determined and corrective action taken, if possible. The batch blank is reanalyzed once. Upon reanalysis, if the acceptance criterion still is not met for the anion(s) of interest, all samples associated with the batch blank must be reprepared and reanalyzed. If the acceptance criterion has been met for a reanalyzed blank, all sample results associated with the batch blank are valid. All corrective action taken must be documented. Refer to 1-P-QM-PRO-9015459.

7. A laboratory control sample (LCSS or LCSW) must be prepared and analyzed for the anions of interest in every batch. An acceptable result is 80 – 120%. Control limits must not be greater than 3 times the standards deviation of the mean LCS recovery. If this criterion is not met, the cause for the out-of-spec condition must be determined if possible. Corrective action must be taken and the laboratory control standard reanalyzed. Upon reanalysis, if the acceptance criterion is still not met, all samples associated with that laboratory control standard must be reprepared and reanalyzed.

If the acceptance criterion is met, the sample results are valid. All corrective action that was taken must be documented. Refer to 1-P-QM-PRO-9015459.

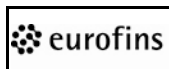
8. Based upon client requirements (when appropriate) a laboratory control sample duplicate (LCSDS or LCSDW) is also prepared and analyzed under the same conditions as the LCS. The acceptable range is the same as that of the LCS. If this criterion is not met, the cause for the out-of-spec condition must be determined, if possible. Corrective action must be taken and the LCS and LCSD reanalyzed. Upon reanalysis, if the acceptance criterion is still not met, all samples associated with the LCS and LCSD must be reprepared and reanalyzed. If the acceptance criterion is met, the sample results are valid. All corrective action that was taken must be documented. For the acceptable RPD between the LCS and LCSD, refer to the current statistical windows in the LIMS. If the RPD is outside these criteria, consult your group leader to determine if reanalysis is necessary.

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9. A CCV and CCB must be analyzed after every 10 injections. An acceptable result for the CCV is a result which does not deviate from the true value by $>\pm 10\%$. An acceptable result for the CCB is a result $< \frac{1}{2}$ the RL. If the CCV and/or CCB do not meet this acceptance criterion, all samples since the last compliant CCV/CCB and before the next compliant CCV/CCB must be reanalyzed for the out-of-spec analyses. The cause of the out-of-spec condition must be determined and corrective action, if taken, must be documented. Refer to 1-P-QM-PRO-9015459.
10. If the instrument has been idle for a period of 4 hours or more, the analysis must be restarted with a CCV and CCB. If these results are acceptable, sample analysis proceeds. If the CCV and/or CCB results are not acceptable, the instrument must be recalibrated.
11. A duplicate must be prepared and analyzed for every 10 samples in the batch (not to exceed 20 samples). An acceptable RPD is 10%. The cause of the out-of-spec condition must be determined if possible the duplicate must be reanalyzed.
12. A matrix spike must be prepared and analyzed for every 10 samples in the batch (not to exceed 20 samples). An acceptable range for the MS recovery is 80 -120%. If the recovery of any analyte falls outside the designated recovery range and the LCS for that analyte is shown to be in control, the recovery problem is judged to be either matrix or solution related, not system related.
13. A matrix spike duplicate must be prepared and analyzed for every samples in the batch (not to exceed 20 samples). An acceptable range for the MSD recovery is 80 – 120%. If the recovery of any analyte falls outside the designated recovery range and the LCS for that analyte is shown to be in control, the recovery problem is judged to be either matrix or solution related, not system related. The RPD between both the MS and MSD must be within 15%.

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Contingencies and Corrective Actions:

Data deemed out-of-control or unacceptable must be reported directly to the supervisor as soon as analysis is complete to determine the corrective action based on project requirements.

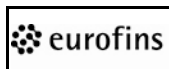
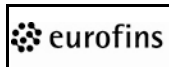
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Table I
Ion Chromatographic Operating Conditions

ICS-1000/ICS-1100	
System Power	On
Service Air Valve (In-house air)	N/A
Helium Pressure Valve	N/A
High Limit Switch	3000
Analytical Pump Flow Rate	1.2 mL/min
Low Limit Switch	0 psi
ASRS current	39 mA
Detector Range (Full Scale)	10 uS
Operating Pressure	1200-2200 psi
Temperature Compensation	1.7 %/°C
Sample Loop	Approx. 50 µL
Analytical Pump	on

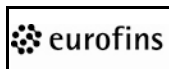
Table II
Ion Chromatography Shutdown Conditions

	ICS-1000-ICS1100
Analytical Pump	off
Service Air Valve (In-house air)	closed
Helium Pressure Valve	N/A
ASRS Suppressor Current	N/A
System Power	off
Analytical Pump	off

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Eurofins Document Reference	1-P-QM-WI -9015112	Revision	6
Effective Date	Mar 31, 2015	Status	Effective
Historical/Local Document Number	Analysis DOD - 10601, 12838		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

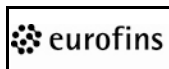
Prepared by	Christine Dolman
Reviewed and Approved by	Susan Goshert;Review;Monday, March 23, 2015 2:00:58 PM EDT Kathryn Brungard;Approval;Tuesday, March 24, 2015 9:08:07 AM EDT

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Revision Log:

Revision: 6		Effective Date:	This version
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Document Title	Enhancement	Change title to: TPH-DRO by Methods 8015C or 8015D in Solids using GC-FID	
Reference Modifications	Clarification	Added modification of the RT window setup.	
Definitions	Clarification	Method blank – removed reference to waters.	
Interferences	Enhancement	Added information about the FID detector.	
Apparatus and Equipment	Reflects current columns in use	Changed primary column from 30 meters × 0.53 mm ID fused silica capillary lined with a 1.5-µm film of RTX 5	
Reagents and standards	Reflect current standards and reagents	Added the hydrogen is provided by a generator or compressed tanks Updated Diesel #2Fuel standards and TPH standards Added Capric acid standards	
Calibration	Reflect current sequence	Updated naming of standards	
Procedure	Clarification	Removed reference to South Carolina since South Carolina is in a separate SOP now.	

Revision: 5		Effective Date:	Sep 27, 2013
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Throughout Document	Reflect re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers	
Document Title	Method referenced in the document	Add 8015D	
Reference	Enhancement	Added method 8015D, 8000B, 8000C references	
Definitions	Enhancement	Added detail to the definitions	
Personnel Training and Qualifications	Reflects current practice	Removed using CCVs and ICVs for DOCs	
Sample Collection, Preservation, and Handling	Reflects current industry approach	Updated refrigeration of samples from 4° ± 2°C to 0° to 6°C, not frozen	
Gas Chromatography Conditions	Method added to this document	Added 8015D reference	
Calibration	Correction	Changed the code of the component check standard in the sequence from API_3 to TPH_3	

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Reference:

1. *Test Methods for Evaluating Solid Waste*, SW-846 Method 8015C, Rev. 3, February 2007.
2. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 8015D, Rev. 4, June 2003.
3. *Determinative Chromatographic Separations*, SW-846, 8000B, Revision 2, December 1996
4. *Determinative Chromatographic Separations*, SW-846, 8000C, Revision 3, March 2003
5. *Chemical Hygiene Plan*, current version.

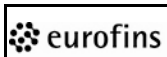
Cross Reference:

Document	Document Title
Analysis #2176	Quick Silica Gel Cleanup for Hydrocarbons by GC in Solid and Water Matrices
Analysis #7004, 10303, 11204, 11205, 11209, 11215, 11218, 11219, 11225, 11228, 11229, 11233, 11236, 11237, 11238, 13097	Sonication Extraction Method 3550C for DRO in Soils or Solids
1-P-QM-PRO-9015447	Maintenance and Troubleshooting Procedures for GC-FID Instrumentation
1-P-QM-PRO-9015448	Common Equations Used During Chromatographic Analyses
1-P-QM-PRO-9015449	QC Data Acceptability and Corrective Action
1-P-QM-PRO-9015450	Monitoring QC Data Acceptance Limits
1-P-QM-PRO-9015451	Interpretation and Integration of Chromatographic Data
1-P-QM-QMA-9017309	Determining Method Detection Limits and Limits of Quantitation

Scope:

This analysis for TPH (Total Petroleum Hydrocarbon) Diesel Range Organics (DRO) is designed to quantitate midrange petroleum products in solids that correspond to a range of C10 normal hydrocarbons through C28 normal hydrocarbons. The limit of quantitation (LOQ) for solids is 12 mg/kg. (Refer to the eLIMS for current LOQs).

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Basic Principles:

Samples are extracted in methylene chloride using sonication (11233) or microwave (12837) extraction techniques. Sample extracts are analyzed by capillary gas chromatography (GC) using a flame ionization detector (FID). Quantitation is performed by comparing the area of all chromatographic peaks (including resolved and unresolved components) eluting between the requested hydrocarbon range(s) with the total peak area between C10 and C28 normal hydrocarbons of the #2 Fuel Oil standard solution.

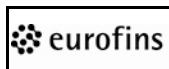
Reference Modifications:

1. GC conditions differ from those listed in 8015C/D. However, all QC criteria are met.
2. In order to ensure the start time and stop time for the diesel range includes the entire C10 and C28 peak, a ± 0.1 minute window from the RT of the marker compound is used in place of the lower and upper statistical RT window, as established by the 72 hour study. This ensures consistency throughout different instruments in the laboratory.

Definitions:

1. Analytical Batch – A group of field and Quality Control (QC) samples of the same matrix, extracted together under the same conditions and period of time, using the same lot(s) of chemicals.
2. Continuing Calibration Verification (CCV) – A mid-level standard used to verify that the analytical response is reliable, and has not changed significantly from the current Initial Calibration curve (ICAL). The verification of the ICAL that is required during the course of analyses at periodic intervals.
3. Initial Calibration Verification (ICV) – Second source calibration verification. A standard obtained or prepared from a source independent of the source of standards for the ICAL. Used to verify the integrity of the standards used for initial calibration.

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4. Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) – A sample of known composition analyzed with each batch of samples to demonstrate laboratory accuracy. The samples either naturally contain the analytes of interest or are clean samples fortified with known concentrations. Used to demonstrate laboratory accuracy. A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test.

5. Matrix Spike/Matrix Spike Duplicate (MS/MSD) – A sample created by fortifying a second aliquot of a soil sample with some or all of the analytes of interest. The concentration added is known and compared to the amount recovered to determine percent recovery. Matrix spike recoveries provide information about the accuracy of the method in light of the matrix analyzed. A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test.

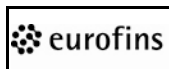
6. Method blanks – A designated sample designed to monitor for sample contamination during the analysis process. Method blanks consist of a purified solid matrix or just the reagents used in the test. The blank demonstrates that no artifacts were introduced during the analysis process.

7. Surrogates – Organic compounds which are similar to the analytes of interest but are not naturally occurring in environmental samples. Surrogates are spiked into all standards and every field and QC sample prior to extraction and analysis to provide information regarding the effects of the sample matrix.

Interferences:

The FID is a non-selective detector. There is potential for many non–target organic compounds present in samples to interfere with this analysis.

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Non-petroleum organics will also be detected by these methods and may interfere with petroleum product characterization and/or LOQ. Cleanup techniques may be employed to reduce background contribution from polar organics that are not related to target hydrocarbon fractions. A quick silica gel cleanup of the concentrated extract by Analysis #2176 may be performed. When a cleanup is employed, all related batch QC must go through the same cleanup protocol.

Safety Precautions and Waste Handling:

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

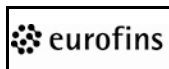
The toxicity and carcinogenicity of each reagent used in this method has not been precisely defined. Therefore, each chemical compound must be treated as a potential health hazard. Exposure to these compounds must be reduced to the lowest possible level by whatever means are available. Good laboratory practices must be employed at all times. Waste GC vials must be placed in a designated container for storage until they are lab packed for disposal. Sample extracts and sample dilutions are disposed of by transfer to a designated container for solvent waste.

Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each analyst performing instrumental analysis must work with an experienced analyst for a period of time until they can independently calibrate the instrument, use the chromatography data system to set up sequences, perform the calculations, interpret chromatograms, perform instrument maintenance, and enter data into the LIMS. Proficiency is measured through documented audits of the tasks listed and over checking of data as well as an Initial Demonstration of Capability (IDOC).

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The IDOC and/or DOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four laboratory control samples or one blind sample. Refer to 1-P-QM-QMA-9015390 (LOM-SOP-ES-238) for more guidance on these options.

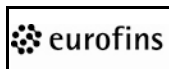
Sample Collection, Preservation, and Handling:

Solid samples are collected in glass containers (minimum 150-mL) with minimal headspace and stored at 0° to 6°C, not frozen. Soils must be extracted within 14 days of collection and analyzed within 40 days of extraction.

Apparatus and Equipment:

1. Hewlett-Packard HP6890 Gas Chromatograph, or equivalent, capable of performing automated direct injection capillary chromatography with temperature programming and flame ionization detection
2. Integrating system such as Chrom Perfect® by Justice Laboratory Software, or equivalent. Chrom Perfect® is a data system capable of storing and reintegrating chromatographic data and determining peak areas using a forced baseline, area summation, baseline projection, and performing baseline compensation as required.
3. Primary column – low polarity phase, 30 meters × 0.53 mm ID fused silica capillary lined with a 1.5-µm film of 5% diphenyl, 95% dimethyl polysiloxane.
4. Various sizes of Class A volumetric pipettes, flasks, and syringes.
5. Analytical balance
6. Disposable Pasteur Pipettes
7. GC autosampler vials – 2 mL glass with Teflon-lined caps or equivalent.

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Reagents and Standards:

A. Reagents

1. Methylene chloride (CH_2Cl_2) – Pesticide quality or equivalent; store at room temperature
2. Ultra high purity hydrogen - Provided by a generator or compressed tanks
3. Air – Provided by a zero air generator or compressed air in tanks
4. Acetone – Pesticide quality or equivalent; store at room temperature
5. Methanol – Pesticide quality or equivalent; store at room temperature

B. Standards

1. All standards are prepared using Class A volumetric pipettes, flasks, and syringes.
2. All weights are made on an analytical balance.
3. All standards are prepared using instructions generated by the standards database.
4. Unopened ampules are stored according to the manufacturer's instructions and are stable until the expiration date provided by the manufacturer.
5. All prepared standard solutions are stored at $\leq -10^\circ\text{C}$ in labeled vials. Standards expire in 6 months unless otherwise noted.
6. Diesel #2 Fuel Stock– Diesel #2 Fuel, 50,000 $\mu\text{g/mL}$ in methylene chloride. Restek Cat. #31259 or equivalent.

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7. Diesel #2 Fuel Calibration Standards – For the #2 fuel calibration prepare the following dilutions (use the chart as a guideline).

Level	Parent Aliquot (mL)	Final Volume	Concentration
	<i>Diesel # 2 Fuel Stock</i>	<i>(mL)</i>	<i>(ppm)</i>
1FUL1	0.0072	5	72
1FUL2	0.0400	5	400
1FUL3	0.4000	25	800
1FUL4	0.1600	5	1600
1FUL5	0.3500	5	3500
FMDLX	0.0024	5	24

8. Diesel #2 Fuel Calibration Verification Check Standard – Follow the dilution scheme for the Level 3 Diesel #2 Fuel Calibration Standard using the Stock Standard.
9. Surrogate Stocks - certified ampulated stocks solutions
- Chlorobenzene 10,000 µg/mL concentration in hexane or methylene chloride. Restek Cat. #558353, or equivalent.
 - o-Terphenyl 10,000 µg/mL concentration in hexane or methylene chloride. Restek Cat. #31097 or equivalent.
10. Hydrocarbon component mix calibration stock solution – A certified, ampulated stock solution containing all even-numbered normal hydrocarbons from C8 (*n*-octane) through C40 (*n*-tetracosane), inclusive. A concentration of 500 µg/mL for each hydrocarbon compound is recommended. This preparation may be in hexane or methylene chloride. Custom Florida TRPH Standard available from Restek, Cat. #554128.

NOTE: Only hydrocarbons C10 through C28 are required for this analytical protocol, but C8 to C40 is a common mix.

11. Working hydrocarbon component and surrogate calibration standards

- a. Use the following table as a guideline using the hydrocarbon component mix calibration stock solution and the surrogate stock solution in methylene chloride.
- b. This results in approximate concentrations of 4, 8, 16, 32, and 40 ppm each hydrocarbon and surrogate.

Level	Parent Aliquot (mL of each stock)			Final Volume
	<i>Florida TRPH</i>	<i>O-Terphenyl</i>	<i>Chlorobenzene</i>	<i>(mL)</i>
TPH_1	0.08	0.004	0.004	10
TPH_2	0.16	0.01	0.01	10
TPH_3	0.32	0.02	0.02	10
TPH_4	0.64	0.03	0.03	10
TPH_5	0.80	0.04	0.04	10

12. ICV #2 Fuel Stock – Ultra Scientific Cat. #RGO-616, or equivalent, at 50,000 µg/mL. This is an ampulated stock of #2 fuel oil prepared in methylene chloride.
13. #2 Fuel Oil ICV Standard (800 ppm) – Dilute of 0.16 mL of the stock to a final volume of 10-mL with methylene chloride and mix. This is coded 1FLKX.
14. Surrogate Stocks –Restek Cat. #558353 (chlorobenzene) and Restek Cat. #31097 (o-terphenyl) at 10,000 ppm in methylene chloride (or equivalent).
15. Spiking solutions for soils extraction
 - a. Surrogate Spiking Solution - Pipette 3.0 mL of each surrogate stock into a 500-mL volumetric flask. Bring to volume with methylene chloride and mix. 1.0 mL of this solution is added to all soil samples as directed by the sample preparation method.

- b. Diesel #2 Fuel Spiking Solution - Dilute 4 mL of the stock to a final volume of 50 mL and bring to volume with acetone. Add 1.0 mL of this solution to samples prepped as directed by the method, or equivalent amounts based on sample volume received.
16. Capric Acid Neat – Chem Service Cat. #334-48-5 Decanoic Acid
17. Capric Acid Spiking Stock – Weigh out 0.1 g of Capric Acid Neat in a 10 mL volumetric flask. Dilute to volume with methylene chloride, concentration 9,950 µg/L.
18. Capric Acid Calibration Standards – For the capric acid calibration, prepare the following dilutions (use the chart as a guideline).

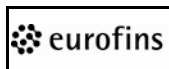
Level	Parent Aliquot (mL)	Final Volume	Concentration
	<i>Capric Acid Stock</i>	<i>(mL)</i>	<i>(ppm)</i>
CAPR5	0.025	10 mL	25 ppm
CAPR4	0.020	10 mL	20 ppm
CAPR3	0.015	10 mL	15 ppm
CAPR2	0.010	10 mL	10 ppm
CAPR1	0.005	10 mL	5 ppm

Extraction Procedure:

See Organic Extraction Analysis scans 11233 or 12837.

Gas Chromatography Conditions:

The conditions listed are usually the optimum operating conditions, but can vary to improve the sensitivity, linearity, and overall chromatography or shorten run times on each GC system.

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Detector	FID, hydrogen at 40 mL/min, air at 400 mL/min
Detector Temp	320°C
Oven Temp	80°C, 1 min, 15°C/min to 190°C, 30°C/min to 340°C, hold 2 min
Carrier	Hydrogen at constant flow of 10 mL/min in constant flow mode
Makeup Gas	Nitrogen at 20 mL/min
Injection Size	1 µL, direct injection
Injection Conditions	300°C, with 15 mL/min septum purge, 30 psi pulse pressure for 1 min to prevent backflash

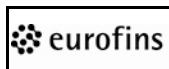
GC conditions differ from those listed in Methods SW-846 8015C and 8015D however, all QC criteria are met.

Calibration:

A. Prior to starting a new calibration:

1. Change the septum on the GC and allow the system to stabilize.
2. Fill the autosampler rinse vials with clean solvent or replace vials which appear dirty.
3. Make several injections of methylene chloride to stabilize the system.
4. If necessary, make a compensation run according to the instrument manual and program the GC to use the run for background subtraction.
5. Prepare a sequence using the following suggested order of injections:
 1. Conditioner/Methylene chloride blank
 2. Conditioner/Methylene chloride blank
 3. IBLK
 4. CAPR1
 5. CAPR2
 6. CAPR3
 7. CAPR4
 8. CAPR5
 9. TPH_1
 10. TPH_2
 11. TPH_3 (used to mark retention times for C10, C28, and o-Terphenyl)
 12. TPH_4

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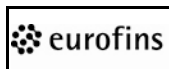
13. TPH_5
14. 1FUL1
15. 1FUL2
16. 1FUL3
17. 1FUL4
18. 1FUL5
19. Methylene chloride blank
20. FMDL (Fuel MDL evaluation standard)
21. Hydrocarbon Component ICV Standard
22. Diesel #2 Fuel ICV
23. Blank
24. LCS
25. 1234567
26. 1234567MS
27. 1234567MSD
- 28–32. Continue running samples
33. Hydrocarbon component check standard (TPH_3)
34. Diesel #2 Fuel check standard (1FUL3)
- 35–44. Continue running groups of injections followed by calibration verification check standards.

- a. The conditioner injection is usually a standard or sample that has already been injected. It is used to prime the system and is best utilized when the GC has not been running and there is a gap in time prior to starting a set of injections.
- b. Methylene chloride blanks may also be run to allow the GC to go through some temperature programs and/or to check the cleanliness of the system.
- c. The check standards include the TPH_3 standard to check surrogate recoveries and mark hydrocarbon retention times, and 1FUL3 to evaluate the Diesel Fuel Range.

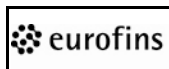
B. Initial Calibration (ICAL)

1. The GC is calibrated using 5 levels of Diesel #2 Fuel, C10-C28 normal hydrocarbons, Capric Acid, and o-terphenyl surrogate.
2. The total area between C10 and C28 in the Diesel Fuel pattern is used for the quantitation of all ranges (i.e. C10-C28, C10-C25, >C28-C35, C10-C32).

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3. The TPH standards contain ten hydrocarbon components from C10 to C28, and o-terphenyl. This standard is used for the o-terphenyl calibration.
4. The working hydrocarbon component standard is used to establish the retention times for all of the marker hydrocarbons.
5. The Capric Acid calibration is used to evaluate the 10g column clean up. This calibration quantitates the recovery of the reverse surrogate.
6. An external standard calibration is used with average calibration factor (AVGCF) when the %RSD is $\leq 20\%$.
7. Alternatively, when the %RSD is $> 20\%$ a linear calibration curve will be used. The correlation coefficient must be 0.99.
8. If the 0.99 curve coefficient cannot be met, inspect the data points to see if one or more calibration levels appear to be off.
 - a. A specific calibration level may have concentrated due to solvent evaporation, or degraded over time. Reinject or remake the standard if this is the cause.
 - b. Otherwise, the instrument may need maintenance. See 1-P-QM-PRO-9015447 (SOP-EP-006).
9. Extrapolate or force zero is not allowed for either curve type. Set the zero to ignore.
10. Curve types and criteria can be altered to meet client or project specific requirements, as well as any regulatory agency requirements, which may differ from those listed here.
11. The calibration file is set-up using the area versus concentration in mg/L.

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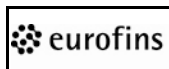
C. Initial Calibration Verification (ICV)

1. An alternate source Diesel #2 Fuel ICV is required after the ICAL.
 - a. The concentration in the ICV standard must be within $\pm 20\%$ difference (%D) of the nominal concentration when compared to the calibration.
 - b. If the standard is outside the QC limits, corrective action must be taken before sample analysis can begin.
 - (1) Reinject or remake the standard.
 - (2) If the standard is not within the $\pm 20\%$ D window, the instrument may need maintenance and a new calibration. See 1-P-QM-PRO-9015447 (SOP-EP-006).
2. Sample analysis can proceed once an acceptable calibration and ICV are attained.
3. The scaling of chromatograms and peak integration parameters must be set so that a standard at the concentration of the Method Detection Limit (MDL) gives a pattern that is discernable from the baseline and can be integrated properly. This ensures that the quantitation limits and MDLs can be met.

D. Continuing Calibration Verification (CCV)

1. CCV is performed prior to the analysis of any samples and then at least every 12 hours throughout the sequence using the 1FUL3 standard.
2. The Diesel #2 Fuel standard is evaluated using the area eluting between and including C10 through C28.
3. The concentration of the Diesel #2 Fuel in the CCV must be within $\pm 20\%$ difference (%D) of the nominal concentration.

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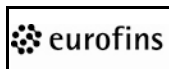
4. The surrogate (o-terphenyl) response in the TPH_3 standard must meet $\pm 20\%$ difference.
5. The hydrocarbon components are used to monitor the retention times for the ranges throughout the run.
6. Samples must be bracketed with compliant standards. If they are not, they must be reanalyzed.

If, however, the standard following a sample is outside the $\pm 20\%$, but exhibits increasing response, the samples before it do not have to be reinjected if the target analytes are not detected.

E. Retention time (RT) windows

1. RT windows are established for the retention time marker hydrocarbons and surrogate in the hydrocarbon/surrogate mix (which is injected throughout the analytical sequence at every check standard point) by using ± 3 standard deviation from the mean retention time for three standards injected over a 72-hour period.
2. These marker hydrocarbons are used to determine the starting and stopping points for the DRO range to be quantitated.
3. If the RTs for continuing (TPH) hydrocarbon/surrogate standard fall outside the RT windows, update the hydrocarbon(s) midpoint retention times using that standard, the window will stay the same.
 - a. Also update the start and stop times used for the DRO range using the same standard.
 - b. Save under the appropriate calibration name to indicate an update has occurred.

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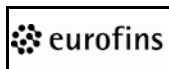
- c. All subsequent standards run within a 24-hour period must be within this window.
- d. Retention times cannot be updated more than once per day.
- 4. If RTs are not consistent, the cause should be investigated and corrective action taken.

Procedure:

1. Establish the area of all chromatographic peaks (including resolved and unresolved components) eluting between, and including, the hydrocarbon range specific to that analysis number.
2. Quantitate samples by comparing the area of the chromatographic peaks to the appropriate Diesel #2 Fuel calibration.
 - a. A horizontal baseline is projected from the lower limit of the retention time window for C10 to after the upper retention time window of C28.
 - (1) When volatile petroleum products eluting earlier than the beginning retention time are present, the baseline should be projected prior to the methylene chloride solvent front.
 - (2) Additional baseline adjusting may be needed, to ensure accurate integration of total area in the hydrocarbon range.
 - (3) The total area is determined from this chromatogram.
 - b. A second integration of the plot is done using a baseline determination that follows the true baseline in a point-to-point manner.

The area for the o-terphenyl peak is determined from this and subtracted from the range in which it elutes.

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- c. See 1-P-QM-PRO-9015451 (SOP-EP-011), Interpretation and Integration of Chromatographic Data, for further guidance.

3. Dilutions

- a. Perform as necessary to bring total sample response within the working range of a #2 fuel oil calibration.
- b. Any single range of a sample whose total area exceeds that of the upper level fuel standard must be diluted into the working range of the fuel calibration.

Calculations:

1. Using AVGCF

$$\frac{\text{Total DRO Sample Area}}{\text{AVGCF}} \times \frac{FV}{IW} \times DF = \text{mg/kg as received}$$

2. Using linear curve

$$[(\text{Total DRO Sample Area Y Intercept}) / \text{Slope}] \times \frac{FV}{IW} \times DF = \text{mg / kg as received}$$

Where:

Total DRO Sample Area = Total area in established RT range minus surrogate area

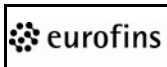
FV (final volume) = 5 mL soils

IW (initial weight) = 30 g

DF (dilution factor) = as needed

3. Also see 1-P-QM-PRO-9015448 (SOP-EP-008) for details on calculations.

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Statistical Information/Method Performance:

Generate method detection limits (MDLs) and limits of quantitation (LOQs) according to 1-P-QM-QMA-9017309 (LOM-SOP-ES-203). Initially perform an MDL study on each instrument used for the analysis. Determine the MDL by taking seven spiked replicates through the entire extraction and analysis procedure. Compare and pool results to determine the final reporting MDL. NELAC allows for an annual verification of the MDL in lieu of an annual EPA MDL study. The department manager maintains annual study data. Updates to the LIMS are made as needed by the QA department and only as directed by the technical management. Update the department database via a download from the LIMS.

Acceptance limits are generated according to 1-P-QM-PRO-9015450 (SOP-EP-010). QC limits for surrogates, LCS/LCSD, and MS/MSD are established through statistical analysis of historical data. The limits are evaluated every 6 months and updated as needed. These limits are maintained on the LIMS for the relevant analysis numbers.

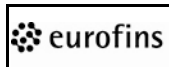
Quality Assurance/Quality Control:

A batch is defined as the samples extracted on any given shift and processed as a unit but not to exceed 20 field samples. If more than 20 samples are prepared in a day, then an additional batch with QC must be extracted.

For each batch of samples extracted a reagent blank, LCS (reagent blank spiked with #2 fuel) and a randomly selected an MS/MSD must be extracted and carried through the entire procedure. The reagent blank matrix is sodium sulfate. If there is limited sample volume that prevents the preparation of an MS/MSD, then an LCSD must be prepared instead.

o-Terphenyl is added as a surrogate to each sample and QC to monitor the efficiency of the extraction, the operation of the autosampler, and to monitor retention times throughout the GC run.


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See 1-P-QM-PRO-9015449 (SOP-EP-009) for details on QC acceptance criteria and corrective action.

If any client, agency or state has more stringent QC or batch requirements, these must be followed instead.


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Eurofins Document Reference	1-P-QM-WI -9015108	Revision	3
Effective Date	Jan 10, 2013	Status	Effective
Historical/Local Document Number	Analysis DOD - 10590		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

Prepared by	Jamie Brillhart
Reviewed and Approved by	Susan Goshert;Review;Wednesday, December 26, 2012 2:16:25 PM EST Kathryn Brungard;Approval;Thursday, December 27, 2012 8:30:50 AM EST

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Revision Log:

Revision: 03		Effective Date:	This version
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Throughout Document	Reflect re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers	
Cross Reference	Referenced in SOP	Added Demonstrations of Capability reference 1-P-QM-QMA-9015390	
Basic Principles	Unnecessary information	Removed 30 gram portion	
Personnel Training and Qualification	Clarification	Added information on IDOC and DOCs.	
Sample Collection, Preservation, and Handling	Unnecessary information	Removed 125 mL reference	
Apparatus and Equipment	Reflects current columns	Changed column names	
Calculation	Unnecessary information	Removed reference to specific volumes and weights.	
Reagents and Standards	Reflect current standards	Removed table and added information about standard database	
Statistical Information/Method Performance	Clarification	Updated to same verbiage as the other Dept 24 analysis SOPs	

Revision: 02		Effective Date:	12/16/2010
Section	Justification	Changes	
Title	Clarification	Included technology used.	
Cross Reference	Referenced in document	Included microwave procedure	
Scope	Deleted unnecessary information	Remove information on extraction and analysis times	
Basic Principles	Process change	Added microwave option	
Safety Precautions and Waste Handling	Formatting requirements per LOM-SOP-LAB-201	Replaced first sentence with required text	
Personnel Training and Qualifications	Formatting requirements per LOM-SOP-LAB-201	Added required text	
Personnel Training and Qualifications	Clarification	Change check standard to laboratory control spike	
Extraction	Process change	Added microwave option	
Calibration	Formatting requirements per LOM-SOP-LAB-201	Added required section	
Calibration	Clarification	Added steps 1 through 11 from previous Procedure section	
Calibration	Update criteria for CCV	Incorporated PA#1 (dated 05/27/10) Updated steps 1 and 9	
Procedure	Addition/Clarification	Add step one, renumber previous procedure 12 and 13 as 2 and 3	
Statistical Information/Method Performance	Process change – hard copies no longer used	Delete last sentence	

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Reference:

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 8081B, February 2007 (Update IV).
2. *Chemical Hygiene Plan*, Eurofins Lancaster Laboratories, Inc., current version.

Cross Reference:


Document	Document Title
Analysis #6006, 11129, 11131, 11134	Sonic Probe Extraction Procedure for the Determination of Pesticides and Polychlorinated Biphenyls (PCBs) in a Solid Matrix
Analysis #10496, 11141	Microwave Extraction Procedure for the Determination of Pesticides in a Solid Matrix
1-P-QM-PRO-9015477	Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
1-P-QM-PRO-9015493	QC Data Acceptability and Corrective Action
1-P-QM-PRO-9015494	Interpretation of Chromatographic Data
1-P-QM-PRO-9015495	Preventative and Corrective GC Maintenance
1-P-QM-PRO-9015496	Monitoring of QC Data Acceptance Limits
1-P-QM-PRO-9015498	Setting Up Single Component Initial Calibrations
1-P-QM-PRO-9015499	Using "Datalog" Software for Data Acquisition of Multicomponent Pesticides/PCBs
1-P-QM-PRO-9015501	Common Equations Used During Chromatographic Analyses
1-P-QM-QMA-9015390	Demonstrations of Capability
1-P-QM-QMA-9017309	Determining Method Detection Limits and Limits of Quantitation

Scope:

This method is used for identifying and quantitating the following Pesticides in solid samples:

<u>Compound</u>	<u>LOQ (µg/kg)</u>
alpha-BHC	0.83
beta-BHC	1.9
delta-BHC	0.83
heptachlor	0.83
aldrin	0.83
heptachlor epoxide	0.83
endosulfan I	0.83
endosulfan II	1.7
endosulfan sulfate	1.7

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<u>Compound</u>	<u>LOQ (µg/kg)</u>
dieldrin	1.7
endrin	1.7
4,4'-DDE (p,p)	1.7
2,4'-DDE (o,p)	1.7
4,4'-DDD (p,p)	1.7
2,4'-DDD (o,p)	1.7
4,4'-DDT (p,p)	1.7
2,4'-DDT (o,p)	1.7
endrin aldehyde	1.7
endrin ketone	1.8
methoxychlor	8.3
technical chlordane	17
alpha-chlordane	0.83
gamma-chlordane	0.83
toxaphene	33.
kepone	7
mirex	1.7
telodrin	1.2
hexachlorobenzene(HCB)	0.83

Limit of Quantitations (LOQs) are based on annual statistical evaluation of laboratory data and are subject to change. The current Method Detection Limits (MDLs) and LOQs are maintained in the LIMS.


Basic Principles:

The sample is extracted using sonication or microwave with 50% hexane/acetone. The extract is dried, concentrated, and exchanged to hexane. The pesticides are then identified and quantitated using gas chromatography with an electron capture detector (GC-ECD). Florisil, GPC, or copper cleanups may be employed to reduce matrix interferences which introduce large, unresolvable peaks into the chromatogram, specifically elemental sulfur.

Reference Modifications:

Gas Chromatography conditions differ from those listed in 8081. However, all quality control (QC) criteria are met.


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Definitions:

1. Analytical Batch – A group of field and Quality Control (QC) samples of the same matrix, extracted together under the same conditions and period of time, using the same lot(s) of chemicals. The batch is limited in size to 20 field samples plus QC for SW-846 series methods.
2. Breakdown check – Analysis of a standard solution containing Endrin and DDT. Area counts of these compounds and their breakdown products are evaluated to verify the inertness of the injection port since DDT and Endrin are easily degraded in the injection port.
3. Continuing calibration verification (CCV) – A mid-level standard used to verify that the analytical response is reliable, and has not changed significantly from the current Initial Calibration curve (ICAL). The verification of the ICAL that is required during the course of analyses at periodic intervals.
4. Initial Calibration Verification (ICV) - Second source calibration verification. A standard obtained or prepared from a source independent of the source of standards for the ICAL. Used to verify the integrity of the standards used for initial calibration.
5. Internal standards – Analytes, which are chemically similar to the analytes of interest, but are not naturally occurring in environmental samples. Internal standards are added to all standards and every field and QC sample after extraction but prior to analysis. Comparison of the response of the internal standards is used in the quantitation of target analytes. Internal standard response also provides a check for changes in the instrument response.
6. Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) – A sample of known composition analyzed with each batch of samples to demonstrate laboratory accuracy. The samples either naturally contain the analytes of interest or are clean samples fortified with known

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concentrations. Used to demonstrate laboratory accuracy. A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test.

7. Matrix spike/matrix spike duplicate (MS/MSD) – A sample created by fortifying a second aliquot of a water or soil sample with some or all of the analytes of interest. The concentration added is known and compared to the amount recovered to determine percent recovery. Matrix spike recoveries provide information about the accuracy of the method in light of the matrix analyzed. A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test.
8. Method blanks – A designated sample designed to monitor for sample contamination during the analysis process. A volume of deionized laboratory water is typically used to monitor water sample analysis, while solids blanks consist of a purified solid matrix or just the reagents used in the test. The blank demonstrates that no artifacts were introduced during the analysis process.
9. Surrogates – Organic compounds which are similar to the analytes of interest but are not naturally occurring in environmental samples. Surrogates are spiked into all standards and every field and QC sample prior to extraction and analysis to provide information regarding the effects of the sample matrix.

Interferences:

- A. Avoid contact with any plastic material during the extraction and analysis procedures to minimize interferences from phthalate esters.
- B. Scrupulously clean all glassware to minimize interferences caused by laboratory contaminants.
- C. An electron capture detector is very sensitive to compounds that contain halogens and will also respond to many other compounds and materials including oxygenated organics, unsaturated organics, and elemental sulfur.

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- D. Extracts may require further cleanup if interferents are present. Refer to 1-P-QM-PRO-9015477 (SOP-OE-004) for details on each cleanup procedure. Interfering materials can introduce large, unresolvable peaks into the chromatogram.
1. Use Florisil cleanup to reduce organics that can interfere (polar compounds).
 2. Use GPC to remove sulfur and higher molecular weight organics.
 3. Use copper cleanup to remove elemental sulfur.
- E. For solid samples, a 1:1 mixture of methylene chloride/acetone has been shown to introduce many extraneous interfering peaks due to reactions that occur between the solvents during the heated concentration process. Therefore, hexane/acetone is used for extraction.

Safety Precautions and Waste Handling:


See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

Gloves, lab coats, and safety glasses must be worn when preparing standards. Lab coats and safety glasses must be worn around the GC where solvents and sample extracts are handled.

All GC vials and vials containing extracts are placed in a hazardous waste container for lab pack disposal. There is a satellite container in the laboratory that is then emptied into the main laboratory waste collection drums. All solvent waste is disposed of in solvent waste containers.

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Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each analyst performing instrumental analysis must work with an experienced analyst for a period of time until they can independently calibrate the instrument, use the chromatography data system to set up sequences, perform the calculations, interpret chromatograms, perform instrument maintenance, and enter data into the LIMS. Proficiency is measured through documented audits of the tasks listed and over checking of data as well as an Initial Demonstration of Capability (IDOC).

The IDOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four laboratory control samples, one blind sample, or one ICAL with ICVs and/or CCVs. Refer to 1-P-QM-QMA-9015390 (LOM-SOP-ES-238) for more guidance on these options.


Sample Collection, Preservation, and Handling:

Samples are collected in wide-mouth glass containers with Teflon-lined caps and kept cool at $4^{\circ} \pm 2^{\circ}\text{C}$. The extraction must be performed within 14 days of collection, and sample analysis must be performed with 40 days of extraction.

Apparatus and Equipment:

1. HP 6890 gas chromatograph equipped with dual electron capture detectors or equivalent
2. Columns:
 - a. Restek Stx-CLPesticides 30m x 0.32mm x 0.5 μm

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b. Restek Stx-CLPesticides2 30 m × 0.32 mm × 0.25 µm

3. Integrating system such as Chrom Perfect® by Justice Laboratory Software, or equivalent. Chrom Perfect® is a data system capable of storing and reintegrating chromatographic data and determining peak areas using a forced baseline, area summation, baseline projection, and performing baseline compensation as required.
4. Various sizes of Class A volumetric flasks, pipettes, and syringes

Reagents and Standards:


A. Reagents

1. Hexane for autosampler rinse vials, stored at room temperature
2. UPC (ultra pure carrier) helium for carrier gas
3. UPC nitrogen for detector make-up gas
4. UPC hydrogen for carrier, either bottled or from a generator

B. Standards

1. All standards are prepared using Class A volumetric pipettes, syringes, and flasks.
2. All weights are made on an analytical balance.
3. Unopened ampules are stored according to the manufacturer's instructions and are stable until the expiration date provided by the manufacturer.
4. All prepared standard solutions are stored at -10° to -15°C in labeled vials or volumetric flasks.


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5. See the electronic standards database for the compound list and concentrations contained in the various mixes.
6. PCB standards are identical to those outlined in analysis 0042 (1-P-QM-WI-9015126).
7. Mix A – Restek Catalog #32292. Equivalent to the CLP (SOW OLMO3.2) Mix A and B, contains all single component pesticides and surrogates in the TCL and PPL organochlorine lists.
8. Mix E – Restek Custom Mix #55992. Contains additional organochlorine pesticides such as kepone, the *o,p* isomers of DDT, DDD, DDE, mirex, telodrin and hexachlorobenzene.
9. Toxaphene stock – Restek Catalog #32005 at 1,000,000 ppb. Prepare an intermediate by placing 2 mL into a 25-mL volumetric and bring to volume with hexane.
10. Technical chlordane stock – Ultra Scientific PP-150 (100,000 ppb in methanol).
11. Surrogate Stock (SS) – Supelco #861284 containing Decachlorobiphenyl (DCB) and Tetra-chloro-meta-xylene (TCX) at 200,000 ppb each in acetone.
12. Pest MS stock – Supelco Catalog #48796, #48196. All compounds in Mix A (#7 above)
13. EVAL stock – Restek 32074-510. Equivalent to CLP performance evaluation mix (PEM).
14. ICV stocks – These must always be from different lot numbers (or vendors) than the working calibration standards.

Accustandard Cat. #M-8081-SC and Accustandard Cat. #P-064S-10x for Methoxychlor. Prepare an intermediate by diluting 0.1 mL of stock into a 10 mL volumetric flask with hexane using the M-8081-SC stock.


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- 15 Instrument Blank (IBLK) – surrogate stock (SS) – Supelco #861284 containing Decachlorobiphenyl (DCB) and Tetrachlorometaxylene (TCX) at 200,000 ppb each in acetone.
16. Prepare working standards using the electronic standard database as a guide.
 - a. In the database, choose the category (i.e. working spike, surrogate, intermediate, etc) and the required standard.
 - b. The database contains the following information: solution description (ex. MIXA1), parent solution name, aliquot used, final volume, solvent used, concentration of each compound in the solution, and expiration date. The working standards have an expiration date of 6 months.
 - c. The calibration scheme begins at or near the reporting limit through a 20 fold of the initial calibration level.

Standard Name	Parent Solution	Aliquot (mL)	Final Volume (mL)	Solvent	Description
SW-846 SS	SS Stock	1.5	10000	Acetone or methanol	SW-846 Water Surrogate – identical to that prepared for PCB analyses
SW-846 MS	MS Stock	1.0	50	Acetone or methanol	SW-846 Water spike for single component organochlorines in TCL/PPL list

17. Standards for the PCBs are run during this analysis since some of the PCB peaks may coelute or overlap with the pesticide peaks of interest. The information is used for proper identification and interpretation of the peaks observed for each sample. Quantitation of the same peak as a pesticide and PCB can be avoided.

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Extraction:

See Organic Extraction analysis #11131 (sonication) or analysis 10496 (microwave)

Gas Chromatographic Conditions:


The conditions listed serve as a guideline only and are typically the optimum operating conditions. The analyst may make changes to the chromatographic conditions to improve the speed of analysis, linearity, sensitivity and/or improve the separation if initial and continuing calibration criteria and quality assurance criteria listed within this analysis document are met.

<i>Detector:</i>	ECD
<i>Detector Temp:</i>	330°C
<i>Oven Temp:</i>	140°C, no hold, 25°C/min to 250°C, then 22C/min to 300 C. hold 3 min
<i>Carrier:</i>	Hydrogen at constant flow of 3.4 ml/min Helium may also be substituted
<i>Makeup Gas:</i>	N ₂ at 55 mL/min
<i>Injection Size:</i>	1 µL, direct injection
<i>Injector Temp:</i>	225°C

Calibration:

- A. The pesticide analysis is run as a dual column approach. One injection is split onto two analytical columns. All initial and continuing calibration criteria listed below applies to both analytical columns.
- B. Prior to starting a new calibration, check injection count. Change the septum on the GC every 200 injections, or more frequently if needed, and allow the system to stabilize.
- C. Fill the autosampler rinse vials with clean solvent or replace vials that appear dirty.

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D. Prepare a sequence using the following order of injections:

1. Conditioner
2. IBLK (instrument blank)
3. EVALX
4. MIXA1
5. MIXA2
6. MIXA3
7. MIXA4
8. MIX A5
9. MIXE1*
10. MIXE2*
11. MIXE3*
12. MIXE4*
13. MIXE5*
14. TOXA3*
15. CHLD3*
16. AR161
17. AR21x
18. AR32x
19. AR42x
20. AR483
21. AR543
22. MDLA (MDL std for Mix A)
23. MDLE (MDL std for Mix E)
24. MDTX (MDL std for toxaphene)
25. MDCH (MDL std for chlordane)
26. ICMAX (ICV std)
27. Blank
28. LCS
29. 1234567
30. 1234567ms
31. 1234567msd
- 32.– 42. Continue running samples for a 12-hour period from last standard
43. EVALX
44. MIXA3 (CCV)
45. MIXE3* (CCV)

E. Run a breakdown evaluation standard (EVAL) at the start of an ICAL to ensure the breakdown of DDT and endrin meets the method acceptance criteria.


1. Evaluates the system for the breakdown of DDT and Endrin before sample analysis can begin.
2. Breakdown check is run ongoing throughout the run after every 12 hours.

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3. Sample analysis cannot be performed if the breakdown exceeds 15% for either compound.
- F. *MIX E is only needed when analyzing for additional pesticide including 2,4-DDE, 2,4-DDD, 2,4-DDT, kepone, mirex, HCB and telodrin.
- G. The order of injections for the multi-components is not critical as long as they are all run before sample analysis.
1. Aroclors are only used to identify possible PCB patterns which may interfere with the pesticide detections.
 2. +A single level of toxaphene and chlordane can be run for use in identifying the presence of these target compounds; however,
 - a. If either of these compounds are detected in a sample, the sample must be rerun with a full five-point curve.
 - b. The full curve can be run at the outset of a new calibration if the samples to be run are known to contain toxaphene or chlordane.
- H. The conditioner injection is usually a standard or sample that has already been injected.
1. The conditioner is used to prime the system.
 2. It is best utilized when the GC has not been running and there is a gap in time prior to starting a set of injections.
- I. Hexane blanks may also be run to allow the GC to go through some temperature programs and/or to check the cleanliness of the system.
- J. Instrument blanks (IBLK) may also be run with the continuing check standards - this is optional but frequently requested for projects.

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1. The instrument blank (IBLK) is injected after the conditioners but before the initial calibration.
2. It is used to determine that the instrument is free of background noise or contamination.

K. Initial Calibration (ICAL)

1. Calibrate using the 5 levels of the single component pesticides contained in MIX A and E, and using the single point for chlordane, toxaphene (or a full curve when sample(s) contain toxaphene or chlordane).
2. An external standard calibration is used with average calibration factor (AVGCF) for all analytes where the %RSD is $\leq 20\%$.
3. If the RSD is $> 20\%$, use a calibration curve.
 - a. Attempt a linear fit first. Use this fit if the correlation coefficient is ≥ 0.99 .
 - b. If the correlation coefficient is less than 0.99, a quadratic fit will be tried.
 - (1) A six-point calibration must be run to use quadratic.
 - (2) Prepare a sixth point somewhere within the established calibration range listed in the standards preparation section.
 - (3) Typically the pesticides in this method will not require a quadratic fit.
 - (4) Quadratic fit can not be used to extend the calibration range or bypass instrument maintenance


NOTE: For samples from **South Carolina**, a quadratic fit may not be used.

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- c. For either curve type, extrapolate or force to zero is not allowed. Set the zero to ignore. See 1-P-QM-PRO-9015498 (SOP-PP-031) for more details.
 - d. If toxaphene or technical chlordane is detected in a sample, the sample will be rerun along with a full five-point calibration for that analyte as well as check standards.
 - e. If the 0.99 curve coefficient cannot be met:
 - (1) Inspect the data points to see if one or more calibration levels appear to be off.
 - (2) Reinject or remake the standard if a specific calibration level has concentrated due to solvent evaporation, or degraded over time.
 - (3) Perform instrument maintenance as needed. See 1-P-QM-PRO-9015495 (SOP-PP-013) for troubleshooting linearity problems.
 - f. Curve types and criteria can be altered to meet client or project specific requirements as well as any regulatory agency requirements that may differ from those listed here.
4. Set up the aroclor data in the custom “datalog” program.
 - a. The retention times of the peaks used for identifying the aroclors are entered into the calibration file along with the corresponding peak heights and concentrations.
 - b. This calibration is only used to help identify potential aroclor patterns and peaks that may overlap or interfere with target pesticides.
 5. Set up the toxaphene and chlordane calibration data in the custom “datalog” program.

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- a. The retention times of the peaks used for identifying and quantifying these multi-component pesticides are entered into the calibration file along with the corresponding peak heights and concentrations.
 - b. The calibration is external standard using the AVGRF.
 - c. Toxaphene and chlordane must meet the 20% RSD criteria.
 - d. See 1-P-QM-PRO-9015499 (SOP-PP-032) for details on this program.
6. Ensure the peaks in the standards are labeled properly, including the surrogates in all injections that contain them.
 7. Set the scaling of chromatograms and peak integration parameters so that the peaks for each compound of interest are detected and integrated at the concentration of the MDL. This ensures that the LOQ and MDL can be met.


L. Initial Calibration Verification (ICV)

1. Verify the calibration curve using the ICV mixtures injected directly after the full ICAL.
2. The % difference of the concentrations for these must be within 20% difference of the nominal concentration.

M. Continuing Calibration Verification (CCV)

1. Analyze a set of check standards after each set of injections in a 12-hour period, or 20 samples, whichever comes first (samples, QC, blanks, etc.).
 - a. Use a mid level single component standard to evaluate the response of single component analytes.
 - b. Run the breakdown evaluation mix (EVAL). Analysis cannot proceed if either compound exceeds 15%.

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2. The concentration quantitated for the continuing calibration check standards must be within 20% difference (%D) of the nominal concentration.
3. Samples must be bracketed by compliant standards.
4. When confirmation of target analytes is needed, the initial calibration criteria must be met and the second column must meet the 20% continuing calibration criteria.
5. When a continuing calibration verification standard (CCV) fails to meet the QC criteria, all samples that were injected after the last CCV that passed must be re-injected.

Exception: If the CCV fails high and those targets are not detected in the associated samples, the samples can be reported.

6. The instrument blank (IBLK) may be injected after each set of continuing calibration verifications.
 - a. This is optional but frequently requested for projects.
 - b. It must be evaluated as a water matrix against the water MDL/LOQs.
 - c. The IBLK must not have any target compounds above the reporting limits.
 - (1) If a target analyte is detected in the IBLK, any associated samples with a detection for that same target must be evaluated.
 - (2) Unless the concentration in the sample is more than 10x the IBLK value, the sample must be reinjected
 - (3) Instrument maintenance, like baking the system or injection port maintenance is usually necessary to clean up the instrument.

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7. Retention time (RT) windows

- a. Established as 3× the standard deviation determined over 72 hours, or at no less than .02 minutes, applied to the initial calibration standard, usually Level 3.
- b. If the RTs for a continuing calibration standard fall outside the RT window, update the midpoint RT using that standard.
 - (1) Save this under the appropriate name to indicate an update has occurred.
 - (2) RTs cannot be updated more than once per day. All subsequent standards run within a 24-hour period must be within this window.
 - (3) If RTs are not consistent, the cause must be investigated and corrective action taken.

Procedure:

1. Make injections via an auto sampler.
2. Samples are analyzed according to the sequence in the calibration section above.
3. Retention times of peaks in the samples are compared to the standard RT windows. Peaks present on both columns (and that are also in the correct ratios to represent an aroclor) are quantitated and the high value is reported unless there are chromatographic anomalies. See 1-P-QM-PRO-9015494 (SOP-PP-011).
4. Continue running groups of samples/injections followed by check standards every 12 hours or every 20 injections, whichever comes first.

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5. If significant interference is present, schedule florisil cleanup. If elemental sulfur is present, copper cleanup the extract or have it put through GPC cleanup. If these techniques do not reduce the matrix problems, dilute the extract, analyze, and adjust the LOQs accordingly.
6. Report the results for the least dilute sample where the concentration measured is within the acceptable calibration range.

Calculations:

- A. See 1-P-QM-PRO-9015501 (SOP-PP-040) for details on all calculations/equations used to evaluate the initial and continuing calibration.
- B. Calculation of results is performed according to the following procedures:
 1. Single-component compounds

- a. Using AVGCF from initial calibration:

$$\frac{\text{Sample Height}}{\text{AVG CF}} \times \frac{\text{FV}}{\text{IW}} \times \text{DF} = \mu\text{g/kg as received}$$


- b. Using linear curve from initial calibration:

$$[(\text{Sample Height} - Y - \text{intercept}) / \text{Slope}] \times \frac{\text{FV}}{\text{IW}} \times \text{DF} = \mu\text{g / kg as received}$$

Where:

FV (final volume) = volume in mLs
 IW (initial weight) = weight in grams
 DF (dilution factor) = as needed

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2. Multi-component compounds

The peak heights generated by the integration system are used to calculate the calibration factors (CF) for peaks of interest for each quantitation peak used for toxaphene and technical chlordane.

Usually the six major peaks are chosen for quantitation. Sample concentrations are calculated per peak using Average Calibration Factor (AVG CF).

$$\frac{\text{Sample Height}}{\text{AVG CF (CF)}} \times \frac{\text{FV}}{\text{IW}} \times \text{DF} = \mu\text{g/kg as received}$$

Where:

FV (final volume) = volume in mLs

IW (initial weight) = weight in grams

AF (additional factor) = based on cleanups
(i.e., 2 mL extract florisiled to 25 mL = 12.5)

DF (dilution factor) = as needed


The final result that is reported is determined as the average of the result for each peak chosen for quantitation:

$$(\text{Result 1} + \text{Result 2} + \dots + \text{Result } n) / n = \text{Average Result}$$

NOTE: If toxaphene or technical chlordane is detected in a sample, the sample will be rerun along with a full five-point calibration for that analyte and a check standard.

3. A breakdown mix (EVALX) containing p,p'-DDT and Endrin is run to check for breakdown. The breakdown must not exceed 15% for either compound. Breakdown is calculated as:

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$$\% \text{ Breakdown for } p,p'\text{-DDT} = \frac{pk \text{ ht (area) of } p,p'\text{-DDE} + p,p'\text{-DDD}}{pk \text{ ht (area) of } p,p'\text{-DDE} + p,p'\text{-DDD} + p,p'\text{-DDT}} \times 100$$

$$\% \text{ Breakdown for Endrin} = \frac{pk \text{ ht (area) of Endrin Aldehyde} + \text{Endrin Ketone}}{pk \text{ ht (area) of Endrin Aldehyde} + \text{Endrin Ketone} + \text{Endrin}} \times 100$$

If breakdown fails, injector maintenance must be performed. Analysis cannot proceed until breakdown check passes.

Statistical Information/Method Performance:

Generate method detection limits (MDLs) and limits of quantitation (LOQs) according to (1-P-QM-QMA-9017309) LOM-SOP-ES-203. Perform an MDL study on each instrument used for the analysis (NELAC allows for an annual verification of the MDL in lieu of an EPA MDL study). Determine the MDL by taking seven spiked replicates through the entire extraction and analysis procedure. Compare and pool results to determine the final reporting MDL. The department management maintains annual study data. The department manager requests that the QA Department update to the LIMS as needed. Update the department database via a download from the LIMS.


QC Acceptance limits are established as statistical limits. See 1-P-QM-PRO-9015496 (SOP-PP-025) for further information on monitoring and establishing limits.

Quality Assurance/Quality Control:

Each extraction batch (up to 20 samples) must contain a method blank, a laboratory control spike sample (LCS), and either an unspiked background sample (US), a matrix spike (MS), a matrix spike duplicate (MSD) or an LCS/LCSD.

The TCL single-component pesticides of interest for each analysis are routinely spiked. Mirex, *o,p*-DDE/DDD/DDT, telodrin, and HCB are not spiked since this would result in co-elution with the other spiked compounds. These can be spiked at a client's request for special projects, within our scope of accreditation.

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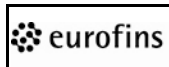
DCB and TCX are added as surrogates to each sample and QC to monitor the efficiency of the extraction, the operation of the autosampler, and to monitor retention times throughout the GC run.

QC limits for surrogates, LCS/LCSD, and MS/MSD are established through statistical analysis of historical data. The limits are evaluated every 6 months and updated as needed. The limits are maintained in the LIMS for the relevant analysis numbers.

See 1-P-QM-PRO-9015493 (SOP-PP-002) for details on QC acceptance criteria and corrective action.

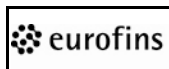
If any client, agency, or state has more stringent QC or batch requirements, these must be followed.

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Eurofins Document Reference	1-P-QM-WI -9015105	Revision	8
Effective Date	Sep 19, 2014	Status	Effective
Historical/Local Document Number	Analysis DOD - 10498, 10809, 10810, 10811, 10812, 10813, 10814, 11630, 11916		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

Prepared by	Heidi Roberts
Reviewed and Approved by	Richard Karam;Review;Monday, September 15, 2014 2:09:30 PM EDT Kathryn Brungard;Approval;Monday, September 15, 2014 2:29:24 PM EDT

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Revision Log:

Revision: 8		Effective Date:	This version
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Sample Collection, Preservation and Handling	Enhancement	Added hold time for the extraction	
Procedure 11	Enhancement	Added information on temperature of microwave and documentation	

Revision: 7		Effective Date:	Jul 18, 2014
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Historical/ Local Document Number	LIMS scan pertains to the procedure	Add analysis 11916	
Document Title	Clarification	Change to include method : Microwave Extraction by Method 3546 for Semivolatiles	
Throughout Document	Reflect re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers	
Procedure 6.	Enhancement	Added analysis 11917 and updated current spiking practices.	
	Scan deactivated in LIMS	Removed 10722	

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Reference:

1. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 3546, February 2007.
2. *MARS Operation Manual*, Revision 2, February 2006.
3. *Chemical Hygiene Plan*, current version.

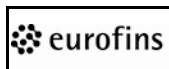
Cross Reference:

Document	Document Title
Analysis #0949, 1309, 1476, 1536, 1946, 1947, 1953, 2035, 2395, 4615, 4678, 4688, 6387, 6397, 7804, 7805, 10032, 10723, 10724, 10727, 10728, 11013	Determination of Semivolatile Organic Compounds by Method 8270C
Analysis #2487	Food and Tissue Preparation
Analysis #4220, 4221	Determination of Tetraethyl Lead (TEL) and Tetramethyl Lead (TML) by GC/MS Analysis
Analysis #8357, 0038, 0039, 10010, 10137, 10138, 10725, 11915, 11917, 12969, 12970, 12971	Semivolatiles by Methods 8270C/D SIM
Analysis #10242, 10262, 11305, 11597	Determination of Parent and Alkyl Substituted Polynuclear Aromatic Hydrocarbons (PAHs), Alkanes and Geochemical Biomarkers by Gas Chromatography/Mass Spectrometry (GC/MS-SIM)
Analysis #10461, 10462, 10726	Determination of Semivolatile Organic Compounds by Method 8270D
Analysis #10962, 11622	Determination of N-Nitrosodimethylamine (NDMA) in Water and Soil by EPA 1625C
1-P-QM-PRO-9015406	Semivolatile Extract Cleanup Using Gel Permeation Chromatography
1-P-QM-PRO-9015452	Semivolatile Spiking and Calibration Standards
1-P-QM-PRO-9015475	Glassware Cleaning for Organic Extractions
1-P-QM-PRO-9015490	Organic Extraction Standards Storage and Handling

Scope:

This procedure is used to clearly outline the steps taken for the extraction of semivolatile compounds from soils or solid wastes using microwave technology.

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Basic Principles:

A portion of sample is placed in an extraction vessel. Surrogate standards are added to each sample to monitor recovery. The vessel is then loaded into the instrument and extracted. The organic compounds present in the sample dissolve in the solvent, which is then removed. The extract is concentrated to about 1 mL. At this time, it is determined if the sample requires gel-permeation cleanup (GPC). If needed, the extract is diluted to 10 mL, then cleaned using GPC and concentrated to 0.5 mL. If GPC is not necessary, the extract is brought to 1.0 mL and bottled. The extract is stored in an amber-autosampler vial in the freezer until analysis.

Reference Modifications:

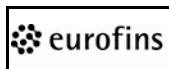
Base/Neutral and Acid compounds are added at a concentration of 50 ppm in the matrix spiking and LCS solutions so that the concentrations in the extract are within calibration range.

After Procedure Step 24, the joint of the K-D is not rinsed with fresh solvent when the ampule is removed. Quad and MDL studies have shown that this step is unnecessary.

Definitions:

1. GPC – Gel Permeation Cleanup
2. Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) – A sample of known composition analyzed with each batch of samples to demonstrate laboratory accuracy. The samples either naturally contain the analytes of interest or are clean samples fortified with known concentrations used to demonstrate laboratory accuracy. A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test.
3. MARS – Microwave Reactions Systems

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4. Matrix spike/matrix spike duplicate (MS/MSD) – A sample created by fortifying a second aliquot of a water or soil sample with some or all of the analytes of interest. The concentration added is known and compared to the amount recovered to determine percent recovery. Matrix spike recoveries provide information about the accuracy of the method in light of the matrix analyzed. A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test.

Interferences:

Impurities in solvents, reagents, glassware, or other hardware used in sample processing can interfere with the method. All glassware must be rinsed with solvent before use. A method blank is performed with each batch of samples to demonstrate that the extraction system is free of contaminants.

Safety Precautions and Waste Handling:

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local laws and regulations.

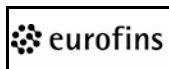
See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined. Each chemical compound must be treated as a potential health hazard. Exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as fume hoods, lab coats, safety glasses, and gloves.

Extracts are concentrated on a steam bath; caution must be exercised while working around this apparatus.

All solvent waste generated from this preparation must be collected for recycling (if applicable) or disposed of in the designated containers. These are then transferred to the lab-wide disposal facility. Any solid waste material (disposable pipettes, broken glassware, pH paper) is disposed of in the normal solid waste collection containers.

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Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each technician performing the extraction must work with an experienced employee for a period of time until they can independently perform the extraction. Proficiency is measured through a documented Initial Demonstration of Capability (IDOC).

The IDOC and the DOC consists of four laboratory control samples (or alternatively, one blind sample for the DOC) that is carried through all steps of the extraction and meet the defined acceptance criteria. The criteria for the LCSs include the calculation of mean accuracy and standard deviation.

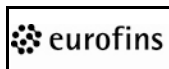
Sample Collection, Preservation and Handling:

Samples are collected in glass wide-mouth jars with PTFE-lined lids and stored under refrigeration at 0° to 6°C, not frozen, prior to extraction. Samples must be extracted within 14 days of sample collection. Extracts are stored in the freezer at -10° to -15°C and must be analyzed within 40 days of the date extracted.

Apparatus and Equipment:

1. MARS Xpress – CEM Corp. or equivalent
2. Kuderna-Danish (K-D) assembly with appropriate ampule for concentrating the solvent used during the extraction
3. Steam bath, VWR/LLI Model #1127 or equivalent
4. Balance – Capable of weighing to 0.01 g

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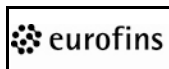
 <div>Lancaster Laboratories Environmental</div>	<p>Document Title: Microwave Extraction by Method 3546 for Semivolatiles</p>	<p>Eurofins Document Reference: 1-P-QM-WI -9015105</p>
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5. Beakers – Stainless steel – Assorted sizes
6. Scoop
7. Pipettes – Class A, assorted sizes
8. Wash bottles – Teflon[®]
9. Teflon[®]-boiling chips
10. Micro Snyder columns
11. Disposable pipettes
12. Autosampler vials – Amber, crimp top
13. Funnels – Stainless steel or Teflon[®]
14. Extraction vessels
15. Frits – Various
16. Sodium sulfate columns

Reagents and Standards:

1. Methylene chloride (CH₂Cl₂) – Pesticide grade or equivalent. Store at room temperature for up to one year.
2. Acetone – Pesticide grade or equivalent. Store at room temperature for up to one year.
3. Sodium Sulfate (Na₂SO₄) – Reagent grade or equivalent. Bake at 400°C for a minimum of 4 hours in a shallow pan to remove contaminants. Store in a glass jar for up to 1 year after baking.

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NOTE: All QC standards added during extraction process are prepared by Organic Extractions using instructions generated by the standards database. Detailed instructions can be found in the corresponding analytical analyses for scans 4221, 10242, 10723, 10724, 10725, 10726, 11622 and 11917.

Calibration:

Not applicable to this procedure.

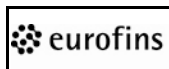
Preparation of Glassware:

See 1-P-QM-PRO-9015475 (SOP-OE-001).

Procedure:

1. Weigh 30 - 30.5 g of sample into a labeled stainless steel beaker.
 - a. Record the initial weight and any comments about the sample in the extraction log.
 - b. Use of alternate weights to meet certain reporting limits is acceptable. However, if over 30 g is used the sample must be divided among multiple vessels and the extracts combined.
 - c. Process all tissues by Analysis #2487 prior to extraction.
2. Add 5 g of sodium sulfate to each sample and mix.
 - a. If the sample has high water content or is a clay-like soil, add an additional 10 g of sodium sulfate.
 - b. Mix the sodium sulfate and sample until a free-flowing consistency is reached.

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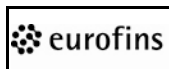
 <div>Lancaster Laboratories Environmental</div>	<div>Document Title:</div> <div>Microwave Extraction by Method 3546 for Semivolatiles</div>	<div>Eurofins Document Reference:</div> <div>1-P-QM-WI -9015105</div>
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3. Perform the background, MS, and MSD on three separate aliquots of a field sample.
4. Prepare the Blank, LCS, and LCSD (if applicable) by filling a Teflon[®] extraction vessel with 35 g of sodium sulfate.

Record 30 g on the extraction log. (The sodium sulfate used for the QC samples is measured out as 35 g to account for the 30 g “sample” plus the 5g of sodium sulfate.)

5. Place each sample into its clearly marked corresponding extraction vessel. Use a funnel to prevent spillage and loss of sample.
6. Add surrogate standards and spiking solutions using volumetric pipettes. Add surrogates to all samples, blanks and spiked samples. Add spikes to the LCS, LCSD (if applicable), MS, and MSD samples. Typically they are as follows:
 - a. Analysis 10727 – Surrogate: 1.0mL of BNA surrogate. Spike: 1.0mL of LCS spike.
 - b. Analysis 10725 – Surrogate: 1.0mL of BNA surrogate. Spike: 1.0mL of SIM LCS spike.
 - c. Analysis 10728 – Surrogate: 1.0mL of BNA surrogate. Spike: 1.0mL of LCS Spike. If required, spike 1.0 mL of Benzenthionol spike in a separate LCS/LCSD.
 - d. Analysis 10723, 10726, 1947 – Surrogate: 1.0mL of BNA surrogate. Spike: 1.0mL each of LCS and ApplX Mix #1. If required, Spike 1.0 mL of ApplX Mix #2 in a separate LCS/LCSD.
 - e. Analysis 10724 – Surrogate: 1.0mL of BNA Surrogate. Spike: 1.0mL of LCS spike.

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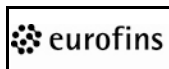
- f. Analysis 4221 – Surrogate: 1.0mL of BNA Surrogate. Spike: 1.0mL of TEL/TML spike.
- g. Analysis 10242 – Surrogate: 1.0 mL of BNA surrogate. Spike: 1.0 mL of “Client Specified” spike. If required, 1.0 mL of DPnB spike.
- h. Analysis 11622 – Surrogate: 1.0 mL of NDMA Surrogate. Spike: 1.0 mL of NDMA spike
- i. Analysis 11917 – Surrogate: 1.0 mL of BNA surrogate. Spike: 1.0mL of SIM LCS.

See 1-P-QM-PRO-9015490 (SOP-OE-017) for storage and handling of spikes and 1-P-QM-PRO-9015452 (SOP-EX-001) for SVOA spiking and calibration standards.

NOTE: If the sample is being divided among multiple vessels, the spike must be divided among the vessels as well.

7. Add 30 mL of 50% acetone in methylene chloride to each vessel.
8. Cap each vessel according to manufacturer’s guidelines.
9. Invert each vessel to ensure mixing of sample and solvent.
10. Place the vessels into the carousel. When all samples are loaded, place the carousel into the microwave.
11. Run Program “LL Soils”. See Table I for Instrument conditions. Verify that the run reaches the 100 °C temperature requirement and document on batchlog.
12. Uncap the cooled vessel.

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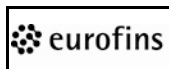
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13. Pour the extract and sample into a column filled with approximately 10cm of sodium sulfate on top of a Kuderna-Danish (K-D) assembly containing a Teflon[®]-boiling chip.
14. Rinse the vessel with 10 to 20 mL of 50% acetone in methylene chloride from a wash bottle.
15. Place a 3-ball Snyder column on the K-D set-up, wet the column with 50% acetone in methylene chloride.
16. Concentrate over a steam bath at 84° to 99°C until the apparent volume in the ampule reaches 1 to 2 mL.

This steam bath temperature ensures concentration in a reasonable length of time.

17. Allow the sample to cool 10 minutes. Approximately 3 mL condenses into the ampule during this time.
18. Attach the ampule of the K-D to a micro-Snyder column, and concentrate the extract to below 1 mL. Allow the sample to cool.
19. If GPC is not needed, go to Procedure Step 20.
 - a. If GPC is needed, dilute the extract to 10 mL with methylene chloride.
 - b. Place the extract into the appropriate GPC queuing area for storage until the cleanup is performed. See 1-P-QM-PRO-9015406 (MC-OE-003).
 - c. Once the GPC clean up is completed, go to Step 20.
20. Place the extract in a Kuderna-Danish containing a Teflon[®]-boiling chip.
21. Place a 3-ball Snyder column on the set-up, wet the column with methylene chloride.

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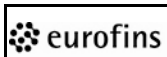
 <div> Lancaster Laboratories Environmental </div>	Document Title: Microwave Extraction by Method 3546 for Semivolatiles	Eurofins Document Reference: 1-P-QM-WI -9015105
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22. Concentrate over a steam bath at 80° to 90°C until the apparent volume reaches 1 to 2 mL.
23. Allow the sample to cool at least 10 minutes. Approximately 3 mL condenses into the ampule at this time.
24. Attach the ampule of the K-D to a micro-Snyder column, and concentrate the extract to below 0.5 mL. Allow the sample to cool.
25. Bring to a final volume of 1.0 mL (0.5 mL if GPC was performed) with methylene chloride in a labeled amber GC vial.
 - a. The final volume is determined by placing the extract into an amber-autosampler vial and comparing the level in the vial to a reference vial containing the exact targeted final volume.
 - b. The vials used for bottling must be the same lot number as the reference vial.
 - c. Methylene chloride is added to the extract using a disposable pipette until exactly the same level is in both vials.
 - d. If too much solvent is added to the sample vial, remove the extract from the vial and concentrate it by micro-snyder to slightly less than the targeted final volume and rebottle.
 - e. Cap the vial and store in the freezer until analysis.
 - f. Record the final volume in the extraction log.

Calculations:

See analysis method.

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Statistical Information/Method Performance:

See analysis method.

Quality Assurance/Quality Control:

For each batch of samples extracted, a method blank, an LCS, an unspiked background sample, an MS, and an MSD must be extracted. If insufficient volume of sample is available for MS/MSD, then an LCSD must be prepared instead.

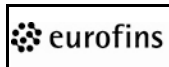
A batch is defined as the samples to be extracted on any given day but not to exceed 20 field samples. If more than 20 samples are prepared in a day, an additional batch must be prepared. If any client, state, or agency has more stringent QC or batching requirements, these must be followed.

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Table I

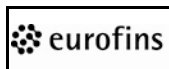
Instrument Conditions

Power:	1600W
Ramp Temperature:	100°C
Ramp Time:	30 minutes
Hold Time:	10 minutes
Cool Down Time:	20 minutes

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Eurofins Document Reference	1-P-QM-WI -9015103	Revision	5
Effective Date	Sep 29, 2014	Status	Effective
Historical/Local Document Number	Analysis DOD - 10496, 11141		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

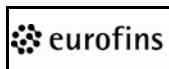
Prepared by	Heidi Roberts
Reviewed and Approved by	Susan Goshert;Review;Friday, September 19, 2014 4:40:15 PM EDT Richard Karam;Review;Friday, September 26, 2014 10:44:51 AM EDT Kathryn Brungard;Approval;Friday, September 26, 2014 1:12:36 PM EDT

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Revision Log:

Revision: 5		Effective Date:	This version
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Throughout Document	Reflect re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers	
Document Title	Enhancement	Add method 3546	
Cross Reference	Method Update	Added Analysis #10590	
Reagents and Standards 5.	Method Update	Added Analysis #10590.	
Procedure 3.b(1) through (5)	Clarification	Reflect current spiking requirements and renumbered steps.	
Procedure 8.	Enhancement	Added information on temperature of microwave and documentation	
Procedure 15	Clarification	Added "Mirex" to the statement.	

Revision: 04		Effective Date:	Mar 13, 2012
Section	Justification	Changes	
Revision Log	Formatting requirements per LOM-SOP-LAB-201	Removed revision logs up to the previous version.	
Header (Number)	New Parallax Scan	Added analysis 11141	
Procedure 3.b.	Correction	Added additional spike requirement for analysis #1420.	
Quality Assurance/ Quality Control	Clarification	Removed unnecessary verbiage.	

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Reference:

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 3546, Revision 0, February 2007.
2. MARS Operation Manual, Revision 2, February 2006.
3. *Chemical Hygiene Plan*, current version.

Cross Reference:

Document	Document Title
Analysis #1363, 1420, 4225, 10738	Analysis of Pesticides in Solid Samples using Gas Chromatography with Electron Capture Detection (GC-ECD)
Analysis #2487	Food and Tissue Preparation
Analysis #10590	Analysis of Pesticides by 8081B in Solid Samples using GC-ECD
1-P-QM-PRO-9015407	Pesticide Extract Cleanup Using Gel Permeation Chromatography
1-P-QM-PRO-9015475	Glassware Cleaning for Organic Extractions
1-P-QM-PRO-9015477	Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
1-P-QM-PRO-9015485	Pesticide Extract Concentration Using a Zymark TurboVap II Concentration Workstation
1-P-QM-PRO-9015490	Organic Extraction Standards Storage and Handling

Scope:

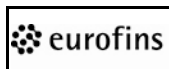
This procedure is used for the extraction of organochlorine pesticides from soils or solid wastes.

Basic Principles:

A portion of sample is placed in an extraction vessel. Surrogate standards are added to each sample to monitor recovery. The vessel is then loaded into the instrument and extracted. The organic compounds present in the soil dissolve in the solvent, which is then removed. The sample is then concentrated and bottled.

Several cleanup procedures are used as needed to eliminate matrix interferences before the sample is analyzed. They include: florisil, copper, and gel-permeation cleanup (GPC).

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Reference Modifications:

The joint of the K-D is not rinsed with fresh solvent when the ampule is removed. Quad and MDL studies have shown that this step is unnecessary.

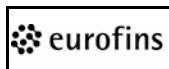
Definitions:

1. Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) – A sample of known composition analyzed with each batch of samples to demonstrate laboratory accuracy. The samples either naturally contain the analytes of interest or are clean samples fortified with known concentrations. This is used to demonstrate laboratory accuracy. A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test.
2. Matrix spike/matrix spike duplicate (MS/MSD) – A sample created by fortifying a second aliquot of a water or soil sample with some or all of the analytes of interest. The concentration added is known and compared to the amount recovered to determine percent recovery. Matrix spike recoveries provide information about the accuracy of the method in light of the matrix analyzed. A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test.
3. Surrogates – Organic compounds which are similar to the analytes of interest but are not naturally occurring in environmental samples. Surrogates are spiked into all standards and every field and QC sample prior to extraction and analysis to provide information regarding the effects of the sample

Interferences:

Method interferences are caused by impurities in solvents, reagents, glassware, or other hardware used in sample processing. All glassware must be rinsed with solvent before use. A method blank is performed with each batch of sample to demonstrate that the extraction system is free of contaminants.

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Safety Precautions and Waste Handling:

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined; however, each chemical compound must be treated as a potential health hazard. Exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as fume hoods, lab coats, safety glasses, and gloves.

The extracts are concentrated on a steam bath. Caution must be exercised while working around this apparatus.

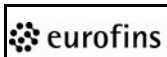
All solvent waste generated from this preparation must be collected for recycling (if applicable) or disposed of in the designated containers. These are transferred to the lab-wide disposal facility. Any solid waste material (disposable pipettes, broken glassware, pH paper) is disposed of in the normal solid waste collection containers.

Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each technician performing these techniques must work with an experienced technician for a period of time until they can independently perform the procedure. Proficiency is measured through an Initial Demonstration of Capability (IDOC).

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The IDOC and the DOC consists of four laboratory control samples (or alternatively, one blind sample for the DOC) that are carried through all steps of the procedure and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation.

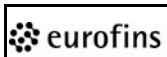
Sample Collection, Preservation, and Handling:

Samples are collected in wide-mouth glass jars with PTFE-lined lids and stored under refrigeration at 0° to 6° C, not frozen, prior to extraction.. Samples must be extracted within 14 days of collection. Extracts are stored in the freezer at -10° to -15°C.

Apparatus and Equipment:

1. MARS Xpress – CEM Corp. or equivalent
2. Kuderna-Danish (K-D) assembly with appropriate ampule for concentrating the solvent used during concentration
3. Steam bath, VWR/LLI Model #1127 or equivalent
4. N-Evap with nitrogen supply
5. Beakers – stainless steel, assorted sizes
6. Pipettes – Class A, assorted sizes
7. Graduated cylinders – Class A, assorted sizes
8. Pipettes – disposable
9. Balance – capable of weighing to 0.01 g
10. Teflon®-wash bottles
11. Vials – assorted sizes

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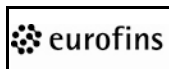
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12. Teflon®-boiling chips
13. Forceps
14. Scoop
15. TurboVap II concentration workstation w/appropriate concentration tubes – Zymark or equivalent
16. Funnels – stainless steel or Teflon®
17. Extraction vessels
18. Frits – various
19. Sodium Sulfate Columns
20. GPC – J2 Scientific or equivalent

Reagents and Standards:

1. Hexane – Pesticide grade or equivalent. Fisher Optima grade or equivalent, stored in a FisherPak at room temperature for one year after receipt.
2. Acetone – Pesticide grade or equivalent. Fisher Optima grade or equivalent, stored in a FisherPak at room temperature for one year after receipt.
3. Methylene Chloride (CH₂Cl₂) – Pesticide grade or equivalent. Fisher Optima grade or equivalent, stored in a FisherPak at room temperature for one year after receipt.
4. Sodium Sulfate (Na₂SO₄) – Reagent grade or equivalent. Bake at 400°C for a minimum of 4 hours in a shallow pan prior to use to remove organic contaminants. After baking, store in a glass jar at room temperature for up to 1 year.

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5. All QC standards added during extraction process are prepared by Organic Extractions using instructions generated by the standards database. Detailed instructions can be found in the corresponding analytical Analysis #1363, 1420, 4225, 10738, and #10590.

Preparation of Glassware:

See 1-P-QM-PRO-9015475 (SOP-OE-001).

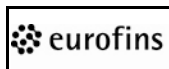
Calibration:

Not applicable to this procedure.

Procedure:

1. Weigh out 30 -30.5 g of sample into a stainless steel beaker.
 - a. Record the initial weight and any comments about the sample in the extraction log.
 - (1) Use of alternate weights is acceptable if necessary due to client specifications, amount of sample available, or sample matrix.
 - (2) Alternate weights may be required to meet certain limits. If over 30 g is to be used, divide the sample among multiple vessels and combine the extracts
 - b. Process all tissues by Analysis #2487 prior to extraction.
 - c. The background, MS, and MSD are performed on three separate aliquots of a field sample.
 - d. Add 5 g of sodium sulfate to each sample and mix.

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(1) If the sample has a high water content or is a clay-like soil, add an additional 10 g of sodium sulfate.

(2) Mix the sodium sulfate and sample until a free-flowing consistency is reached.

e. The Blank, LCS, and LCSD (if applicable) are prepared by filling a Teflon® extraction vessel with 35 g of sodium sulfate.

Record 30 g on the extraction log. (The sodium sulfate used for the QC samples is measured out as 35 grams to account for the 30 gram “sample” plus the 5 grams of sodium sulfate.)

2. Carefully place each sample into its clearly marked corresponding extraction vessel. A funnel is used to prevent spillage and loss of sample.

3. Use pipettes to add surrogate standards and spiking solutions.

a. Surrogates – 1.0 mL of SW-846 surrogate is added to all samples, blanks, and spikes.

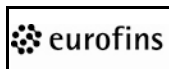
b. Spiking solutions – Spiking solutions are added to the LCS, LCSD (if applicable), MS, and MSD samples. The type of spike is determined by an analysis number. Typically they are as follows:

(1) Spike 1.0 mL SW-846 spike.

Analysis #1420 has an additional LCS/LCSD spiked with 1.0 mL of Alachlor spike.

(2) If the client requests Kepone, spike an additional LCS/LCSD with 1.0 mL of Kepone spike.

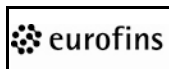
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- (3) If the client requests Mirex or Mirex & Kepone together, spike an additional LCS/LCSD with 1.0 mL of Mirex spike (also known as MIX E spike)
 - (4) These may change to accommodate specific client requirements as appropriate.
 - (5) See 1-P-QM-PRO-9015490 (SOP-OE-017) for storage and handling of spikes.
4. Add 30 mL of 50% acetone in methylene chloride to each vessel.
 5. Cap each vessel according to manufacturer's guidelines.
 6. Invert each vessel to ensure mixing of sample and solvent.
 7. Place the vessels into the carousel. When all samples are loaded, place the carousel into the microwave.
 8. Run Program "LL Soils". See Table 1 for instrument conditions. Verify that the run reached 100°C and document on the batchlog.
 9. Uncap the cooled vessel.
 10. Pour the extract and sample into a column filled with approximately 10cm of sodium sulfate on top of a Kuderna-Danish (K-D) assembly containing a Teflon®-boiling chip. Rinse the vessel with 10-20 mL of methylene chloride from a wash bottle.
 11. Place a 3-Ball Snyder column on the K-D set-up, wet the column with methylene chloride, and concentrate over a steam bath at 85° to 99°C.

This steam bath temperature ensures concentration in a reasonable length of time.

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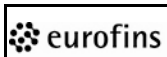
12. If the sample requires GPC, skip this Step.

When the apparent volume in the ampule is 3 to 5 mL, use a graduated cylinder to add approximately 50 mL of hexane directly to the KD through the Snyder column.

****Do not allow the ampule to go dry since loss of analytes will result.****

13. When the apparent volume in the ampule again reaches 3 to 5 mL remove the sample from the bath and allow to cool for 10 minutes.
14. Remove the ampule and use a wash bottle to adjust the final volume.
 - a. Samples that do not require GPC: Adjust final volume to exactly 10 mL with hexane in a calibrated ampule. Mix thoroughly with a disposable pipette.
 - b. Samples that require GPC: Adjust the final volume to exactly 10 mL with methylene chloride. Mix thoroughly with a disposable pipette.
 - (1) Perform GPC cleanup following 1-P-QM-PRO-9015407 (MC-OE-004).
 - (2) When GPC cleanup is complete, concentrate the extract to final volume 5 mL using a TurboVap as described in 1-P-QM-PRO-9015485 (SOP-OE-012).
15. Florisil the sample 2 mL to 2 mL as described in the Pesticide Florisil Cleanup section of 1-P-QM-PRO-9015477 (SOP-OE-004).
 - a. Bottle twice in an appropriately labeled crimp-top autosampler vial.
 - b. Place the remaining extract in an appropriately labeled screw-cap vial.
 - c. Store all extracts in the freezer at -10° to -15°C.

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NOTE: DO NOT florisil the Kepone or Mirex LCS/LCSD if the batch contains them.

16. Perform copper cleanup upon request by the analytical department.
 - a. Removes sulfur interference from extracts.
 - b. See 1-P-QM-PRO-9015477 (SOP-OE-004) for this procedure.

Calculations:

See analysis method.

Statistical Information/Method Performance:

See analysis method.

Quality Assurance/Quality Control:

A batch is defined as the samples to be extracted in any given day but not to exceed 20 field samples. If more than 20 samples are prepared in a day, an additional batch must be prepared.

For each batch of samples extracted, a blank, an LCS, MS, and MSD must be extracted. If insufficient volume of sample is available for MS/MSD, then an LCSD must be prepared instead.

If any client, state, or agency has more stringent QC or batching requirements, these must be followed.

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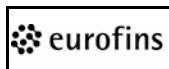
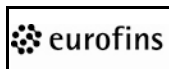
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Table I

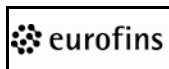
LL Soils: Instrument Conditions

Power: 1600W
Ramp Temperature: 100°C
Ramp Time: 30 minutes
Hold Time: 10 minutes
Cool Down Time: 20 minutes

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Eurofins Document Reference	1-P-QM-WI -9015100	Revision	5
Effective Date	Jan 23, 2015	Status	Effective
Historical/Local Document Number	Analysis DOD - 10461, 10462, 10726		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

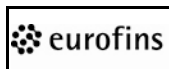
Prepared by	Holly Berry
Reviewed and Approved by	Richard Karam;Review;Thursday, January 15, 2015 12:32:05 PM EST Kathryn Brungard;Approval;Friday, January 16, 2015 8:44:16 AM EST

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Revision Log:

Revision: 5		Effective Date:	This version
Section	Justification	Changes	
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
Throughout Document	Reflect re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers	
Document Title	Enhancement	Add matrices and instrumentation to title. Semivolatile Organic Compounds by Method 8270D in Aqueous and Non-Aqueous Matrices using GC-MS	
Basic Principles	Correction	Changed quadruple to quadrupole	
Sample Collection, Preservation, and Handling	Reflects current practices	Changed sample storage conditions	
Procedure D	Correction	Changed return to retune	
Procedure F	Reflects current practices	Changed acceptance criteria #4 from average areas to areas from the mid-level standard of the calibration	
Quality Assurance/Quality Control	Reflects current practices	Updated acceptance criteria to specify that LCS and MS/D windows are updated semiannually and not annually	

Revision: 04		Effective Date:	Oct 25, 2012
Section	Justification	Changes	
Revision Log	Formatting requirement per LOM-SOP-LAB-201	Removed revision logs up to the previous version	
Reference	Enhancement	Added revision numbers for SW-846 methods.	
Personnel Training and Qualifications	Change in Demonstration of Capability requirements	Added reference to LOM-SOP-ES-238.	
Procedure F.	Concentration of continuing calibration standard changed.	Removed requirement for alternating calibration levels. Now run continuing calibration at the fifth level (30 µg/mL) only.	

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Reference:

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 8270D, Rev. 4, February 2007.
2. Test Methods for Evaluating Solid Wastes, SW-846 Method 8000B, Rev. 2, December 1996.
3. *Federal Register*, Vol. 57, No. 227, November 24, 1992, p. 55114 (TCLP).
4. *Federal Register*, Vol. 57, No. 160, August 18, 1992, p. 37203 (CCW).
5. *Chemical Hygiene Plan*, current version.

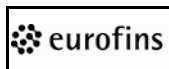
Cross Reference:

Document	Document Title
1-P-QM-FOR-9007858	Nonconformance Form
1-P-QM-PRO-9015393	GC/MS Preventative and Corrective Maintenance
1-P-QM-PRO-9015452	Semivolatile Spiking and Calibration Standards
1-P-QM-QMA-9015390	Demonstrations of Capability

Scope:

This method is suitable for the determination of the concentration of certain semivolatile organic compounds (priority pollutant list, target compound list, Appendix IX list, TCLP list, and CCW list) found in soils, tissues, waters, and leachates. Typical limits of quantitation (LOQ) achieved are 33 µg/kg for soils, 132 µg/kg for tissues, 1 µg/L for waters and 0.002 mg/L for leachates. Specific compound lists and associated method detection limits (MDLs) and LOQ can be found in the Laboratory Information Management System (LIMS) under the analysis numbers listed in the header of this SOP.

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Basic Principles:

A 1-microliter mixture of organic compounds in methylene chloride is injected onto a fused silica capillary column coated with a relatively non-polar stationary phase, which is enclosed in a temperature controlled oven. A carrier gas, ultra pure helium, passes continuously through the column. The GC oven is temperature programmed and the organic mixture separates into its individual components as it moves along the length of the column. This separation is a function of the polarity and boiling point of the individual compounds. The column empties into a mass selective detector. When a compound reaches the detector, it is bombarded by high energy electrons (70 eV). This causes the compounds to fragment, forming ions. By applying various voltages to lenses in the area where the ions are formed, the positive ions are thrust into a quadrupole mass analyzer, which selects for a given mass fragment at a given time. These selected fragments reach an electron multiplier, which detects and generates a signal for each mass fragment. The signals are amplified and sent to a computer making storage and manipulation of the data possible. Target compounds are identified on the basis of relative retention times and spectral match to standards. Standards are injected every 12 hours on each system used for analysis.

Quantification is achieved via use of the internal standard calibration technique. The average relative response factor of a multi-point calibration is used for quantification when the appropriate criteria are met.

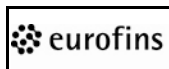
Interferences:

Method interferences may be caused by impurities in solvents, reagents, and glassware, or other hardware used in the processing of samples. All glassware is solvent rinsed before use and a method blank is performed with each extraction batch to demonstrate that the extraction system is free of contamination.

Safety Precautions and Waste Handling:

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

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See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined; however, each chemical compound and reagent should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means are available such as fume hoods, safety glasses, lab coats, and gloves.

All solvent waste generated from this analysis must be collected for recycling (if applicable) or must be disposed of in designated containers. These are then transferred to a lab-wide disposal facility. Any solid waste material (disposable pipettes, broken glassware, pH paper) must be disposed of in the normal solid waste collection containers or sharps containers, as applicable.

Personnel Training and Qualifications:

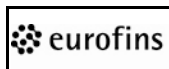
Education Requirement: Degree in science or relevant experience.

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each analyst performing instrumental analysis must work with an experienced analyst for a period of time until they can independently perform daily maintenance, column and source changing procedures, calibration techniques, interpret chromatograms, calculation, data review, and enter data into the LIMS. Proficiency is measured through documented audits of the tasks listed and over checking of data as well as an Initial Demonstration of Capability (IDOC).

The IDOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four laboratory control samples or one blind sample. Refer to 1-P-QM-QMA-9015390 (LOM-SOP-ES-238 for more guidance on these options.

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Sample Collection, Preservation, and Handling:

Water samples may be preserved with sodium thiosulfate ($\text{Na}_2\text{S}_2\text{O}_3$) and must be extracted within 7 days of collection. Solid samples are not preserved and must be extracted within 14 days of collection.

Samples are stored at 0° to 6°C, not frozen. Extracts must be analyzed within 40 days of extraction and are stored in amber vials at $\leq -10^\circ\text{C}$ (freezer).

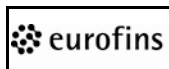
Apparatus and Equipment:

1. 25- μL syringe
2. Hewlett-Packard Model 5890 (Series I and II) or Hewlett-Packard/Agilent 6890 Gas Chromatograph or equivalent
3. Hewlett-Packard Models 5971, 5972, and Hewlett-Packard/Agilent 5973, 5975 Mass Selective Detector or equivalent
4. Thru-Put Systems Target Acquisition Software/Oracle Database or equivalent

Reagents and Standards:

- A. Standard/spiking concentration and reagent vendors are subject to change without notification.
- B. Reagents
 1. Methylene chloride, pesticide grade. Store at room temperature.
 2. UPC (ultra pure carrier) helium for carrier gas.

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C. Standards

1. Documentation of all stocks and calibration standards is maintained in the Standards Database (electronic standard preparation notebook) or in a standards preparation logbook.
2. 50 ng/μL Solution of decafluorotriphenylphosphine (DFTPP) containing pentachlorophenol, benzidine and DDT, prepared from Absolute Standards, Inc., Part #43030 in methylene chloride or equivalent. Store at 0° to 6°C for up to 6 months.
3. Supelco Equity Semivolatile Internal Standard Mix, Part #46955-U or equivalent, 1000 μg/mL in methylene chloride. Ampulated solutions are maintained under refrigeration (0° to 6°C) until consumed or manufacturer determined expiration date. Working solution is maintained at room temperature and is replenished daily from ampulated solutions.
4. Refer to 1-P-QM-PRO-9015452 (SOP-EX-001) for the preparation and storage of calibration, check, and spiking solutions.

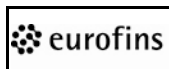
Calibration:

See Procedure E for initial calibration processing and Procedure F for continuing calibration check processing.

Procedure:

- A. Standard preparation – These solutions are used to standardize the GC/MS system every 12 hours and are prepared approximately every week to 10 days or more frequently if needed based on consumption. See 1-P-QM-PRO-9015452 for standard preparation. Calibration standard solutions may be used up to the labeled expiration date or until component degradation is observed.

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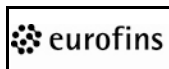
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- B. Internal standard mix is added to all standards and subsequent samples at a concentration of 20 µg/mL. Using a 25-µL syringe, 20 µL of Supelco Equity Semivolatile Internal Standard Mix or equivalent, 1000 µg/mL in methylene chloride are added to the 1 mL of standard or sample extract.
- C. Daily maintenance – Refer to 1-P-QM-PRO-9015393 (MC-EX-001) for this procedure.
- D. Instrument conditions

Equip a GC/MS (such as referenced under Apparatus and Equipment) in one of the two following manners:

1. For a 5890/5971 or 5972 and 6890/5973 or 5975
 - a. Column – 30M × 0.25 mm ID, 1.0 µm df, J&W Scientific DB-5MS or equivalent
 - b. Injector – Split/splitless operated in splitless mode
 - c. Injector Temp – 275°C
 - d. Detector Temp – 300°C
 - e. Gas – Helium at approximately 1.5 mL/min, constant flow mode
 - f. Oven Temp – 45°C for 3 minutes, ramp at 8°C/minute to 225°C, then ramp at 12°C/minute to 300°C and hold for 7.5 minutes.
2. For a 6890/5973 or 5975
 - a. Column – 20M × 0.18 mm ID, 0.18 µm df, J&W Scientific DB-5MS or equivalent
 - b. Injector – Split/splitless operated in split mode, 30:1 split

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- c. Injector Temp – 275°C
- d. Detector Temp – 280°C
- e. Gas – Helium at approximately 1.0 mL/min, constant flow mode
- f. Oven Temp – 40°C for 1 minute, ramp at 25°C/minute to 100°C, then ramp at 30°C/minute to 280°C, followed by another ramp at 25°C/minute to 320°C, hold for 2 minutes.

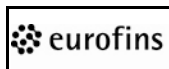
NOTE: It is not necessary to use the exact parameters listed above. Equivalent columns and conditions that give the performance required by the method are acceptable.

E. Tuning

The GC/MS must be tuned using a 50-ng/μL solution of DFTPP containing pentachlorophenol, benzidine, and DDT.

Frequency	Acceptance Criteria	Corrective Action
Every 12 hours	<ol style="list-style-type: none"> 1. Criteria in Table I 2. DDT breakdown ≤20%* 3. Tailing factors: <ul style="list-style-type: none"> • Benzidine ≤2 • Pentachlorophenol ≤2 	<ol style="list-style-type: none"> 1. Retune. Analysis cannot proceed until tune meets criteria 2. More aggressive injection port maintenance 3. Clean the source 4. Change the column

***NOTE:** DDT breakdown greater than 20 percent may be acceptable if you are calibrating for polynuclear aromatic hydrocarbon compounds only. Consult supervisor when this situation occurs.

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1. Use only the background-subtracted spectrum of the following when evaluating the DFTPP:

A three scan average of the apex of the scan, the apex of the scan –1 and the apex of the scan +1.

NOTE: All standards, samples, and associated quality control samples with a particular tune must use the identical conditions of the mass spectrometer.

2. Calculation of DDT breakdown

$$\% \text{ DDT Breakdown} = \frac{\text{DDE TIC AREA} + \text{DDD TIC AREA}}{\text{DDE TIC AREA} + \text{DDD TIC AREA} + \text{DDT TIC AREA}} \times 100$$

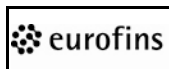
Where:

DDE and DDD = The breakdown products of DDT

TIC = Total Ion Chromatogram

F. Initial calibration (ICAL)

1. Perform standardization by analyzing at least six levels of calibration standards ranging from 0.5 µg/mL to 120 µg/mL. (Refer to 1-P-QM-PRO-9015452 for the preparation of calibration standards.) Use the internal standard calibration technique to generate an average relative response factor for each compound. Table III lists the six internal standards used for the method and the target compounds that are associated with each internal standard.
2. A method detection limit (MDL) standard must be analyzed with each initial calibration. This standard is prepared at the departmental MDL and is not to be included in the calibration curve. All compounds must be detected in the MDL standard.

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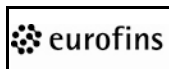
3. Initial Calibration Verification (ICV) standard is also analyzed with each initial calibration. The ICV is made from a second source standard and has an acceptance window of 70% - to 130%.

Frequency	Acceptance Criteria	Corrective Action
Initially and when the daily calibration standard fails criteria. Initially establish with at least six levels of standards and an MDL standard.	<ol style="list-style-type: none"> 1. Minimum response factors must be met in all levels of the calibration – especially in the lowest level of the calibration (see table IV). 2. %RSD for each compound should be less than or equal to 20%. If more than 10% of the compounds in the ICAL exceed 20% RSD and/or also do not meet the minimum correlation coefficient for alternate fits (ie, the correlation coefficient is <0.990) then the analysis cannot proceed. 3. If a linear calibration is used, the low calibration is re-fitted back into the curve and the recalculated concentration of the low calibration point must be within plus or minus 30% of the standard's true concentration to verify the linearity of the curve. 4. All compounds of interest must be detected in the MDL standard. 5. The relative retention times of the target compounds must agree within 0.06 relative retention time units. The exception would be in the case of system maintenance. 6. Structural isomers that produce very similar mass spectra are identified as individual isomers if they have sufficiently different GC retention times. Sufficient GC resolution is achieved if the height of the valley between two isomer peaks is <50% of the sum of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs. 	<ol style="list-style-type: none"> 1. Any target analyte with an %RSD of $\geq 20\%$ should use the average RRF. For any analyte in which the %RSD >20%, use a first degree (linear) fit if the correlation coefficient is ≥ 0.99. If the CC of the linear fit is <0.99, then a second order (quadratic) fit may be used provided the coefficient of determination is ≥ 0.99. If both the CC for the linear fit and the COD for the quadratic fit are ≥ 0.99 for any given analyte, then use the fit with the smallest negative y-intercept. When using a quadratic fit, if the y-intercept quantifies to be greater than the MDL, consult your supervisor immediately or recalibrate. See below for corrective action if the coefficient of determination (COD) for a quadratic fit is <0.99.** 2. When a linear regression is used, If the recalculated concentration of the low calibration point exceeds 30% then the limit of quantitation will need to be raised or target analytes that failed this criteria will be reported as estimated when the concentration is at or near the lowest calibration point. 3. If a compound is not detected in the MDL standard, then report to the level of the lowest standard detected. All compounds manually integrated in this standard must be checked for in each sample analyzed under this initial calibration.* 4. More aggressive system maintenance, and recalibrate

*If these situations occur, your supervisor is to be consulted immediately.

**See USEPA Method 8000B for the calculations associated with non-linear fit types.

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With supervisory approval, the following problematic compounds can be allowed to fail the 0.99 coefficient of determination criteria for a quadratic fit:

1,4-Phenylenediamine
4-Aminobiphenyl
3,3'-Dimethylbenzidine
4,4'-Methylenebis(2-chloroaniline)
4-Nitroquinoline-1-oxide
1,4-Naphthoquinone
methapyrilene

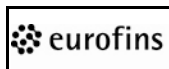
If the COD is less than 0.99 for any other compound, the system should be inspected for problems and recalibrated. Supervisory approval is required for exceptions to these guidelines.

NOTE: Quadratic fits are not permitted when analyzing samples from South Carolina.

G. Continuing Calibration Verification (CCV)

Frequency	Acceptance Criteria	Corrective Action
1. Every 12 hours. 2. Check standard area analyzed at the 30 µg/mL concentration or the fifth level of the calibration.	1. Target analytes should meet the minimum response factor criteria (see Table IV). 2. The maximum % drift for all target analytes is 20%. No more than 20% of the target analytes can be greater than 20% drift. All target analytes that exceed 20% drift must be less than or equal to 50% drift. 3. The relative retention times of the target compounds must agree within 0.06 relative retention time units. The exception would be for the case of system maintenance. 4. The EICP area for each internal standard must fall within the window of -50% to +100% from the areas of the mid-level standard produced during the last initial calibration. 5. Structural isomers that produce very similar mass spectra should be identified as individual isomers if they have sufficiently different GC retention times. Sufficient GC resolution is achieved if the height of the valley between two isomer peaks is <50% of the sum of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs. The resolution should be verified on the mid-point concentration of the ICAL as well as the check standard.	1. More aggressive system maintenance 2. In cases where compounds fail, they may still be reported as non-detects if it can be demonstrated that there was adequate sensitivity to detect the compound at the applicable quantitation limit. For situations when the failed compound is present, the concentrations must be reported as estimated values. 3. Recalibrate

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In the event that two consecutive continuing calibration check standards fail for the list of target analytes being quantified, then after the appropriate system maintenance has been performed, two consecutive continuing calibration check standards must pass criteria, before analysis can continue. If the analytical system cannot pass two consecutive checks, then the system must be recalibrated.

H. Calibration calculations

1. Calculation of the relative response factor (RRF):

$$RRF = \frac{[A(x) \times C(is)]}{[A(is) \times C(x)]}$$

Where:

A(x) = Area of the characteristic ion for the compound being measured

A(is) = Area of the characteristic ion for the specific internal standard

C(x) = Concentration of the compound being measured

C(is) = Concentration of specific internal standard

2. Regression equations

1st Order (linear) regression: $Y = M(X) + B$

2nd Order (quadratic) regression: $Y = B + M(X) + CX^2$

Where:

$$Y = \frac{\text{Conc Std}}{\text{Conc Istd}}$$

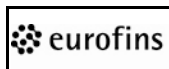
$$X = \frac{\text{Area Std}}{\text{Area Istd}}$$

M = 1st degree slope

C = 2nd degree slope

B = Y intercept

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3. Calculation of the percent drift:

$$\%Drift = \frac{C(i) - C(c)}{C(i)} \times 100$$

Where:

C(i) = Calibration check compound standard concentration

C(c) = Measured concentration using selected quantification method

4. Calculation of the percent relative standard deviation (%RSD):

$$\%RSD = \frac{SD}{\overline{RF}} \times 100$$

Where:

SD = Standard deviation

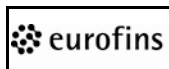
\overline{RF} = Average response factor

I. Qualitative analysis

A compound is identified by comparison of the following parameters with those of a standard of this suspected compound (standard reference spectra). In order to verify identification, the following criteria must be met:

1. The intensities of the characteristic ions of the compound must maximize in the same scan or within one scan of each other.
2. The sample component relative retention time must compare within ± 0.06 RRT units of the RRT of the standard component.
3. The characteristic ions from the reference mass spectrum are defined to be the three ions of greatest relative intensity, or any ions over 30% relative intensity if less than three such ions occur in the reference spectrum.
4. The primary and secondary ions can be found in Table IV.

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NOTE: N-Nitrosodiphenylamine decomposes in the gas chromatographic inlet and cannot be separated from diphenylamine. For this reason, it is acceptable to report the combined result for both n-nitrosodiphenylamine and diphenylamine for either of these compounds as a combined concentration.

NOTE: 1,2-Diphenylhydrazine is unstable even at room temperature and readily converts to azobenzene. Given the stability problems, it would be acceptable to calibrate for 1,2-diphenylhydrazine using azobenzene. Under these poor compound separation circumstances the results for either of these compounds should be reported as a combined concentration.

J. Quantitative analysis

Once a compound has been identified, quantitation is based on the internal standard technique and the integrated abundance from the extracted ion current profile (EICP) of the primary characteristic ion. The list of primary characteristic ions is listed in Table IV.

Waters:

$$\text{Concentration } (\mu\text{g} / \text{L}) = \frac{A(x) \times I(s) \times V(t) \times D_f}{A(is) \times RRF \times V(o) \times V(i)}$$

Where:

A(x) = Area of characteristic ion for compound being measured

I(s) = Amount of internal standard injected (ng)

V(t) = Volume of concentrated extract in microliters (μL)

D_f = Dilution factor

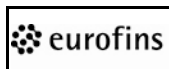
A(is) = Area of characteristic ion for the internal standard

RRF = Relative response factor for the compound being measured

V(i) = Volume of extract injected (μL)

V(o) = Volume of water extracted (mL)

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Soils:

$$\text{Concentration } (\mu\text{g/kg}) = \frac{A(x) \times I(s) \times V(t) \times G \times D_f}{A(is) \times RRF \times W(s) \times V(i) \times D}$$

Where:

A(x) = Area of characteristic ion for compound being measured

I(s) = Amount of internal standard injected (ng)

V(t) = Volume of concentrated extract in microliters

D_f = Dilution factor

A(is) = Area of characteristic ion for the internal standard

RRF = Relative Response factor for the compound being measured

V(i) = Volume of extract injected (μL)

W(s) = Weight of sample extracted or diluted in grams

D = The percent solids (100 - % moisture)/100

G = 1 if extract did not require GPC cleanup

G = 2 if extract required GPC cleanup

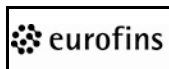
Calculations:

Calculations are found throughout document.

Statistical Information/Method Performance:

The LCS/MS and surrogate recoveries and RPD are compared to statistically generated limits for acceptance criteria. The current data is stored in the LIMS under the analysis numbers listed in the header of this SOP. The historical data for MDLs, MS/MSD, LCS/D, and measurement of uncertainty is reviewed at least annually and updated if necessary. Refer to the Quality Assurance/Quality Control section of this SOP and the criteria listed throughout this procedure for additional information on the performance of this method.

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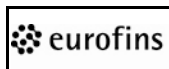
Quality Assurance/Quality Control:

Each extraction batch must contain a method blank, a laboratory control sample (LCS), and either an unspiked background sample (US), a matrix spike (MS), a matrix spike duplicate (MSD) or a laboratory control sample/laboratory control sample duplicate (LCS/LCSD). Refer to 1-P-QM-PRO-9015452 for the preparation of quality control spikes. Additional QC samples may be required to meet project or state certification requirements.

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Quality Control Item	Acceptance Criteria	Corrective Action
Internal Standards	<ol style="list-style-type: none"> 1. Peak area within -50% to +100% of the area in the associated reference standard. 2. Retention time (RT) within 30 seconds of RT for associated reference standard. 	<ol style="list-style-type: none"> 1. Check instrument for possible problems and then reanalyze samples. 2. If reinjection meets the criteria, report this injection. 3. If reinjection still shows same problem, report first injection and qualify data with a comment.
Method Blank	<ol style="list-style-type: none"> 1. Must meet internal standard criteria. 2. Must meet surrogate criteria. 3. All target compounds must be less than the reporting limit for the associated samples. 	<ol style="list-style-type: none"> 1. Inspect system for possible problems and reanalyze. 2. If the surrogates are out of spec high data can be used. (Unless project requirements dictate otherwise).* 3. If the method blank contains target analytes and the associated samples do not contain these compounds, no corrective action is required. If the target compounds in the blank are also in the associated samples, the samples should be reextracted unless it does not interfere with project data requirements.
Laboratory Control Sample/Laboratory Control Sample Duplicate	All percent recoveries within QC limits. Refer to the GC/MS Semivolatile SOP manual for QC windows. These are reviewed and updated on a semiannual basis.	<ol style="list-style-type: none"> 1. If non-compliant, check for calculation or preparation errors. 2. If no errors found, check system for problems and reanalyze. 3. If LCS/LCSD still out of spec, consult supervisor immediately. Samples may need to be re-extracted.
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	<ol style="list-style-type: none"> 1. % Recoveries within QC limits. Refer to the GC/MS Semivolatile SOP manual for QC windows. These are reviewed and updated on a semiannual basis. . 2. RPDs within QC limits. 	<ol style="list-style-type: none"> 1. If LCS within QC limits, proceed with sample analysis. 2. If most recoveries or RPDs out of spec, consult supervisor.
Surrogates	All recoveries must be within QC limits. Refer to the GC/MS Semivolatile SOP manual for surrogate windows. These are updated on a semiannual basis.	<ol style="list-style-type: none"> 1. If non-compliant, check for calculation or preparation errors. 2. If no errors found, check system for problems and reanalyze. <p>If no problem is found, reextract and reanalyze. If surrogates are out of spec high and no targets are detected in the sample no corrective action is required.</p>

*Requires approval of supervisor and completion of Non-Conformance Form 2586 (1-P-QM-FOR-9007858).

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A. Dilution Criteria

1. Initial dilutions:

- a. More than three internal standard areas are less than -50%.
- b. Either of the last two internal standard areas are less than -80%.
- c. Prescreen data or analyst's judgement of a sample extract's color or viscosity, indicate a possible matrix interference.

2. Secondary dilutions:

Are required to bring all target compounds in the calibration range of the GC/MS.

B. QC Calculations

1. Percent Recovery:

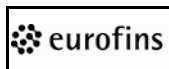
$$\%Recovery = Concentration\ found \div Concentration\ spiked \times 100$$

2. Calculations for MS/MSD:

$$Matrix\ spike\ recovery = SSR \times SR \div SA \times 100$$

Where:

SSR = Spike sample result
SR = Sample result
SA = Spike added

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3. Relative Percent Difference (RPD):

$$RPD = \left\{ \left| MSR \times MSDR \right| \div \frac{1}{2} (MSR \times MSDR) \right\} \times 100$$

Where:

RPD = Relative percent difference

MSR = Matrix Spike Recovery

MSDR = Matrix Spike Dup Recovery

Table I
DFTPP Key Ions and Ion Abundance Criteria

<u>Mass</u>	<u>Ion Abundance Criteria</u>
51	10% to 80% of mass 198
68	<2% of mass 69
70	<2% of mass 69
127	10% to 80% of mass 198
197	<2% of mass 198
198	Base peak, or >50% of mass 442
199	5% to 9% of mass 198
275	10% to 60% of mass 198
365	>1% of mass 198
441	Present but less than 24% of mass 442
442	Base peak, or >50% of mass 198
443	15% to 24% of mass 442

Table II
Semivolatile Internal Standard with Corresponding Analytes
Assigned for Quantitation

1,4-Dichlorobenzene-d ₄	Naphthalene-d ₈	Acenaphthene-d ₁₀
Acrylamide		
Aniline	Acetophenone	Acenaphthene
Benzyl alcohol	Benzoic acid	Acenaphthylene
Bis(2-chloroethyl) ether	Bis(2-chloroethoxy)methane	1-Chloronaphthalene
Bis(2-chloroisopropyl) ether	4-Chloroaniline	2-Chloronaphthalene
2-Chlorophenol	4-Chloro-3-methylphenol	4-Chlorophenyl phenyl ether
1,3-Dichlorobenzene	2,4-Dichlorophenol	Dibenzofuran
1,4-Dichlorobenzene	2,6-Dichlorophenol	Diethyl phthalate
1,2-Dichlorobenzene	α,α -Dimethylphenylamine	Dimethyl phthalate
Ethyl methanesulfonate	2,4-Dimethylphenol	2,4-Dinitrophenol
2-Fluorophenol (surr)	Hexachlorobutadiene	2,4-Dinitrotoluene
Hexachloroethane	Isophorone	2,6-Dinitrotoluene
Methyl methanesulfonate	2-Methylnaphthalene	Fluorene
2-Methylphenol	Naphthalene	2-Fluorobiphenyl (surr)
4-Methylphenol	Nitrobenzene	Hexachlorocyclopentadiene
N-Nitrosodimethylamine	Nitrobenzene-d ₅ (surr)	1-Naphthylamine
N-Nitroso-di-n-propyl amine	2-Nitrophenol	2-Naphthylamine
Phenol	N-Nitrosodi-n-butylamine	2-Nitroaniline
Phenol-d ₆ (surr)	N-Nitrosopiperidine	3-Nitroaniline
2-Picoline	1,2,4-Trichlorobenzene	4-Nitroaniline
1,4-Dioxane	1-Methylnaphthalene	4-Nitrophenol
Pyridine	O,O,O-triethylphosphorothioate	Pentachlorobenzene
		1,2,3,4-Tetrachlorobenzene
		1,2,3,5-Tetrachlorobenzene
Acetophenone	Hexachloropropene	1,2,4,5-Tetrachlorobenzene
o-Toluidine	1,4-Phenylenediamine	2,3,4,6-Tetrachlorophenol
N-Nitrosomethylethylamine	Safrole	2,4,6-Tribromophenol (surr)
N-Nitrosodiethylamine	(2-Bromoethyl)benzene	2,4,6-Trichlorophenol
N-Nitrosopyrrolidine	Caprolactam	2,4,5-Trichlorophenol
N-Nitrosomorpholine	1, 3, 5 – Trichlorobenzene	1,1'-Biphenyl
N,N-dimethyl formamide	1, 2, 3 – Trichlorobenzene	Diphenyl ether
N,N-dimethyl acetamide	1, 2, 3, 4 – Tetrachlorobenzene	Isosafrole
Benzaldehyde	1 – Chloro-4-Nitrobenzene	1,4-Naphthoquinone
	2-chlorobenzaldehyde	1,4-Dinitrobenzene
		1,3-Dinitrobenzene
		Thionazin
		5-Nitro-o-toluidine
		2-chlorobenzalmalononitrile

(surr) = surrogate

Table II (continued)

Phenanthrene-d ₁₀	Pyrene-d ₁₀	Perylene-d ₁₂
4-Aminobiphenyl	Benzidine	Benzo(b)fluoranthene
Anthracene	Benzo(a)anthracene	Benzo(k)fluoranthene
4-Bromophenyl phenyl ether	Bis(2-ethylhexyl) phthalate	Benzo(g,h,i)perylene
Di-n-butyl phthalate	Butyl benzyl phthalate	Benzo(a)pyrene
4,6-Dinitro-2-methylphenol	Chrysene	Dibenz(a,j)acridine
Fluoranthene	3,3'-Dichlorobenzidine	Dibenz(a,h)anthracene
Hexachlorobenzene	p-Dimethylaminoazobenzene	Indeno(1,2,3-cd)pyrene
N-Nitrosodiphenylamine	Pyrene	Di-n-octylphthalate
Octachlorostyrene		
Pentachlorophenol	Terphenyl-d ₁₄ (surr)	3-Methylcholanthrene
Pentachloronitrobenzene	7,12-Dimethylbenz(a)anthracene	
Phenacetin	Chlorobenzilate	
Phenanthrene	2-Acetylaminofluorene	
Pronamide	3,3'-Dimethylbenzidine	
1-Nitronaphthalene	4,4'-Methylenebis(2-Chloroaniline)	
1,2-Diphenylhydrazine	3-Quinuclidinyl benzilate	
Carbazole		
Tetraethyldithiopyrophosphate		
1,3,5-Trinitrobenzene		
Diallate trans/cis		
Phorate		
Dimethoate		
Methyl parathion		
Parathion		
4-Nitroquinoline-1-oxide		
Methapyrilene		
Isodrin		
Atrazine		
(surr) = surrogate		
Benzophenone		

Table III
Characteristic Ions for Semivolatile Compounds

1.1.1 Compound	<u>Primary Ion</u>	<u>Secondary Ions</u>
2-Picoline	93	66,92
Aniline	93	66,65
Phenol	94	65,66
Bis(2-chloroethyl) ether	93	63,95
2-Chlorophenol	128	64,130
1,3-Dichlorobenzene	146	148, 113
1,4-Dichlorobenzene-d ₄ (IS)	152	150,115
1,4-Dichlorobenzene	146	148, 113
Benzyl alcohol	108	79,77
1,2-Dichlorobenzene	146	148, 113
N-Nitrosomethylethylamine	88	42,43,56
Bis(2-chloroisopropyl) ether	45	77, 121, 79
Methyl methanesulfonate	80	79,65,95
N-Nitrosodi-n-propylamine	70	42,101,130
Hexachloroethane	117	201,199
Nitrobenzene	77	123,65
Isophorone	82	95,138
N-Nitrosodiethylamine	102	42,57,44,56
2-Nitrophenol	139	109,65
2,4-Dimethylphenol	107	122, 121
Bis(2-chloroethoxy)methane	93	95,123
Benzoic acid	105	122,77
2,4-Dichlorophenol	162	164,98
Ethyl methanesulfonate	109	79,97,45,65
1,2,4-Trichlorobenzene	180	182,145
Naphthalene-d ₈ (IS)	136	68
Naphthalene	128	129,127
Hexachlorobutadiene	225	223,227
4-Chloro-3-methylphenol	107	144,142
2-Methylnaphthalene	142	141, 115
2-Methylphenol	108	107,77,79,90
Hexachloropropene	213	211, 215, 117, 141
Hexachlorocyclopentadiene	237	235,272
N-Nitrosopyrrolidine	100	41,42,68,69
Acetophenone	105	71,51,120
4-Methylphenol	108	107,77,79,90
2,4,6-Trichlorophenol	196	198,200

Table III (continued)

1.1.2 Compound	Primary Ion	Secondary Ions
o-Toluidine	106	107,77,51,79
3-Methylphenol (as 4-Methylphenol)	108	107,77,79,90
2-Chloronaphthalene	162	127,164
N-Nitrosopiperidine	114	42,55,56,41
1,4-Phenylenediamine	108	80,53,54,52
1-Chloronaphthalene	162	127,164
2-Nitroaniline	138	92, 65
Dimethyl phthalate	163	194,164
Acenaphthylene	152	151,153
2,6-Dinitrotoluene	165	63,89, 121
Phthalic anhydride	104	76,148
3-Nitroaniline	138	108,92
Acenaphthene-d ₁₀ (IS)	164	162,160
Acenaphthene	153	154, 152
2,4-Dinitrophenol	184	63, 154, 107
2,6-Dinitrophenol	162	164,126,98,63
4-Chloroaniline	127	129,65,92
Isosafrole	162	131,104,77,51
Dibenzofuran	168	139
2,4-Dinitrotoluene	165	63,89, 182
4-Nitrophenol	109	139,65
2-Naphthylamine	143	115,116
1,4-Naphthoquinone	158	104,102,76,130
Diethyl phthalate	149	177,150
Fluorene	166	165,167
N-Nitrosodi-n-butylamine	84	57,41,116,158
4-Chlorophenyl phenyl ether	204	206,141
4,6-Dinitro-2-methylphenol	198	51, 105, 182, 77
N-Nitrosodiphenylamine	169	168,167
Safrole	162	104,77,103,135
Diphenylamine	169	168,167
1,2,4,5-Tetrachlorobenzene	216	214,179,143,218
1-Naphthylamine	143	115,89,63
4-Bromophenyl phenyl ether	248	250,141
2,4,5-Trichlorophenol	196	198,97,132,200
Hexachlorobenzene	283	142,249
Pentachlorophenol	266	264,268
5-Nitro-o-toluidine	152	77,79,106,94
Thionazin	107	96,97,143,79

Table III (continued)

1.1.3 Compound	Primary Ion	Secondary Ions
4-Nitroaniline	138	65,108,92,80
Phenanthrene-d ₁₀ (IS)	188	94,80
Phenanthrene	178	179,176
Anthracene	178	176,179
1,4-Dinitrobenzene	168	75,50,76,92
1,3-Dinitrobenzene	168	76,50,75,92
Diallate (cis or trans)	86	234,43,70
Pentachlorobenzene	250	252,248,215,254
5-Nitro-o-anisidine	168	79,52,138,153,77
Pentachloronitrobenzene	237	142,214,249,295
4-Nitroquinoline-1-oxide	190	160, 116, 114
Di-n-butyl phthalate	149	150,104
2,3,4,6-Tetrachlorophenol	232	131,230,166,234
Fluoranthene	202	101, 203, 100
1,3,5-Trinitrobenzene	213	74,75,120,91
Benzidine	184	92,185
Pyrene	202	101,203
Phorate	75	121,97,93,260
Phenacetin	108	179,109,137,80
Dimethoate	87	93,125,143,229
4-Aminobiphenyl	169	168,170,115
Pronamide	173	175,145,109,147
Dinoseb	211	163,147,117,240
Disulfoton	88	97,89,142,186
Butyl benzyl phthalate	149	91,206
Methyl parathion	109	125,263,79,93
Dimethylaminoazobenzene	225	120,77,148,42
Benz(a)anthracene	228	229,226
Chrysene-d ₁₂ (IS)	240	120,236
3,3'-Dichlorobenzidine	252	254,126
Chrysene	228	226,229
Parathion	109	97,291, 186
Bis(2-ethylhexyl) phthalate	149	167,279
3,3'-Dimethylbenzidine	212	106,196,180
Methapyrilene	97	58, 72, 191, 261
Isodrin	193	66, 195, 263, 265,
Di-n-octyl phthalate	149	167,43, 150
2-Aminoanthraquinone	223	167, 195, 139
Aramite	185	191,319,334,197,321

Table III (continued)

1.1.4 Compound	Primary Ion	Secondary Ions
Benzo(b)fluoranthene	252	253,125
Benzo(k)fluoranthene	252	253,125
Chlorobenzilate	139	251, 253, 111, 141
Benzo(a)pyrene	252	253,125
Perylene-d ₁₂ (IS)	264	260,265
7,12-Dimethylbenz(a)anthracene	256	241,239,120
2-Acetylaminofluorene	181	180,223,152
4,4'-Methylenebis(2-chloroaniline)	231	266, 140, 195
3-Methylcholanthrene	268	252,253,126,134
Indeno(1,2,3-cd)pyrene	276	138,227
Dibenz(a,h)anthracene	278	139,279
Benzo(g,h,i)perylene	276	138,277
1,2-Diphenylhydrazine	77	105, 182, 51
Endosulfan I	195	33
2-Fluorobiphenyl (surr)	172	171
2-Fluorophenol (surr)	112	64, 92
Nitrobenzene-d ₅ (surr)	82	128,54
N-Nitrosodimethylamine	74	42,44
Phenol-d ₆ (surr)	99	42,71
Terphenyl-d ₁₄ (surr)	244	122,212
2,4,6-Tribromophenol (surr)	330	332,141
N,N-dimethyl formamide	73	44,42
N,N-dimethyl acetamide	87	72,44,42
(2-Bromoethyl)benzene	184	77,91,105,186
Atrazine	200	173,215
Benzaldehyde	77	105, 106
Caprolactam	113	55,56
1,1-Biphenyl	154	153,152,76
Carbazole	167	166,139
1,3,5-Trichlorobenzene	180	182,145,109
1,2,3-Trichlorobenzene	180	182,145,109
1,2,3,4-Tetrachlorobenzene	216	214,218,179
1-Chloro-4-Nitrobenzene	157	111,75,99
IS = internal standard		
surr = surrogate		

Table III (continued)

1.1.5 Compound	<u>Primary Ion</u>	<u>Secondary Ions</u>
Acrylamide	71	55, 44
Octachlorostyrene	308	343, 380, 273
1,2,3,5-tetrachlorobenzene	216	214, 218, 179, 143
1,2,3,4-tetrachlorobenzene	216	214, 218, 179, 143
2-chlorobenzaldehyde	139	111, 140, 76
Benzophenone	105	182, 77, 51
3-Quinuclidinyl benzilate	183	126, 337, 110
2-chlorobenzalmalononitrile	153	188, 126

Table IV
Recommended Minimum Response Factor Criteria for Initial and Continuing Calibration Verification Using the Suggested Ions from Table III

Semivolatile Compounds	Minimum Response Factor (RF)
Benzaldehyde	0.010
Phenol	0.800
Bis(2-chloroethyl)ether	0.700
2-Chlorophenol	0.800
2-Methylphenol	0.700
2,2'-Oxybis-(1-chloropropane)	0.010
Acetophenone	0.010
4-Methylphenol	0.600
N-Nitroso-di-n-propylamine	0.500
Hexachloroethane	0.300
Nitrobenzene	0.200
Isophorone	0.400
2-Nitrophenol	0.100
2,4-Dimethylphenol	0.200
Bis(2-chloroethoxy)methane	0.300
2,4-Dichlorophenol	0.200
Naphthalene	0.700
4-Chloroaniline	0.010
Caprolactam	0.010
4-Chloro-3-methylphenol	0.200
2-Methylnaphthalene	0.400
Hexachlorocyclopentadiene	0.050

Table IV (continued)

Semivolatile Compounds	Minimum Response Factor (RF)
2,4,6-Trichlorophenol	0.200
2,4,5-Trichlorophenol	0.200
1,1'-Biphenyl	0.010
2-Chloronaphthalene	0.800
2-Nitroaniline	0.010
Dimethylphthalate	0.010
2,6-Dinitrotoluene	0.200
Acenaphthylene	0.900
3-Nitroaniline	0.010
Acenaphthene	0.900
2,4-Dinitrophenol	0.010
4-Nitrophenol	0.010
Dibenzofuran	0.800
2,4-Dinitrotoluene	0.200
Diethylphthalate	0.010
1,2,4,5-Tetrachlorobenzene	0.010
4-Chlorophenyl-phenylether	0.400
Fluorene	0.900
4-Nitroaniline	0.010
4,6-Dinitro-2-methylphenol	0.010
4-Bromophenyl-phenylether	0.100
N-Nitrosodiphenylamine	0.010
Hexachlorobenzene	0.100

Table IV (continued)

Semivolatile Compounds	Minimum Response Factor (RF)
Atrazine	0.010
Pentachlorophenol	0.050
Phenanthrene	0.700
Anthracene	0.700
Carbazole	0.010
Di-n-butylphthalate	0.010
Fluoranthene	0.600
Pyrene	0.600
Butylbenzylphthalate	0.010
3,3'-Bichlorobenzidine	0.010
Benzo(a)anthracene	0.800
Chrysene	0.700
Bis(2-ethylhexyl)phthalate	0.010
Di-n-octylphthalate	0.010
Benzo(b)fluoranthene	0.700
Benzo(k)fluoranthene	0.700
Benzo(a)pyrene	0.700
Indeno(1,2,3-cd)pyrene	0.500
Dibenz(a,h)anthracene	0.400
Benzo(g,h,i)perylene	0.500
2,3,4,6-Tetrachlorophenol	0.010

ATTACHMENT 2 – DANIEL B. STEPHENS & ASSOCIATES

Table 2-1: Laboratory Accreditation, Quality Manual, and Standard Operating Procedures

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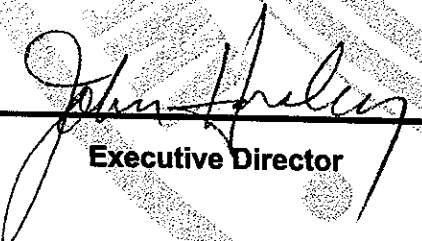
American Association of State Highway and Transportation Officials AASHTO Accreditation Program - Certificate of Accreditation

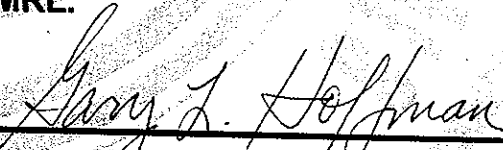
This is to signify that

DBS&A Soil Testing Laboratory
Albuquerque, New Mexico

has demonstrated proficiency for the testing of construction materials
and has met the minimum requirements in AASHTO R18
set forth by the AASHTO Highway Subcommittee on Materials.

The scope of accreditation can be obtained by viewing
the AAP Directories of Accredited Laboratories (www.amrl.net)
or by contacting AMRL.


Executive Director


Chair, AASHTO Highway
Subcommittee on Materials



Soil Testing & Research Laboratory

Quality Management System

Program

August 2016
(Rev. 26)



Daniel B. Stephens & Associates, Inc.

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Appendix

- A Laboratory Methods
- B Information Flow and Laboratory Staff Position Descriptions
- C Ownership
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1. Overview of the Program

1.1 Organizational Vision and Objectives

DBS&A's vision is to be the premier provider of innovative and specialized environmental and hydrology services.

The policy of the quality management system (QMS) of the organization is to provide clients with high quality and timely environmental and hydrology services by adhering to the following:

- To fulfill or exceed customer needs and expectations by delivering a quality product in a consistent and timely manner;
- To promote a working environment where training and tools are provided for all work to proceed in a safe and efficient fashion;
- To furnish a system of methods and policies which are periodically reviewed to ensure the ability of all employees to perform their work in an efficient manner.

1.2 Responsibilities of Laboratory Personnel

Laboratory staff position descriptions and a flow chart can be found in Appendix B detailing the responsibilities of laboratory personnel.

- Corporate Quality Assurance/Quality Control (QA/QC) Manager
 - Develop and implement Corporate QA/QC program
 - Identify Corporate QA/QC needs
 - Direct Corporate QA/QC audits



- Laboratory Manager
 - Oversee implementation and maintenance of all laboratory QMS activities and documents, laboratory reports, H&S program activities and documents, and laboratory personnel
 - Provide technical direction for the activities of the laboratory and ensure that all testing is carried out in a way that complies with the QMS
 - Maintain overall responsibility for the technical operations of the laboratory
 - Provide direct oversight of technical staff
 - Promote and market laboratory
 - Maintain client contact
 - Oversee all aspects of daily laboratory activities
 - Estimate costs of laboratory contracts
 - Implement nonconformance and corrective action activities
- Supervising Laboratory Technician
 - Perform work in accordance with the QMS
 - Serves as the technical manager in the laboratory manager's absence
 - Implement and maintain training program and documents
 - Assign and oversee lab work to be performed by the technicians
 - Oversee equipment calibration and maintenance
- Laboratory Safety Officer
 - Perform work in accordance with the QMS
 - Implement and maintain all aspects of the laboratory H&S program
 - Maintain material safety data sheets (MSDSs)
- Laboratory Technician
 - Perform work in accordance with the QMS
 - Perform or assist with laboratory analysis
 - Conduct laboratory equipment maintenance and calibration
 - Check raw data, data input



- Organize raw data to computer printout and graphs
- Organize draft data report
- Clean the laboratory area
- Archive reports and QMS materials
- Sample Custodian
 - Perform work in accordance with the QMS
 - Receive and return samples
 - Check for and correct discrepancies on chain-of-custody documentation
 - Contact clients for sample return
 - Fill out Job Schedule Forms
 - Maintain chain-of-custody documentation, store and track samples, and maintain sample handling records and procedures

1.3 Summary of Specific Requirements, QMS Program

1. Sample Custody, Identification, Tracking, and Storage Procedures
 - a. Maintain chain-of-custody documentation
 - b. Follow procedures for tracking samples
 - c. Store or return sample material, including foreign soils waste
2. Data Collection
 - a. Type of data collected
 - b. Methods of data collection
 - c. Accuracy/precision limits of data collected
3. Data and Document Handling Procedures
 - a. Information system for data and documents
4. Data Reduction Procedures
 - a. Data input checks



5. Analytical, Numerical Analysis
 - a. Verification of the basis of the method of analysis
 - b. Independent check of the results of all calculations for their reasonableness, to include, if necessary, an independent partial analysis
 - c. Documentation of all numerical codes
 - d. Verification of all numerical codes (whether internal or public domain) each time they are used, with any change to the code verified by the author and run against either test cases or hand calculations
6. Report Review
 - a. Check to ensure contractual obligation is fulfilled
 - b. Verify that all QMS requirements are met
 - c. Verify correctness of final report copies
7. Performance of Systems and Personnel
 - a. Equipment calibration and maintenance program
 - b. Personnel training and evaluation
8. Quality Assurance Audits
 - a. Control of nonconformances
 - b. Corrective action
9. Quality Assurance Records
 - a. Archive system



2. Specific Requirements of the QMS Program

2.1 Sample Custody, Identification, Tracking, and Storage Procedures

All samples which have been collected and transported under a chain-of-custody system will be accepted by DBS&A's laboratory custodian (or designee) following a set of standard operating procedures as described below. The laboratory custodian or designee must carefully check the identification information (e.g., sample number, depth interval, and any other descriptive information) on each sample (either written on the sample container or on a sample tag) with the identification information on the chain-of-custody forms to ensure that all samples are accounted for. If discrepancies exist between a particular sample and the chain-of-custody form, DBS&A's laboratory custodian or designee will note this clearly on the form before signing the custody forms and accepting the shipment of samples. Discrepancies will be brought to the client's attention and resolved before a Job Schedule Form is made. The original chain-of-custody form will be kept in the laboratory project file created for the client. DBS&A will forward copies of the chain-of-custody forms to the client if requested.

After the required testing program is completed, samples will be shipped back to the client together with the chain-of-custody form, or disposed of properly. The same procedure of checking the information on each sample with that on the custody forms, as well as noting any changes in sample descriptions, will be followed when relinquishing samples.

All sample identification information together with all tests requested by the client for each sample will be legibly recorded on Lab Form "Job Schedule." If a DBS&A laboratory number is assigned to samples (for the sake of convenience), the DBS&A number will be written on this form adjacent to the identification information received from the client. All information on this form will be initialed and dated by the form originator, or the form originator's supervisor.

One photocopy of the Job Schedule form will be provided to the analyst initiating the requested testing. After reviewing the form and preparing the samples, the form will be posted in the laboratory for continued reference during testing. The original will be filed in the Laboratory Project File created for the testing program requested by the client.



The Job Schedule form will be used to track samples through the testing program requested by the client. The completion of each test or task on a sample will be noted on the Job Schedule form.

Sample identification numbers will be clearly marked on each sample. If a sample is transferred to another sample container, the sample identification number will be carefully copied to the new sample container.

All original sample material received from a client that will not be tested will be stored together and clearly marked.

All foreign soil samples will be handled under the conditions outlined in DBS&A's current USDA soil import permit and compliance agreement. The laboratory will remain secure and only DBS&A trained personnel will have access to these regulated soils. Soils from each project will be clearly marked and kept separate from other soils. Upon project completion, the regulated soils will be shipped back to the source in sturdy leak proof containers, or be dry heat treated prior to disposal. A copy of the current soil import permit, the compliance agreement, and sample receipt/disposal records are maintained by the permittee in the laboratory.

The laboratory does not accept or store radioactive samples.

2.2 Laboratory Methods and Data Collection

Laboratory procedures are based on published standards or documentation available in the literature. The procedures used for each laboratory test are presented as Appendix A, Laboratory Procedures and Methods. Published standards are referenced within these methods.

The type of data collected for each laboratory test is stated under "Laboratory Methods" (Appendix A). In general, the method of laboratory analysis used to perform a test will dictate the type of data to be collected. Because explicit written laboratory procedures and methods are based upon documentation available in the literature, such as the ASTM standards or other



recognized publications, the type of data collected is dictated by that standard or published method.

Methods of data collection follow standard laboratory practice. Each employee is trained in the basic techniques of reading values from gauges, burettes, balances, and other laboratory equipment. In addition, each employee is specifically trained in each method by a senior laboratory analyst. This training documentation is archived in the laboratory and is available for inspection by auditors. The senior laboratory technician or laboratory manager certifies that the technician has received the appropriate training.

Laboratory measurements of mass, temperature, and pressure are dependent on the accuracy of instruments or equipment. Accuracy of our laboratory equipment relies on a rigorous program of calibration, and equipment used to make these measurements is calibrated on a regular schedule. These instruments and typical measurement ranges are listed below.

- *Mass* measured with electronic balance: 0.0001 to 300g, 0.001 to 200g, 0.01 to 2,000g, and 1 to 12,000g
- *Temperature* measured by mercury in glass thermometer: -20° C to 110°C
- *Pressure* measured by gas pressure gauges: -0.005 to -3 bars, -0.02 to -4 bars, -0.01 to -10 bars, and -0.1 to -20 bars

Measurements that depend on limitations in the reading of the instrument are volume and length. The uncertainties associated with measurements of volume and length depend on the piece of equipment being used for measurement. The following uncertainties are typical for the equipment listed:



Instrument	Typical Uncertainty
100-mL graduated cylinder	± 0.2 mL
10-mL graduated cylinder	± 0.1 mL
50-mL burette	± 0.02 mL
Steel ruler (graduated to 1 mm)	± 1.0 mm
Digital Caliper	± 0.03 mm

Uncertainties for specific equipment not listed above are:

Instrument	Typical Uncertainty
Thermometer (-20 to 100°C, graduated to 1°C)	$\pm 0.2^\circ\text{C}$

2.3 Control of QMS Documents, Laboratory Data, and Data Reports

All QMS documents, laboratory data, and lab data reports are subject to document control procedures. Specific control procedures differ depending on the item being controlled.

QMS documents are defined as this QMS Manual, including technical methods of analyses (SOPs), QMS forms and records, and forms that document any changes to the above-mentioned QMS documents. Laboratory data are defined as all data generated during laboratory tests specified by the client. Laboratory data reports include the raw laboratory data, summary data tables and figures, a discussion of the reasonableness and consistency of the data, and a list of method references used in the client-specified testing program.

The preparation, issue, and change of the QMS documents that specify quality requirements or prescribe activities affecting quality must be controlled to ensure that correct documents are being employed. In addition, these documents must be reviewed for adequacy and approved for release by authorized personnel. The following paragraphs describe how changes are made to documents, who reviews and approves these changes, how often documents are routinely reviewed to ensure quality procedures are up to date and reflect industry standards, and how documents are stored and archived for future reference. In addition, the following describes how data and data reports are handled, stored, and archived.



Changes in QMS documents can be made only by or under the direct supervision of the laboratory manager or designee. All changes must be reviewed and approved by the laboratory manager.

Indelible ink must be used on all QMS documents and laboratory data sheets when entering information or data by hand. Initial entries shall never be obscured. If necessary, a single line shall be used to cross-out incorrect information. The correct information shall be written next to the crossed-out entry, and the change shall be initialed and dated by the personnel making the change.

All original raw laboratory data for each client-specified testing program are archived in the laboratory office. The original copy of the final laboratory report, including raw laboratory data, data in spreadsheet form, summary tables and plots, and written text concerning the consistency and reasonableness of data, are also stored in the laboratory office until samples are disposed of. If the client received the final report electronically, an electronic copy is maintained by the laboratory. In addition, a magnetic disk copy of the final laboratory report summary and tables is stored on tape backup. Once the samples have been disposed of, the raw data, QMS spreadsheets, and final report data are incorporated into the job file folder and stored in the laboratory central files or at TMM Business Records Storage (TMM) for a minimum of five years.

Original data, final data reports, and magnetic disks are all filed according to project number. The client's name also appears on these documents. DBS&A will archive these data and documents for a period of at least five years. After five years, the corporate QA/QC manager and the laboratory manager will decide on final disposition of data and documents; magnetic media will be maintained indefinitely. All non-laboratory personnel must obtain permission from the laboratory manager or corporate QA/QC manager to view these original documents. If the client requests, DBS&A will store the information in a locked file cabinet.

A formal system has been developed for handling and controlling laboratory data, QMS information, and laboratory data reports. This system consists of a structured entry, exit, and archive point for all of the above information.



Finally, all data, QMS information, and data reports are considered confidential. Only persons authorized by the laboratory manager are permitted to view, handle, transport, or analyze data obtained through client-specified testing. Unauthorized personnel must have written and verified permission from the client before they will be allowed access to testing data.

2.4 Data Reduction Procedures

Data are transferred from the laboratory data sheets, which contain the raw data, to computer files by manual entry through the keyboard. Every manually entered datum in the computer file is checked against the raw data sheet by a second party before or during the report review process.

2.5 Analytical, Numerical Analysis

Methods of analysis not verified in the literature or not published as a standard method of analysis by a recognized organization (such as ASTM) will be verified in-house. Verification of a method of analysis will rely on the use of accepted principles and concepts of soil physics as they are presently understood. Laboratory procedures, raw data, methods of analysis, and results will be made available to any interested party who wishes to examine an in-house verification.

All calculations, whether performed by computer or by hand, are examined by a second party for their reasonableness. A standard data set is used for macro calculation verification.

Documentation of numerical codes is available for inspection by any interested party with approval by the laboratory manager. For numerical codes that have been written in-house, documentation may consist of published articles in recognized journals, in-house analytical analysis, or both. For all codes, test cases with known analytical solutions are used as a primary tool in the verification procedure.



2.6 Report Review

Final reports are thoroughly checked by the laboratory manager or designee. The correctness of every reported value is verified and the report is checked for completion of contractual obligations and QA/QC requirements.

When a report must be amended, the amended report date along with a reference to the previously existing report date, will be included on the title page and elsewhere in the report as applicable. Added, deleted, or amended data is clearly identified on the notes page of the report, providing a clear audit trail from the latest issuance or deletion to the original report data. The amended report shall be processed in the normal manner, and filed with the original report. The laboratory deputy manager has overall responsibility for maintaining test records and reports. Finalized test reports are distributed to the requesting client and to the project file.

2.7 Quality Assurance Audits, Nonconformances, and Corrective Action

Random audits or checks of the QMS system and personnel may be made periodically by the laboratory manager or designee, &/or the corporate QA/QC manager. An internal audit will be performed annually. A system and/or personnel QMS audit may be performed at any time by the client's QA/QC personnel with the authorization of the laboratory manager. During an internal audit, the Internal Audit form will be completed by the lead auditor.

If an audit determines that the laboratory is not conforming to any component of the QMS program as defined in this document, including internal audits, customer complaints, equipment calibrations, standardizations checks and maintenance, external assessments, and proficiency sample testing, a written Quality Finding Report describing the nonconformance(s) shall be generated by the auditor and delivered to the laboratory deputy manager, if applicable. The responsible designee will have one month to take corrective action to eliminate the nonconformance and to document in writing the nature of the corrective action. All Quality Finding Reports will be logged in the Quality Finding Report binder which is maintained by the laboratory manager.



Laboratory measurement equipment or analytical methods that fail to meet project QC requirements will be immediately brought to the attention of the laboratory manager. If failure is due to equipment malfunction, the equipment will be repaired and recalibrated, and the analysis will be repeated. All affected parts of the analysis will be repeated so that data will not be affected by failure to meet QC requirements. Deficiencies noted during checks of raw data will be immediately corrected. Corrections may vary depending upon problems noted and can range from correcting miscalculated data to re-analyzing samples. Documentation of corrective actions will be maintained by the laboratory manager. Corrective action documentation will include the following information (where applicable):

- Nature of the problem
- Date and time of discovery
- Root cause analysis
- Analytical parameter(s) affected
- Sample lot affected
- Date, time, and description of the resulting corrective action
- Name of the corrective action originator

The laboratory manager will prepare a written summary of corrective actions for the client, as necessary. This summary will review the validity, quality, and completeness of the data in question and, as necessary, make recommendations for corrective action, such as further sampling or additional analyses. Corrective actions will be implemented when the project objectives are not met or when conditions adverse to quality have been identified. Conditions adverse to quality shall be promptly identified and corrected as soon as possible. The identification, cause, and corrective actions to prevent recurrence shall be determined and documented for significant conditions adverse to quality.

It is the responsibility of the supervising laboratory technician to review all reports pertaining to proficiency sample testing and to bring poor results or differences to the attention of the laboratory manager. It is the responsibility of the laboratory manager to ensure that corrective action is taken and documented.



The laboratory will maintain participation in AAP's (AASHTO Accreditation Program) on-site inspection program tour.

The laboratory will maintain participation in the AAP proficiency sample program, and will document corrective actions taken for responses of 0, 1, or 2 within 60 days.

Reports covering the results of proficiency sample testing and any corrective action taken, including any letters to AAP shall be maintained by the laboratory manager.

In the event that a technical issue is made by a client regarding laboratory analysis, data, or reports the following actions shall be taken:

1. The laboratory manager shall be notified.
2. The issue is brought to the attention of the supervisor of the department or section in question.
3. Laboratory manager or supervisor contacts the person identifying the issue to verify all aspects of the complaint and establish resolution data (if necessary).
4. All reports, records and pertinent data shall be reviewed; and all calculations are to be checked for accuracy.
5. The technician(s) performing the test is consulted by the supervisor to determine any unusual problems or circumstances involved.
6. Supervisor reports all information gathered to the laboratory manager.
7. The laboratory manager and supervisor shall formulate an appropriate reply and issue same to the person identifying the issue.



2.8 Quality Assurance Records

The following paragraphs outline the storage requirements for QMS records. QMS records pertaining to the collection, analysis, and reporting of data remain as a permanent part of the original data set in the project file.

QMS records covering the training of personnel are kept in the laboratory training manual. Records concerning the performance of laboratory personnel are confidential and require the authorization of the president of DBS&A to be examined by persons other than the laboratory manager.

QMS records documenting and approving changes in any QMS document shall be stored in the QMS file.

QMS records are stored in the laboratory central files or at TMM Business Records Storage (TMM) for a minimum of five years.

2.9 Subcontracting

Subcontracting activities will be conducted through only accredited and/or certified laboratories. It is the responsibility of the deputy laboratory manager to obtain applicable accreditations /certifications from subcontracting entities prior to establishing a working relationship with the subcontractor. A copy of the accreditation or certification will be maintained in the laboratory.

Subcontracted data obtained and reported are subject to the quality policies described in this program including record retention, data presentation, and report amendment policies.



3. Implementation of the QMS Program

The principal areas covered by QMS procedures are (1) sample custody, identification, and tracking, (2) instrumentation and equipment performance, (3) laboratory testing methods and the recording, reduction, and analysis of the data obtained from such testing, (4) personnel training, (5) QMS audits, nonconformances, and corrective action, and (6) document control. Specific procedures and forms have been developed by DBS&A to ensure that quality is maintained in all these areas. The specific reporting mechanisms which form the basis of the QMS program are described in this section.

3.1 Sample Custody, Identification, and Tracking

The chain-of-custody form that accompanies samples (or other documents as provided by the client) ensures that samples collected in the field are the same samples that will be tested in the laboratory. This form also helps to track samples lost in shipment and to document any sample damage that may have occurred during shipping.

Samples are tracked through a testing program requested by the client with the Job Schedule form. The completion of each task on each sample is noted on the Job Schedule form.

3.2 Instrumentation and Equipment Performance

A complete inventory of major sampling, testing, calibration, and check equipment associated with the test methods covered by the scope of this manual is maintained in the corporate office. The inventory includes, for each piece of major equipment where applicable, the name, date received, date placed in service, condition when received, manufacturer, and model number, serial number, or other identifying number. Manufacturer's instructions, where applicable, are located in the laboratory office.

A written record of equipment and instrument calibration and maintenance is the primary means to ensure performance. The supervising laboratory technician is responsible for maintaining the equipment calibration and verification records. The supervising laboratory



technician ensures that calibration and maintenance activities are performed on time by regularly (at least monthly) referring to and updating the calibration and maintenance calendar. Equipment found to be out of calibration, malfunctioning, or defective will be removed from service. Newly acquired equipment without a manufacturer's certification, and equipment that has not been calibrated, standardized, or checked because it has been removed from service, shall be calibrated or checked before being returned to service. The equipment calibration binder is maintained in the laboratory office. This calibration record includes:

1. A summary table (see Equipment Calibrations Record) listing all equipment requiring calibration, the interval of time between calibrations, dates of previous calibrations, and dates of the next required calibrations
2. Calibration data sheets from each (NIST traceable) calibration conducted on each piece of equipment

At a minimum, calibration data to be provided from the analytical laboratory shall include:

- Type of equipment used and the detection limits for the equipment
- Calibration method and sequential actions
- Calibration data regarding form and format
- List of primary and secondary standards used
- Continuing calibration control charts
- List of critical or replacement parts

Each piece of equipment shall be identified such that the pertinent calibration information can be retrieved. The equipment shall have an individual calibration log and be calibrated/standardized prior to use or as a part of the operational use following the manufacturer's recommended procedures for calibration/standardization.

Measuring and test equipment shall be calibrated at prescribed intervals, prior to use, or both. Frequency shall be based upon the type of equipment, inherent stability, manufacturer's recommendations, intended use, and experience.



Responsibility for calibration rests with the supervising laboratory technician. Personnel shall check the calibration status before using the equipment to ensure that the equipment is operational.

Records shall be prepared and maintained for each piece of calibrated equipment to indicate that established calibration procedures have been followed. Calibration records are maintained in the laboratory office. A copy of the instrument logbook shall be provided to indicate calibration status when the samples were being analyzed upon request.

Field and laboratory equipment found to be out of calibration shall be recalibrated in accordance with the requirements of this section. When test equipment is found to be out of calibration, damaged, lost, or stolen, laboratory personnel shall ascertain the validity of previous inspection or test results and the acceptability of components inspected or tested since the last calibration check. When it is necessary to ensure the acceptability of suspect items, the originally required inspections or tests shall be repeated using properly calibrated equipment. Suspect items on which a questionable device was used shall be listed in a nonconformance report or a deficiency notice, as applicable. Test equipment consistently found to be out of calibration shall be repaired or replaced. Inspection and test reports shall include identification of the test equipment used to perform the inspection and/or test.

DBS&A also follows a program of regular equipment maintenance to ensure that equipment performs as intended. Most maintenance involves good housekeeping procedures, such as cleaning after each use or as needed. An instrument maintenance logbook shall be kept that includes maintenance schedules, instructions, and maintenance history. The supervising laboratory technician shall be responsible for all laboratory preventative maintenance.

Finally, DBS&A relies on competent and trained personnel to follow documented methods and recognize when equipment is malfunctioning. A combination of regular equipment calibration, regular maintenance, and operation by trained and competent personnel who follow standard procedures ensures proper equipment performance and a data product that will stand up to the highest level of QA/QC technical review.



3.3 Laboratory Testing Methods and the Recording, Reduction, and Analysis of the Data Obtained From Such Testing

A total of three written records control the QMS of laboratory testing methodology and the data obtained during testing. The following two written records accompany the laboratory data set when requested:

1. Equipment Calibration Record. This record lists all DBS&A equipment requiring calibration, the time interval between calibrations, dates of previous calibrations, and dates of the next required calibrations. The record is located in the Equipment Calibration logbook in the laboratory office.
2. Check of Computer Programs Used in the Analysis of Laboratory Data. Computer programs are updated as needed and the results of computer programs are checked by hand for reasonableness.

The initial documentation and verification of a computer code is performed as a separate task. The computer code, relevant written documentation of the code, and the results of computer runs of test cases do not accompany the data set, but are kept in permanent open files.

3.4 Personnel Performance

DBS&A recruits and hires the most qualified personnel available. Résumés and biographical sketches documenting training and experience are kept on file for all regular employees. These records are located in the corporate office.

All new laboratory personnel are trained in each laboratory testing method by experienced senior laboratory staff (e.g., laboratory manager, supervising laboratory technician, or an experienced laboratory technician). This training is documented in a Record of Training form, which is kept in the laboratory training manual.



Group training sessions are conducted periodically to increase the skill levels of the employees. Employees are encouraged to attend outside training sessions

To ensure that a high level of competence is maintained, performance is reviewed periodically. These reviews are done at least every 3 years for the supervising laboratory technician for tests performed regularly or at least every 2 years for the testing and field technicians for tests performed regularly. If a technician does not routinely perform a test it may not be necessary to evaluate his or her competency to perform the test. However, the technician's competency shall be evaluated prior to performing the test. The review process consists of both written exam and visual observations by supervisors with oral examination for each certifying test. Though performance reviews are confidential, a log of initial training and assessment and subsequent assessments will be maintained for each laboratory technician in the laboratory training manual in the laboratory office.

Proficiency sample testing may be used in conjunction with observation of actual testing performed to evaluate competency.

3.5 QMS Audits, Nonconformances, and Corrective Action

All QMS audits, nonconformances, and corrective actions are documented in writing and archived in DBS&A's QMS files. At a minimum, the QMS audit documentation must contain the names and affiliations of the auditor(s), the date, and the components of the QMS program audited, with any nonconformance(s) clearly detailed. At a minimum, corrective action documentation initiated by the laboratory manager must contain the name of the laboratory manager, the date, the nonconformance(s) as specified in the audit, and a detailed description of corrective action(s) taken and the date these actions were implemented.

3.6 Document Control

General procedures for control of QMS documents, laboratory data, and laboratory data reports are outlined in Section 2.3.



3.7 Laboratory Environmental Parameters

The laboratory temperature and relative humidity are recorded on paper strip charts. A copy of the strip charts is kept in an open file.



Standard Test Method for Particle-Size Analysis of Soils¹

This standard is issued under the fixed designation D422; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

^{ε1} NOTE—Editorial changes made throughout in February 2014.

^{ε2} NOTE—Further editorial corrections made in July 2014.

1. Scope

1.1 This test method covers the quantitative determination of the distribution of particle sizes in soils. The distribution of particle sizes larger than 75 μm (retained on the No. 200 sieve) is determined by sieving, while the distribution of particle sizes smaller than 75 μm is determined by a sedimentation process, using a hydrometer to secure the necessary data (Note 1 and Note 2).

NOTE 1—Separation may be made on the No. 4 (4.75-mm), No. 40 (425-μm), or No. 200 (75-μm) sieve instead of the No. 10. For whatever sieve used, the size shall be indicated in the report.

NOTE 2—Two types of dispersion devices are provided: (1) a high-speed mechanical stirrer, and (2) air dispersion. Extensive investigations indicate that air-dispersion devices produce a more positive dispersion of plastic soils below the 20-μm size and appreciably less degradation on all sizes when used with sandy soils. Because of the definite advantages favoring air dispersion, its use is recommended. The results from the two types of devices differ in magnitude, depending upon soil type, leading to marked differences in particle size distribution, especially for sizes finer than 20 μm.

2. Referenced Documents

2.1 ASTM Standards:²

D421 Practice for Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants

E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

E100 Specification for ASTM Hydrometers

2.2 ASTM Adjuncts:

Air-Jet Dispersion Cup for Grain-Size Analysis of Soil³

¹ This test method is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.03 on Texture, Plasticity and Density Characteristics of Soils.

Current edition approved Oct. 15, 2007. Published October 2007. Originally approved in 1935. Last previous edition approved in 2002 as D422 – 63 (2002)^{ε1}. DOI: 10.1520/D0422-63R07E02.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from ASTM International Headquarters. Order Adjunct No. ADJD0422.

3. Apparatus

3.1 *Balances*—A balance sensitive to 0.01 g for weighing the material passing a No. 10 (2.00-mm) sieve, and a balance sensitive to 0.1 % of the mass of the sample to be weighed for weighing the material retained on a No. 10 sieve.

3.2 *Stirring Apparatus*—Either apparatus A or B may be used.

3.2.1 Apparatus A shall consist of a mechanically operated stirring device in which a suitably mounted electric motor turns a vertical shaft at a speed of not less than 10 000 rpm without load. The shaft shall be equipped with a replaceable stirring paddle made of metal, plastic, or hard rubber, as shown in Fig. 1. The shaft shall be of such length that the stirring paddle will operate not less than ¾ in. (19.0 mm) nor more than 1½ in. (38.1 mm) above the bottom of the dispersion cup. A special dispersion cup conforming to either of the designs shown in Fig. 2 shall be provided to hold the sample while it is being dispersed.

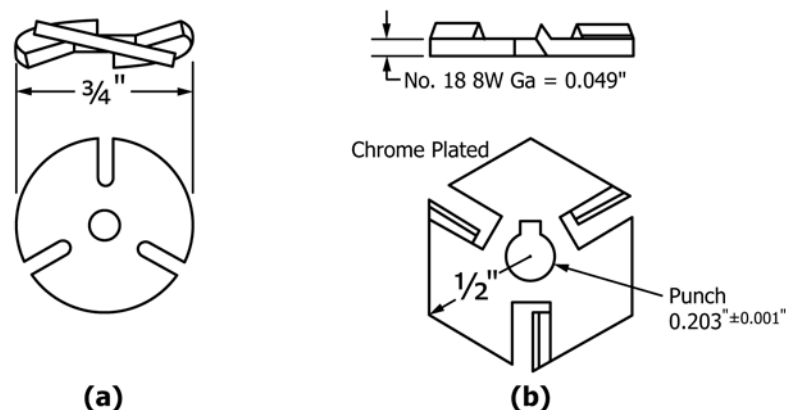
3.2.2 Apparatus B shall consist of an air-jet dispersion cup (see drawing ³) (Note 3) conforming to the general details shown in Fig. 3 (Note 4 and Note 5).

NOTE 3—The amount of air required by an air-jet dispersion cup is of the order of 2 ft³/min; some small air compressors are not capable of supplying sufficient air to operate a cup.

NOTE 4—Another air-type dispersion device, known as a dispersion tube, developed by Chu and Davidson at Iowa State College, has been shown to give results equivalent to those secured by the air-jet dispersion cups. When it is used, soaking of the sample can be done in the sedimentation cylinder, thus eliminating the need for transferring the slurry. When the air-dispersion tube is used, it shall be so indicated in the report.

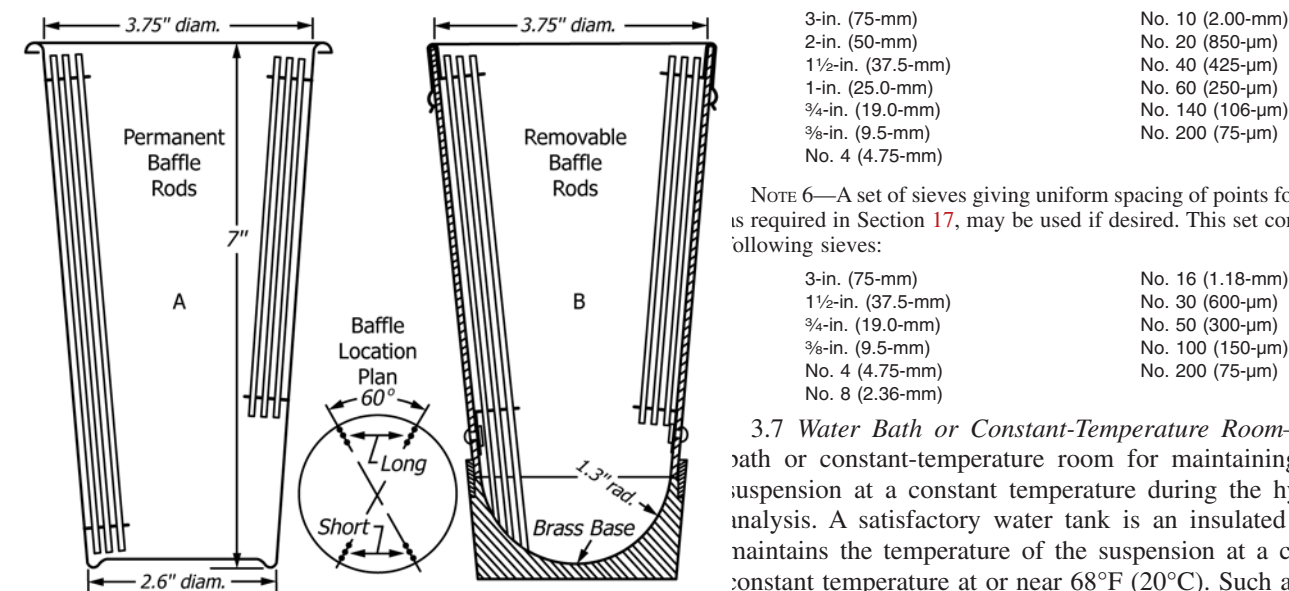
NOTE 5—Water may condense in air lines when not in use. This water must be removed, either by using a water trap on the air line, or by blowing the water out of the line before using any of the air for dispersion purposes.

3.3 *Hydrometer*—An ASTM hydrometer, graduated to read in either specific gravity of the suspension or grams per litre of suspension, and conforming to the requirements for hydrometers 151H or 152H in Specifications E100. Dimensions of both hydrometers are the same, the scale being the only item of difference.



Metric Equivalents					
in.	0.001	0.049	0.203	1/2	3/4
mm	0.03	1.24	5.16	12.7	19.0

FIG. 1 Detail of Stirring Paddles



Metric Equivalents			
in.	1.3	2.6	3.75
mm	33	66	95.2

FIG. 2 Dispersion Cups of Apparatus

3.4 *Sedimentation Cylinder*—A glass cylinder essentially 18 in. (457 mm) in height and 2½ in. (63.5 mm) in diameter, and marked for a volume of 1000 mL. The inside diameter shall be such that the 1000-mL mark is 36 ± 2 cm from the bottom on the inside.

3.5 *Thermometer*—A thermometer accurate to 1°F (0.5°C).

3.6 *Sieves*—A series of sieves, of square-mesh woven-wire cloth, conforming to the requirements of Specification E11. A full set of sieves includes the following (Note 6):

3-in. (75-mm)	No. 10 (2.00-mm)
2-in. (50-mm)	No. 20 (850-μm)
1½-in. (37.5-mm)	No. 40 (425-μm)
1-in. (25.0-mm)	No. 60 (250-μm)
¾-in. (19.0-mm)	No. 140 (106-μm)
⅝-in. (9.5-mm)	No. 200 (75-μm)
No. 4 (4.75-mm)	

NOTE 6—A set of sieves giving uniform spacing of points for the graph, is required in Section 17, may be used if desired. This set consists of the following sieves:

3-in. (75-mm)	No. 16 (1.18-mm)
1½-in. (37.5-mm)	No. 30 (600-μm)
¾-in. (19.0-mm)	No. 50 (300-μm)
⅝-in. (9.5-mm)	No. 100 (150-μm)
No. 4 (4.75-mm)	No. 200 (75-μm)
No. 8 (2.36-mm)	

3.7 *Water Bath or Constant-Temperature Room*—A water bath or constant-temperature room for maintaining the soil suspension at a constant temperature during the hydrometer analysis. A satisfactory water tank is an insulated tank that maintains the temperature of the suspension at a convenient constant temperature at or near 68°F (20°C). Such a device is illustrated in Fig. 4. In cases where the work is performed in a room at an automatically controlled constant temperature, the water bath is not necessary.

3.8 *Beaker*—A beaker of 250-mL capacity.

3.9 *Timing Device*—A watch or clock with a second hand.

4. Dispersing Agent

4.1 A solution of sodium hexametaphosphate (sometimes called sodium metaphosphate) shall be used in distilled or demineralized water, at the rate of 40 g of sodium hexametaphosphate/litre of solution (Note 7).

NOTE 7—Solutions of this salt, if acidic, slowly revert or hydrolyze back to the orthophosphate form with a resultant decrease in dispersive action. Solutions should be prepared frequently (at least once a month) or adjusted to pH of 8 or 9 by means of sodium carbonate. Bottles containing solutions should have the date of preparation marked on them.

4.2 All water used shall be either distilled or demineralized water. The water for a hydrometer test shall be brought to the

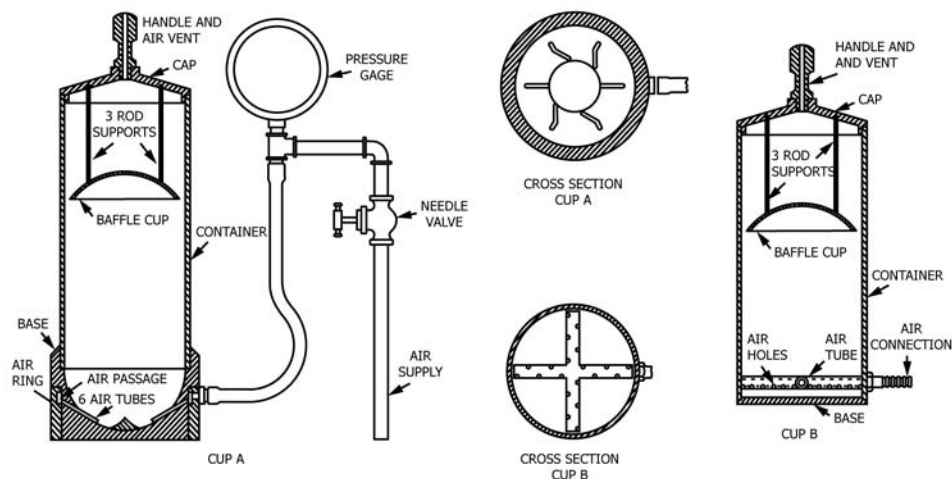
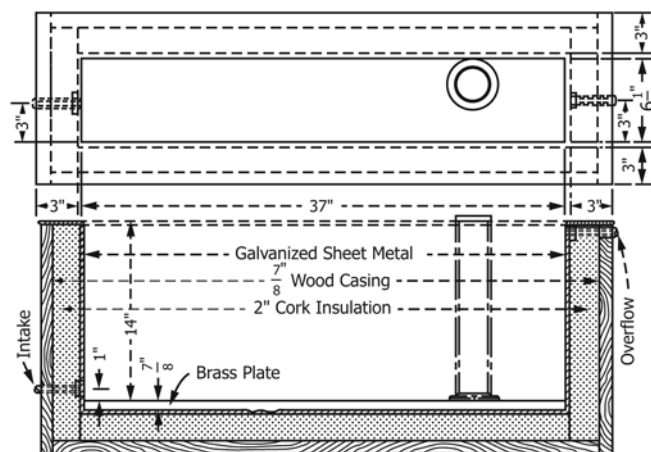


FIG. 3 Air-Jet Dispersion Cups of Apparatus B



Metric Equivalents						
in.	7/8	1	3	6 1/4	14	37
mm	22.2	25.4	76.2	158.2	356	940

FIG. 4 Insulated Water Bath

temperature that is expected to prevail during the hydrometer test. For example, if the sedimentation cylinder is to be placed in the water bath, the distilled or demineralized water to be used shall be brought to the temperature of the controlled water bath; or, if the sedimentation cylinder is used in a room with controlled temperature, the water for the test shall be at the temperature of the room. The basic temperature for the hydrometer test is 68°F (20°C). Small variations of tempera-

ture do not introduce differences that are of practical significance and do not prevent the use of corrections derived as prescribed.

5. Test Sample

5.1 Prepare the test sample for mechanical analysis as outlined in Practice D421. During the preparation procedure the sample is divided into two portions. One portion contains

only particles retained on the No. 10 (2.00-mm) sieve while the other portion contains only particles passing the No. 10 sieve. The mass of air-dried soil selected for purpose of tests, as prescribed in Practice **D421**, shall be sufficient to yield quantities for mechanical analysis as follows:

5.1.1 The size of the portion retained on the No. 10 sieve shall depend on the maximum size of particle, according to the following schedule:

Nominal Diameter of Largest Particles, in. (mm)	Approximate Minimum Mass of Portion, g
3/8 (9.5)	500
3/4 (19.0)	1000
1 (25.4)	2000
1 1/2 (38.1)	3000
2 (50.8)	4000
3 (76.2)	5000

5.1.2 The size of the portion passing the No. 10 sieve shall be approximately 115 g for sandy soils and approximately 65 g for silt and clay soils.

5.2 Provision is made in Section **5** of Practice **D421** for weighing of the air-dry soil selected for purpose of tests, the separation of the soil on the No. 10 sieve by dry-sieving and washing, and the weighing of the washed and dried fraction retained on the No. 10 sieve. From these two masses the percentages retained and passing the No. 10 sieve can be calculated in accordance with **12.1**.

NOTE 8—A check on the mass values and the thoroughness of pulverization of the clods may be secured by weighing the portion passing the No. 10 sieve and adding this value to the mass of the washed and oven-dried portion retained on the No. 10 sieve.

SIEVE ANALYSIS OF PORTION RETAINED ON NO. 10 (2.00-mm) SIEVE

6. Procedure

6.1 Separate the portion retained on the No. 10 (2.00-mm) sieve into a series of fractions using the 3-in. (75-mm), 2-in. (50-mm), 1 1/2-in. (37.5-mm), 1-in. (25.0-mm), 3/4-in. (19.0-mm), 3/8-in. (9.5-mm), No. 4 (4.75-mm), and No. 10 sieves, or as many as may be needed depending on the sample, or upon the specifications for the material under test.

6.2 Conduct the sieving operation by means of a lateral and vertical motion of the sieve, accompanied by a jarring action in order to keep the sample moving continuously over the surface of the sieve. In no case turn or manipulate fragments in the sample through the sieve by hand. Continue sieving until not more than 1 mass % of the residue on a sieve passes that sieve during 1 min of sieving. When mechanical sieving is used, test the thoroughness of sieving by using the hand method of sieving as described above.

6.3 Determine the mass of each fraction on a balance conforming to the requirements of **3.1**. At the end of weighing, the sum of the masses retained on all the sieves used should equal closely the original mass of the quantity sieved.

HYDROMETER AND SIEVE ANALYSIS OF PORTION PASSING THE NO. 10 (2.00-mm) SIEVE

7. Determination of Composite Correction for Hydrometer Reading

7.1 Equations for percentages of soil remaining in suspension, as given in **14.3**, are based on the use of distilled or demineralized water. A dispersing agent is used in the water, however, and the specific gravity of the resulting liquid is appreciably greater than that of distilled or demineralized water.

7.1.1 Both soil hydrometers are calibrated at 68°F (20°C), and variations in temperature from this standard temperature produce inaccuracies in the actual hydrometer readings. The amount of the inaccuracy increases as the variation from the standard temperature increases.

7.1.2 Hydrometers are graduated by the manufacturer to be read at the bottom of the meniscus formed by the liquid on the stem. Since it is not possible to secure readings of soil suspensions at the bottom of the meniscus, readings must be taken at the top and a correction applied.

7.1.3 The net amount of the corrections for the three items enumerated is designated as the composite correction, and may be determined experimentally.

7.2 For convenience, a graph or table of composite corrections for a series of 1° temperature differences for the range of expected test temperatures may be prepared and used as needed. Measurement of the composite corrections may be made at two temperatures spanning the range of expected test temperatures, and corrections for the intermediate temperatures calculated assuming a straight-line relationship between the two observed values.

7.3 Prepare 1000 mL of liquid composed of distilled or demineralized water and dispersing agent in the same proportion as will prevail in the sedimentation (hydrometer) test. Place the liquid in a sedimentation cylinder and the cylinder in the constant-temperature water bath, set for one of the two temperatures to be used. When the temperature of the liquid becomes constant, insert the hydrometer, and, after a short interval to permit the hydrometer to come to the temperature of the liquid, read the hydrometer at the top of the meniscus formed on the stem. For hydrometer 151H the composite correction is the difference between this reading and one; for hydrometer 152H it is the difference between the reading and zero. Bring the liquid and the hydrometer to the other temperature to be used, and secure the composite correction as before.

8. Hygroscopic Moisture

8.1 When the sample is weighed for the hydrometer test, weigh out an auxiliary portion of from 10 to 15 g in a small metal or glass container, dry the sample to a constant mass in an oven at 230 ± 9°F (110 ± 5°C), and weigh again. Record the masses.

9. Dispersion of Soil Sample

9.1 When the soil is mostly of the clay and silt sizes, weigh out a sample of air-dry soil of approximately 50 g. When the soil is mostly sand the sample should be approximately 100 g.

9.2 Place the sample in the 250-mL beaker and cover with 125 mL of sodium hexametaphosphate solution (40 g/L). Stir until the soil is thoroughly wetted. Allow to soak for at least 16 h.

9.3 At the end of the soaking period, disperse the sample further, using either stirring apparatus A or B. If stirring apparatus A is used, transfer the soil-water slurry from the beaker into the special dispersion cup shown in Fig. 2, washing any residue from the beaker into the cup with distilled or demineralized water (Note 9). Add distilled or demineralized water, if necessary, so that the cup is more than half full. Stir for a period of 1 min.

NOTE 9—A large size syringe is a convenient device for handling the water in the washing operation. Other devices include the wash-water bottle and a hose with nozzle connected to a pressurized distilled water tank.

9.4 If stirring apparatus B (Fig. 3) is used, remove the cover cap and connect the cup to a compressed air supply by means of a rubber hose. A air gage must be on the line between the cup and the control valve. Open the control valve so that the gage indicates 1 psi (7 kPa) pressure (Note 10). Transfer the soil-water slurry from the beaker to the air-jet dispersion cup by washing with distilled or demineralized water. Add distilled or demineralized water, if necessary, so that the total volume in the cup is 250 mL, but no more.

NOTE 10—The initial air pressure of 1 psi is required to prevent the soil-water mixture from entering the air-jet chamber when the mixture is transferred to the dispersion cup.

9.5 Place the cover cap on the cup and open the air control valve until the gage pressure is 20 psi (140 kPa). Disperse the soil according to the following schedule:

Plasticity Index	Dispersion Period, min
Under 5	5
6 to 20	10
Over 20	15

Soils containing large percentages of mica need be dispersed for only 1 min. After the dispersion period, reduce the gage pressure to 1 psi preparatory to transfer of soil-water slurry to the sedimentation cylinder.

10. Hydrometer Test

10.1 Immediately after dispersion, transfer the soil-water slurry to the glass sedimentation cylinder, and add distilled or demineralized water until the total volume is 1000 mL.

10.2 Using the palm of the hand over the open end of the cylinder (or a rubber stopper in the open end), turn the cylinder upside down and back for a period of 1 min to complete the agitation of the slurry (Note 11). At the end of 1 min set the cylinder in a convenient location and take hydrometer readings at the following intervals of time (measured from the beginning of sedimentation), or as many as may be needed, depending on the sample or the specification for the material under test: 2, 5,

15, 30, 60, 250, and 1440 min. If the controlled water bath is used, the sedimentation cylinder should be placed in the bath between the 2- and 5-min readings.

NOTE 11—The number of turns during this minute should be approximately 60, counting the turn upside down and back as two turns. Any soil remaining in the bottom of the cylinder during the first few turns should be loosened by vigorous shaking of the cylinder while it is in the inverted position.

10.3 When it is desired to take a hydrometer reading, carefully insert the hydrometer about 20 to 25 s before the reading is due to approximately the depth it will have when the reading is taken. As soon as the reading is taken, carefully remove the hydrometer and place it with a spinning motion in a graduate of clean distilled or demineralized water.

NOTE 12—It is important to remove the hydrometer immediately after each reading. Readings shall be taken at the top of the meniscus formed by the suspension around the stem, since it is not possible to secure readings at the bottom of the meniscus.

10.4 After each reading, take the temperature of the suspension by inserting the thermometer into the suspension.

11. Sieve Analysis

11.1 After taking the final hydrometer reading, transfer the suspension to a No. 200 (75- μ m) sieve and wash with tap water until the wash water is clear. Transfer the material on the No. 200 sieve to a suitable container, dry in an oven at $230 \pm 9^\circ\text{F}$ ($110 \pm 5^\circ\text{C}$) and make a sieve analysis of the portion retained, using as many sieves as desired, or required for the material, or upon the specification of the material under test.

CALCULATIONS AND REPORT

12. Sieve Analysis Values for the Portion Coarser than the No. 10 (2.00-mm) Sieve

12.1 Calculate the percentage passing the No. 10 sieve by dividing the mass passing the No. 10 sieve by the mass of soil originally split on the No. 10 sieve, and multiplying the result by 100. To obtain the mass passing the No. 10 sieve, subtract the mass retained on the No. 10 sieve from the original mass.

12.2 To secure the total mass of soil passing the No. 4 (4.75-mm) sieve, add to the mass of the material passing the No. 10 sieve the mass of the fraction passing the No. 4 sieve and retained on the No. 10 sieve. To secure the total mass of soil passing the $\frac{3}{8}$ -in. (9.5-mm) sieve, add to the total mass of soil passing the No. 4 sieve, the mass of the fraction passing the $\frac{3}{8}$ -in. sieve and retained on the No. 4 sieve. For the remaining sieves, continue the calculations in the same manner.

12.3 To determine the total percentage passing for each sieve, divide the total mass passing (see 12.2) by the total mass of sample and multiply the result by 100.

13. Hygroscopic Moisture Correction Factor

13.1 The hygroscopic moisture correction factor is the ratio between the mass of the oven-dried sample and the air-dry mass before drying. It is a number less than one, except when there is no hygroscopic moisture.

14. Percentages of Soil in Suspension

14.1 Calculate the oven-dry mass of soil used in the hydrometer analysis by multiplying the air-dry mass by the hygroscopic moisture correction factor.

14.2 Calculate the mass of the total sample represented by the mass of soil used in the hydrometer test, by dividing the oven-dry mass (as calculated in 14.1) by the percentage passing the No. 10 (2.00-mm) sieve, and multiplying the result by 100. This value is the weight W in the equation for percentage remaining in suspension.

14.3 The percentage of soil remaining in suspension at the level at which the hydrometer is measuring the density of the suspension may be calculated as follows (Note 13): For hydrometer 151H:

$$P = [(100000/W) \times G/(G - G_1)](R - G_1) \quad (1)$$

NOTE 13—The bracketed portion of the equation for hydrometer 151H is constant for a series of readings and may be calculated first and then multiplied by the portion in the parentheses.

For hydrometer 152H:

$$P = (Ra/W) \times 100 \quad (2)$$

where:

- a = correction factor to be applied to the reading of hydrometer 152H. (Values shown on the scale are computed using a specific gravity of 2.65. Correction factors are given in Table 1),
- P = percentage of soil remaining in suspension at the level at which the hydrometer measures the density of the suspension,
- R = hydrometer reading with composite correction applied (Section 7),
- W = oven-dry mass of soil in a total test sample represented by mass of soil dispersed (see 14.2), g,
- G = specific gravity of the soil particles, and
- G_1 = specific gravity of the liquid in which soil particles are suspended. Use numerical value of one in both instances in the equation. In the first instance any possible variation produces no significant effect, and in the second instance, the composite correction for R is based on a value of one for G_1 .

TABLE 1 Values of Correction Factor, a , for Different Specific Gravities of Soil Particles^A

Specific Gravity	Correction Factor ^A
2.95	0.94
2.90	0.95
2.85	0.96
2.80	0.97
2.75	0.98
2.70	0.99
2.65	1.00
2.60	1.01
2.55	1.02
2.50	1.03
2.45	1.05

^AFor use in equation for percentage of soil remaining in suspension when using Hydrometer 152H.

15. Diameter of Soil Particles

15.1 The diameter of a particle corresponding to the percentage indicated by a given hydrometer reading shall be calculated according to Stokes' law (Note 14), on the basis that a particle of this diameter was at the surface of the suspension at the beginning of sedimentation and had settled to the level at which the hydrometer is measuring the density of the suspension. According to Stokes' law (see Table 2):

$$D = \sqrt{[30n/980(G - G_1)] \times L/T} \quad (3)$$

where:

- D = diameter of particle, mm,
- n = coefficient of viscosity of the suspending medium (in this case water) in poises (varies with changes in temperature of the suspending medium),
- L = distance from the surface of the suspension to the level at which the density of the suspension is being measured, cm. (For a given hydrometer and sedimentation cylinder, values vary according to the hydrometer readings. This distance is known as effective depth (see Table 2)),
- T = interval of time from beginning of sedimentation to the taking of the reading, min,
- G = specific gravity of soil particles, and
- G_1 = specific gravity (relative density) of suspending medium (value may be used as 1.000 for all practical purposes).

NOTE 14—Since Stokes' law considers the terminal velocity of a single sphere falling in an infinity of liquid, the sizes calculated represent the diameter of spheres that would fall at the same rate as the soil particles.

15.2 For convenience in calculations the above equation may be written as follows (see Table 3):

$$D = K\sqrt{L/T} \quad (5)$$

where:

- K = constant depending on the temperature of the suspension and the specific gravity of the soil particles. Values of K for a range of temperatures and specific gravities are given in Table 3. The value of K does not change for a series of readings constituting a test, while values of L and T do vary.

15.3 Values of D may be computed with sufficient accuracy, using an ordinary 10-in. slide rule.

NOTE 15—The value of L is divided by T using the A - and B -scales, the square root being indicated on the D -scale. Without ascertaining the value of the square root it may be multiplied by K , using either the C - or CI -scale.

16. Sieve Analysis Values for Portion Finer than No. 10 (2.00-mm) Sieve

16.1 Calculation of percentages passing the various sieves used in sieving the portion of the sample from the hydrometer test involves several steps. The first step is to calculate the mass of the fraction that would have been retained on the No. 10 sieve had the material not been removed. This mass is equal to the total percentage retained on the No. 10 sieve (100 minus total percentage passing) times the mass of the total sample

**TABLE 2 Values of Effective Depth Based on Hydrometer and Sedimentation Cylinder of Specified Sizes^A**

Hydrometer 151H		Hydrometer 152H			
Actual Hydrometer Reading	Effective Depth, L, cm	Actual Hydrometer Reading	Effective Depth, L, cm	Actual Hydrometer Reading	Effective Depth, L, cm
1.000	16.3	0	16.3	31	11.2
1.001	16.0	1	16.1	32	11.1
1.002	15.8	2	16.0	33	10.9
1.003	15.5	3	15.8	34	10.7
1.004	15.2	4	15.6	35	10.6
1.005	15.0	5	15.5		
1.006	14.7	6	15.3	36	10.4
1.007	14.4	7	15.2	37	10.2
1.008	14.2	8	15.0	38	10.1
1.009	13.9	9	14.8	39	9.9
1.010	13.7	10	14.7	40	9.7
1.011	13.4	11	14.5	41	9.6
1.012	13.1	12	14.3	42	9.4
1.013	12.9	13	14.2	43	9.2
1.014	12.6	14	14.0	44	9.1
1.015	12.3	15	13.8	45	8.9
1.016	12.1	16	13.7	46	8.8
1.017	11.8	17	13.5	47	8.6
1.018	11.5	18	13.3	48	8.4
1.019	11.3	19	13.2	49	8.3
1.020	11.0	20	13.0	50	8.1
1.021	10.7	21	12.9	51	7.9
1.022	10.5	22	12.7	52	7.8
1.023	10.2	23	12.5	53	7.6
1.024	10.0	24	12.4	54	7.4
1.025	9.7	25	12.2	55	7.3
1.026	9.4	26	12.0	56	7.1
1.027	9.2	27	11.9	57	7.0
1.028	8.9	28	11.7	58	6.8
1.029	8.6	29	11.5	59	6.6
1.030	8.4	30	11.4	60	6.5
1.031	8.1				
1.032	7.8				
1.033	7.6				
1.034	7.3				
1.035	7.0				
1.036	6.8				
1.037	6.5				
1.038	6.2				

^A Values of effective depth are calculated from the equation:

$$L = L_1 + 1/2 [L_2 - (V_B/A)] \quad (4)$$

where:

- L = effective depth, cm,
 L_1 = distance along the stem of the hydrometer from the top of the bulb to the mark for a hydrometer reading, cm,
 L_2 = overall length of the hydrometer bulb, cm,
 V_B = volume of hydrometer bulb, cm³, and
 A = cross-sectional area of sedimentation cylinder, cm²

Values used in calculating the values in Table 2 are as follows:

For both hydrometers, 151H and 152H:

- L_2 = 14.0 cm
 V_B = 67.0 cm³
 A = 27.8 cm²

For hydrometer 151H:

- L_1 = 10.5 cm for a reading of 1.000
= 2.3 cm for a reading of 1.031

For hydrometer 152H:

- L_1 = 10.5 cm for a reading of 0 g/litre
= 2.3 cm for a reading of 50 g/litre

represented by the mass of soil used (as calculated in 14.2), and the result divided by 100.

16.2 Calculate next the total mass passing the No. 200 sieve. Add together the fractional masses retained on all the sieves, including the No. 10 sieve, and subtract this sum from the mass of the total sample (as calculated in 14.2).

16.3 Calculate next the total masses passing each of the other sieves, in a manner similar to that given in 12.2.

16.4 Calculate last the total percentages passing by dividing the total mass passing (as calculated in 16.3) by the total mass of sample (as calculated in 14.2), and multiply the result by 100.

17. Graph

17.1 When the hydrometer analysis is performed, a graph of the test results shall be made, plotting the diameters of the particles on a logarithmic scale as the abscissa and the percentages smaller than the corresponding diameters to an arithmetic scale as the ordinate. When the hydrometer analysis is not made on a portion of the soil, the preparation of the graph is optional, since values may be secured directly from tabulated data.

18. Report: Test Data Sheet(s)/Form(s)

18.1 Record as a minimum the following general information:

- 18.1.1 Maximum size of particles,
18.1.2 Percentage passing (or retained on) each sieve, which may be tabulated or presented by plotting on a graph (Note 16),
18.1.3 Description of sand and gravel particles:
18.1.3.1 Shape—rounded or angular,
18.1.3.2 Hardness—hard and durable, soft, or weathered and friable,
18.1.4 Specific gravity, if unusually high or low,
18.1.5 Any difficulty in dispersing the fraction passing the No. 10 (2.00-mm) sieve, indicating any change in type and amount of dispersing agent, and
18.1.6 The dispersion device used and the length of the dispersion period.

NOTE 16—This tabulation of graph represents the gradation of the sample tested. If particles larger than those contained in the sample were removed before testing, the report shall so state giving the amount and maximum size.

18.2 For materials tested for compliance with definite specifications, the fractions called for in such specifications shall be reported. The fractions smaller than the No. 10 sieve shall be read from the graph.

18.3 For materials for which compliance with definite specifications is not indicated and when the soil is composed almost entirely of particles passing the No. 4 (4.75-mm) sieve, the results read from the graph may be reported as follows:

- (1) Gravel, passing 3-in. and retained on No. 4 sieve . . .
(2) Sand, passing No. 4 sieve and retained on No. 200 sieve . . .
(a) Coarse sand, passing No. 4 sieve and retained on No. 10 sieve . . .
(b) Medium sand, passing No. 10 sieve and retained on No. 40 sieve . . .
(c) Fine sand, passing No. 40 sieve and retained on No. 200 sieve . . .
(3) Silt size, 0.074 to 0.005 mm . . .
(4) Clay size, smaller than 0.005 mm . . .
Colloids, smaller than 0.001 mm . . .

18.4 For materials for which compliance with definite specifications is not indicated and when the soil contains

TABLE 3 Values of K for Use in Equation for Computing Diameter of Particle in Hydrometer Analysis

Temperature, ° C	Specific Gravity of Soil Particles								
	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85
16	0.01531	0.01505	0.01481	0.01458	0.01435	0.01414	0.01394	0.01374	0.01355
17	0.01511	0.01486	0.01462	0.01439	0.01417	0.01396	0.01376	0.01356	0.01338
18	0.01492	0.01467	0.01443	0.01420	0.01399	0.01378	0.01358	0.01339	0.01321
19	0.01474	0.01449	0.01426	0.01403	0.01382	0.01361	0.01342	0.01323	0.01305
20	0.01456	0.01431	0.01408	0.01386	0.01365	0.01345	0.01326	0.01307	0.01289
21	0.01438	0.01414	0.01391	0.01369	0.01348	0.01328	0.01309	0.01291	0.01273
22	0.01421	0.01397	0.01374	0.01353	0.01332	0.01312	0.01294	0.01275	0.01258
23	0.01404	0.01381	0.01358	0.01337	0.01316	0.01297	0.01278	0.01260	0.01243
24	0.01388	0.01365	0.01342	0.01321	0.01301	0.01282	0.01263	0.01246	0.01229
25	0.01372	0.01349	0.01327	0.01306	0.01286	0.01267	0.01249	0.01232	0.01215
26	0.01357	0.01334	0.01312	0.01292	0.01272	0.01253	0.01235	0.01218	0.01201
27	0.01342	0.01319	0.01298	0.01277	0.01258	0.01239	0.01221	0.01204	0.01188
28	0.01327	0.01305	0.01283	0.01263	0.01244	0.01225	0.01208	0.01191	0.01175
29	0.01312	0.01290	0.01269	0.01249	0.01230	0.01212	0.01194	0.01178	0.01162
30	0.01298	0.01276	0.01255	0.01235	0.01217	0.01199	0.01181	0.01165	0.01149

material retained on the No. 4 sieve sufficient to require a sieve analysis on that portion, the results may be reported as follows (Note 17):

No. 10 (2.00-mm) . . .
 No. 40 (425- μ m) . . .
 No. 200 (75- μ m) . . .

HYDROMETER ANALYSIS

SIEVE ANALYSIS

Sieve Size	Percentage Passing
3-in.	...
2-in.	...
1½-in.	...
1-in.	...
¾-in.	...
⅝-in.	...
No. 4 (4.75-mm)	...

0.074 mm . . .
 0.005 mm . . .
 0.001 mm . . .

NOTE 17—No. 8 (2.36-mm) and No. 50 (300- μ m) sieves may be substituted for No. 10 and No. 40 sieves.

19. Keywords

19.1 grain-size; hydrometer analysis; hygroscopic moisture; particle-size; sieve analysis

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ATTACHMENT 3 – QUALITY CONTROL FORMS

Table 3-1: Daily Quality Control Form – Non-Construction (Main)

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Kirtland AFB Bulk Fuels Facility GWTS Expansion/Monitoring -- 62599DM01
Daily Quality Control Report – Non-Construction

ROLE: _____

DATE: _____

WEATHER:

1. ONSITE PERSONNEL (including subcontractors and government employees)	
Name	Organization
	EA - Site Manager/Supervisor
	EA - Site Health and Safety Office

2. OPERATING EQUIPMENT		
Team #1	Team #2	Spare
YSI Professional Plus 15K101398 <input type="checkbox"/> Wh0003	YSI Professional Plus 15K101396 <input type="checkbox"/> Wh0001	YSI Professional Plus 15L100541 <input type="checkbox"/> Wh0002
MiniRAE 3000 592-915778 <input type="checkbox"/> Wh0005	MiniRAE 3000 592-915790 <input type="checkbox"/> Wh0004	MiniRAE 3000 592-915579 <input type="checkbox"/> Wh0006
Hach 2100Q 15100C045034 <input type="checkbox"/> Wh0008	Hach 2100Q 15100C044633 <input type="checkbox"/> Wh0009	Hach 2100Q 15100C045025 <input type="checkbox"/> Wh0007
Solinst Water Level Meter 253054 <input type="checkbox"/>	Solinst Water Level Meter 253053 <input type="checkbox"/>	Solinst Water Level Meter 253056 <input type="checkbox"/>

3. DAILY SUMMARY (include QC samples collected, deviations from planning documents, conversations with the public and governmental employees, and problems encountered and remedies applied)	

4. WORK PERFORMED (Indicate location, time, and description of work performed by prime and/or subcontractors)	

Reviewed by: _____

Initials: _____

Reviewed date: _____

Kirtland AFB Bulk Fuels Facility GWTS Expansion/Monitoring -- 62599DM01
Daily Quality Control Report – Non-Construction

DATE: _____

[illegible][illegible]

5. CONTRACTOR'S VERIFICATION: I certify that to the best of my knowledge the above report is complete and correct. All equipment used, and work performed during this reporting period is in compliance with the contract plans and specifications noted above.

Name

Signature

EA Engineering, Science and Technology Inc., PBC

Reviewed by: _____

Initials: _____

Reviewed date: _____

ATTACHMENT 3 – QUALITY CONTROL FORMS

Table 3-2: Field Assessment Checklist

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FIELD ASSESSMENT CHECKLIST

	Yes	No	NA	Explain
A GENERAL PROCEDURES				
A1 PROJECT PLANS				
Is a copy of the approved Work Plan onsite and readily available to field personnel?				
Is a copy of the approved field sampling plan (FSP) onsite and readily available to field personnel?				
Is a copy of the approved health and safety plan (HASP) onsite and readily available to field personnel?				
Is a copy of the approved quality assurance project plan (QAPjP) onsite and readily available to field personnel?				
Is a copy of the approved Data Management Plan onsite and readily available to field personnel?				
Are field personnel knowledgeable of the project plans?				
A2 ORGANIZATION, PERSONNEL, AND RESPONSIBILITIES				
Does either the FSP or the QAPjP include an organizational chart?				
Does either the FSP or the QAPjP include a list of personnel responsibilities?				
Is a daily meeting held to present the planned activities to the team and provide updates on any health and safety and QC issues?				
Do the field personnel understand the chain of command? Discuss with individuals.				
Is a health and safety officer present onsite? Name:				
Have all field personnel reviewed and signed the HASP?				
Do field personnel have certification documentation on hand?				

	Yes	No	NA	Explain
Is the site secure from unauthorized personnel?				
A3 SAMPLE DOCUMENTATION AND HANDLING				
Are all sampling containers used onsite clean certified? Is documentation available on file?				
Are certificates of analyses on file for all shipments of deionized water used?				
Is a sample manager/custodian identified? Name:				
Have all personnel involved with sample handling/shipment received training in all applicable and appropriate procedures?				
Are all transfers of sample custody documented?				
Have samples been preserved as specified in the approved QAPjP?				
Does the identification and packaging of samples include each of the following items:				
a. Entries in permanent ink of all applicable sample labels and tags, chain-of-custody (COC) forms and seals, and any associated paperwork?				
b. Legible sample IDs				
c. Complete and legible sample labels				
d. Signed and dated COC forms				
e. Placement of samples in a clear Ziploc plastic bag (if applicable)				
Additional placing of sample in a metal container (for example paint can) for medium/high concentration samples or dioxin samples				
Are sample collection logs and shipping records maintained onsite, well organized and accurate? Is any QC performed?				
Are the coolers packed in a contamination-free area?				

	Yes	No	NA	Explain
A3 SAMPLE DOCUMENTATION AND HANDLING (continued)				
Is there adequate protection against breakage of sample containers (for example packed with sufficient padding material)?				
Are procedures in place to ensure that samples that need to be maintained at 4 degrees C are kept at that temperature and are not going to freeze or overheat?				
Are all entries on the COC and associated paperwork (field forms, logbook, air bill) complete, accurate, legible and made in permanent ink where required?				
Are samples shipped to the appropriate laboratories?				
Are COC forms placed in a clear waterproof Ziploc plastic bag and taped to the inside of the cooler's lid?				
If coolers are shipped, are they properly secured with duct and clear/strapping tape?				
Are shipping labels filled out properly?				
Are shipping labels appropriately secured to the outside of the coolers? Additional clear tape is needed to secure self-adhesive air bill envelopes.				
Are samples shipped to the laboratories in a timely fashion to minimize potential problems with holding times exceedances?				
Is there a system in place to report sample shipments to the laboratory contact?				
Is there a system in place to report sample shipments to the project chemist if not present onsite?				
Are accurate sample collection logs and shipping records maintained onsite in a well-organized fashion?				

	Yes	No	NA	Explain
A4 FIELD RECORDS				
Are all record kept in bound numbered waterproof logbooks?				
Is each field logbook issued as a controlled document?				
Is a document control system in place to track the logbooks issued?				
Are all pages of the logbooks numbered consecutively?				
Are all entries in the logbook made promptly? Is time indicated in military format?				
Are any blank pages or spaces left in the logbook? Any blank space in the logbook as well as the bottom of the last page should be crossed out, signed and dated.				
Are all field logbook entries made in indelible ink?				
Are all corrections indicated by a single-line strikethrough, dated and initialed?				
Do all logbooks contain at least the following information on the cover:				
a. Project name				
b. Site name				
c. Logbook number				
d. Start and end dates for the field effort				
e. Names of the individuals that are using the logbook?				
Do all logbooks contain at least the following information on the cover:				
Are entries in the logbook adequate to allow a competent person other than the originator to reconstruct the activities?				
Are sufficient data recorded to allow all field calculation to be replicated (for example total volume of water calculations for well development)?				
Are field calculations accurate? The inspector should verify 10% of the calculations.				
Are soil-boring logs filled out promptly, accurately, and legibly?				
Is soil classification adequate and consistent, and does it follow the scheme specified in the FSP or QAPjP?				

	Yes	No	NA	Explain
Are monitoring well diagrams filled out promptly, accurately, and legibly?				
Does sample collection information include the following items:				
a. Sampling personnel				
b. Sample identification				
c. Sampling location map				
d. Sample depth				
e. Sample description				
f. Collection date				
g. Collection time (military time)				
h. Ambient weather conditions				
i. Analytical suite				
j. Field data sheets				
Are sample log sheets or electronic tracking file filled out promptly accurately and legibly?				
Is there a master site logbook containing all other log sheets?				
A5 INSTRUMENT MAINTENANCE AND CALIBRATION				
Has all analytical and monitoring equipment been calibrated according to the schedule required in the approved FSP or QAPjP?				
Instrument_____ Calibration Personnel _____				
Instrument_____ Calibration Personnel _____				
Instrument_____ Calibration Personnel _____				
Instrument_____ Calibration Personnel _____				
Instrument_____ Calibration Personnel _____				
Instrument_____ Calibration Personnel _____				

		Yes	No	NA	Explain
	Are all instruments In use (or that will be used today) within calibration tolerance? Inspector should request that the designated calibration personnel analyze the appropriate standard as an unknown.				
	Instrument_____ Calibration Personnel _____				
	Instrument_____ Calibration Personnel _____				
	Instrument_____ Calibration Personnel _____				
	Instrument_____ Calibration Personnel _____				
	Instrument_____ Calibration Personnel _____				
	Instrument_____ Calibration Personnel _____				
	Are all instruments used properly, as detailed in the FSP or QAPjP and according to SOPs and manufacturer's instructions?				
	Are all instruments appropriately maintained, according to manufacturer's instructions?				
	Additional comments on section A.				
B FIELD PROCEDURES					
B1	Has the inspector reviewed the FSP and QAPjP prior to the site visit?				
B2	Do the FSP or QAPjP include specific procedural instructions, for example SOPs, necessary for the completion of the scheduled field activities?				
B3	Do the FSP or QAPjP and SOPs provide sufficient detail and effectively describe the objectives and requirements of the activities?				
B4	Is all equipment necessary to complete the work at hand and in good working condition?				

		Yes	No	NA	Explain
B5	Are daily reports prepared to identify deviations from the approved plans or SOPs?				
B6	Have appropriate authorizations been granted on all the deviations?				
B7	Have all field and QC samples been collected as per the FSP or QAPjP and applicable instructions? Inspector should check for proper sample collection order, for example VOCs first, proper containers, no homogenization for samples to be analyzed for VOCs, etc.).				
B8	Were any samples collected in a fashion that may question their integrity; for example VOCs collected in the vicinity of a running vehicle?				
B9	Additional comments on section B.				
C INSPECTION SUMMARY					
C1	Do the responses to the inspector indicate that the field personnel are aware of the QA/QC and its importance to the success of the projects?				
C2	Do field personnel place positive emphasis on QA/QC procedures?				
C3	Have responses with respect to QA/QC procedures been open and direct?				
C4	Has a cooperative attitude been displayed by the field personnel?				
C5	Are all procedures and documentation performed consistent with the FSP or QAPjP? Is there evidence that the field team has corrected deficiencies identified in the previous inspection (if applicable)?				
C6	Additional comments on section C.				
D DEFICIENCY REPORT					
D1	Were any deficiencies identified as a result of the field inspection?				
D2	Were all deficiencies and observations discussed with the field team leader during inspection debriefing?				

		Yes	No	NA	Explain
	Deficiency # _____ Description _____ _____ _____ Corrective Action(s): _____ _____ _____ _____ Implementation Date(s): _____				
	Deficiency # _____ Description _____ _____ _____ Corrective Action(s): _____ _____ _____ _____ Implementation Date(s): _____				

		Yes	No	NA	Explain
D DEFICIENCY REPORT (continued)					
D2	Were all deficiencies and observations discussed with the field team leader during inspection debriefing? (continued)				
	Deficiency # _____ Description _____ _____ _____ _____ Corrective Action(s): _____ _____ _____ _____ Implementation Date(s): _____				
	Deficiency # _____ Description _____ _____ _____ _____ Corrective Action(s): _____ _____ _____ _____ Implementation Date(s): _____				

		Yes	No	NA	Explain
D DEFICIENCY REPORT (Continued)					
D2	Were all deficiencies and observations discussed with the field team leader during inspection debriefing? (Continued)				
	Deficiency # _____ Description _____ _____ _____ _____ Corrective Action(s): _____ _____ _____ _____ Implementation Date(s): _____				
	Deficiency # _____ Description _____ _____ _____ _____ Corrective Action(s): _____ _____ _____ _____ Implementation Date(s): _____				

		Yes	No	NA	Explain
D DEFICIENCY REPORT (Continued)					
D2	Were all deficiencies and observations discussed with the field team leader during inspection debriefing? (Continued)				
	Deficiency # _____ Description _____ _____ _____ _____ Corrective Action(s): _____ _____ _____ _____ Implementation Date(s): _____				
	Deficiency # _____ Description _____ _____ _____ _____ Corrective Action(s): _____ _____ _____ _____ Implementation Date(s): _____				

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ATTACHMENT 3 – QUALITY CONTROL FORMS

Table 3-3: Non-Conformance Report

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NON-CONFORMANCE REPORT

Project:		RFI No.:		Date:	
To:		Contract No:			
		REFERENCES			
Attention:		Drawing/Spec:			
Subject:		Detail/Section:			
		Discipline:			
POTENTIAL IMPACT		ROUTING	DATE SENT	DATE REC'D	COMMENTS
<div><div></div> QUALITY/TECHNICAL COMPLETION</div> <div><div></div> COST</div> <div><div></div> SCHEDULE</div> <div>ACTIVITY:</div>					
		RESPONSE REQUESTED BY:		PRIORITY:	
NONCONFORMANCE					
CORRECTIVE ACTION					
Addressee: Sign and return original to		By: EA Engineering, Science, and Technology, Inc., PBC			
		Name/ Signature:			
		Title:			

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APPENDIX B

Construction Schematics for New Wells and Existing Monitoring Well Construction Diagrams

**SCHEMATIC NESTED MONITORING WELL CONSTRUCTION
KAFB-106240 THROUGH KAFB-106245**

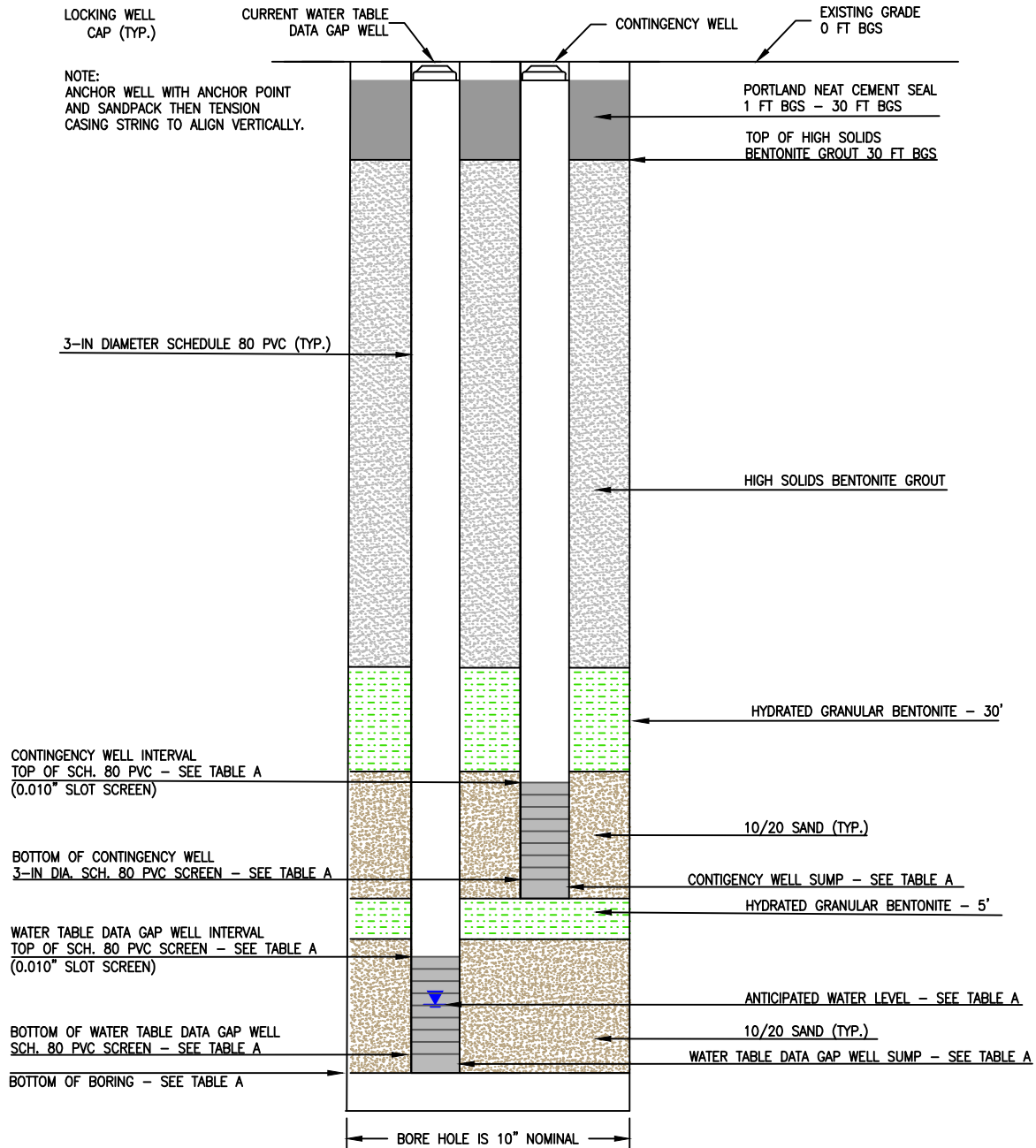


Table A

Well	Approx. Depth to Water (BGS)	Anticipated Water Table Data Gap Well Screen Interval	Anticipated Water Table Data Gap Well Sump Interval	Anticipated Contingency Well Screen Interval	Anticipated Contingency Well Sump Interval
KAFB-106240	462.3	437.3-477.3	477.3-479.3	403.3-428.3	428.3-430.3
KAFB-106241	454.9	429.9-469.9	469.9-471.9	395.9-420.9	420.9-422.9
KAFB-106242	443.4	418.3-458.3	458.3-460.3	384.3-409.3	409.3-411.3
KAFB-106243	453.7	428.7-468.7	468.7-470.7	394.7-419.7	419.7-421.7
KAFB-106244	474.2	449.2-489.2	489.2-491.2	415.2-440.2	440.2-442.2
KAFB-106245	482.2	457.2-497.2	497.2-499.2	423.2-448.2	448.2-450.2

All depths and intervals listed in feet below ground surface (bgs).

NOTE: APPROXIMATE DEPTH TO WATER DETERMINED FROM Q4 2017 DATA IN SURROUNDING GROUNDWATER MONITORING WELLS. DEPTH INTERVALS MAYBE MODIFIED DURING DRILLING BASED ON OBSERVED CONDITIONS; WELL SCREENS WILL BE POSITIONED WITH APPROXIMATELY 15' OF WATER COLUMN UPON COMPLETION.

NOT TO SCALE
BGS=BELOW GROUND SURFACE
FT=FEET



320 Gold Avenue, SW Suite 1300
Albuquerque, NM 87102
Phone: (505) 224-9013
Fax: (505) 224-9016
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC., PBC

KIRTLAND AIR FORCE BASE

PROJECT NO.:

WELL ID:

INSTALLATION START DATE/TIME:

INSTALLATION END DATE/TIME:

GEOLOGIST:

DRILLER:

Monitoring Well Completion Diagram KAFB-106041

Installation Start Date/Time: 6/4/2011 @ 09:11

Installation End Date/Time: 6/6/2011 @ 14:00

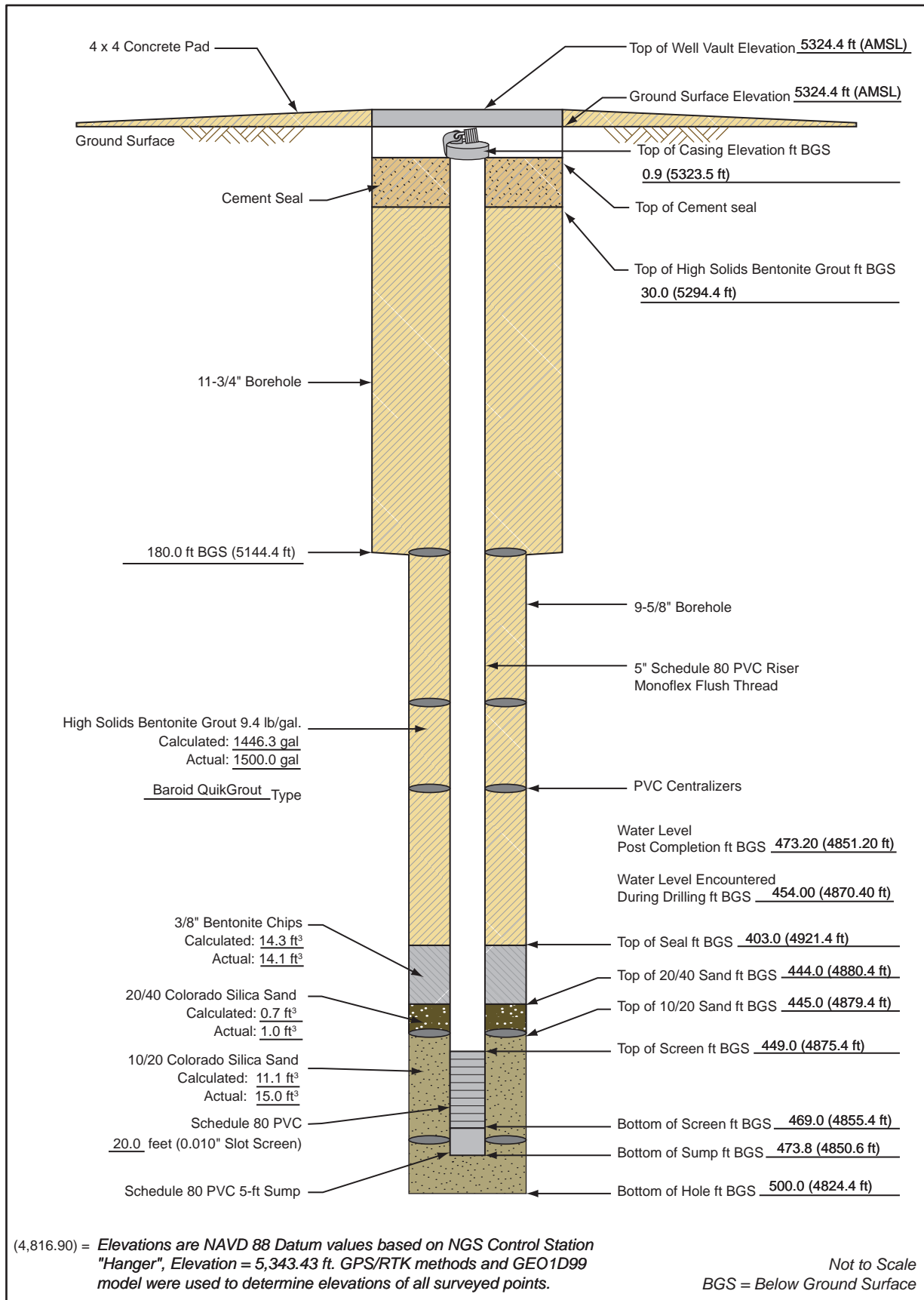
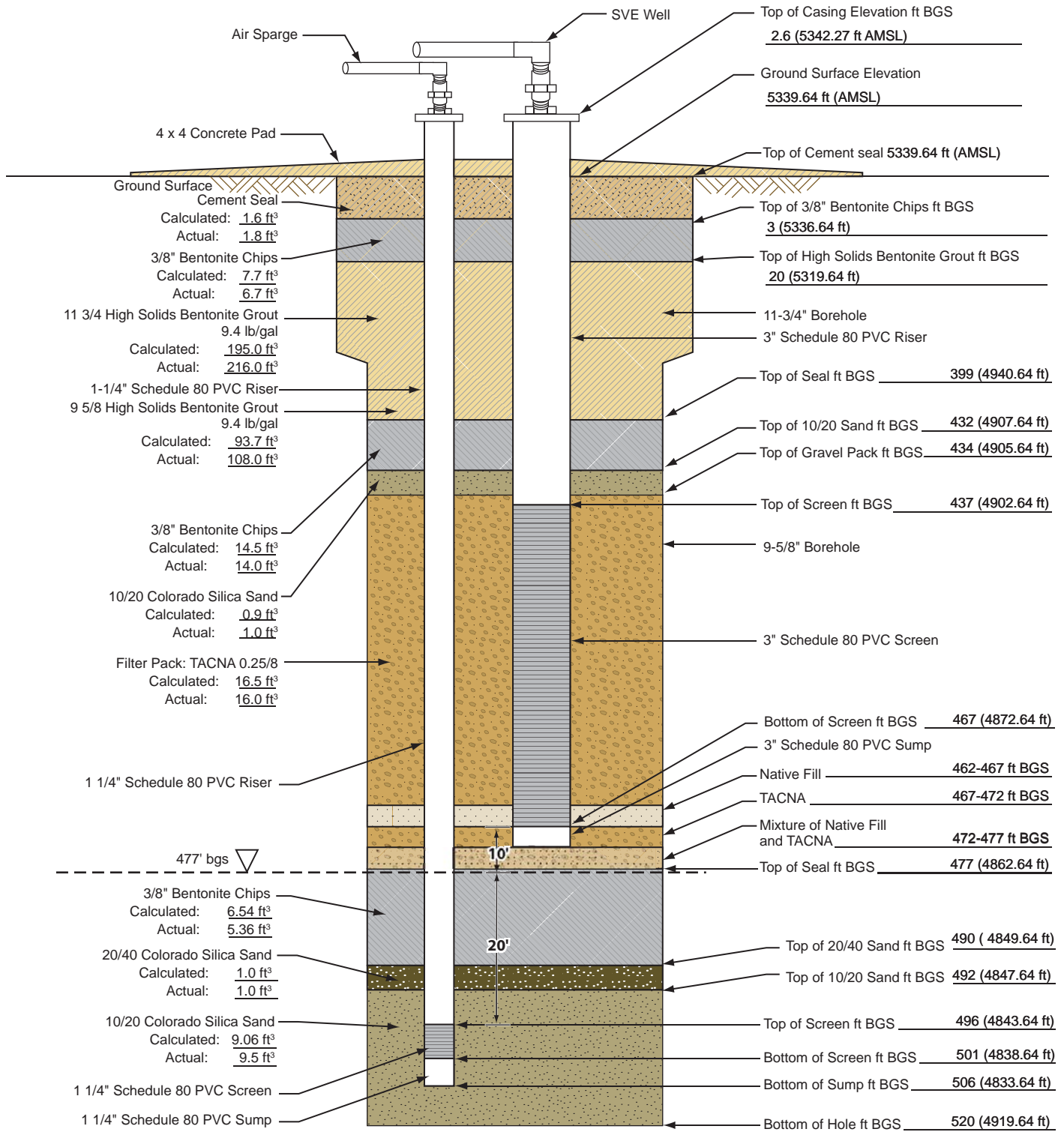


Figure 4
KAFB-106211 Air Sparge/SVE Well Construction

Installation Start Date/Time: 6/16/14 @ 0840
 Installation End Date/Time: 6/19/14 @ 1630



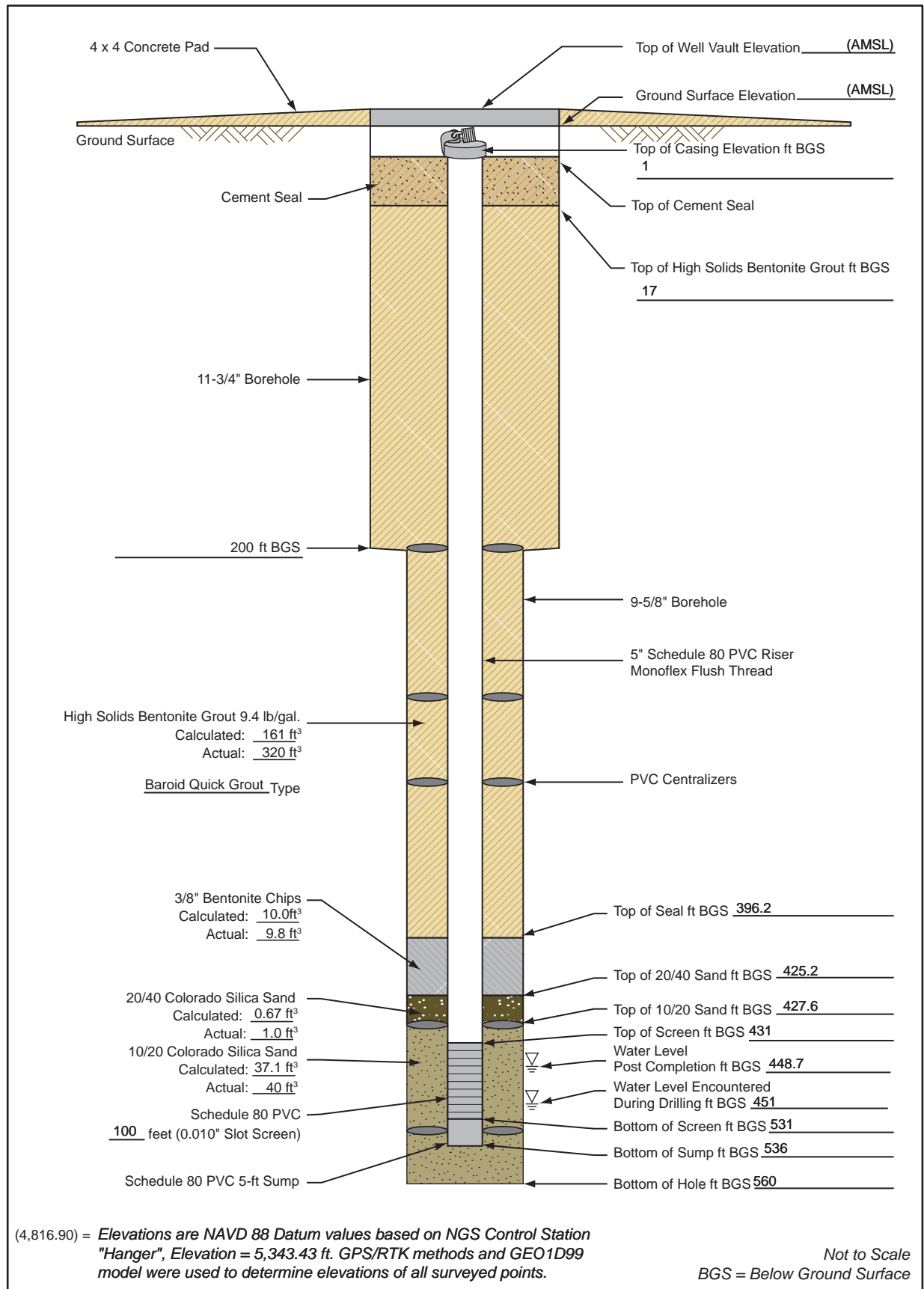
Not to Scale
 BGS = Below Ground Surface
 Depths Subject to Change
 Based on Field Observations

Monitoring Well Completion Diagram KAFB-106229

Installation Start Date/Time: 8/19/2015

Installation End Date/Time: 8/20/2015

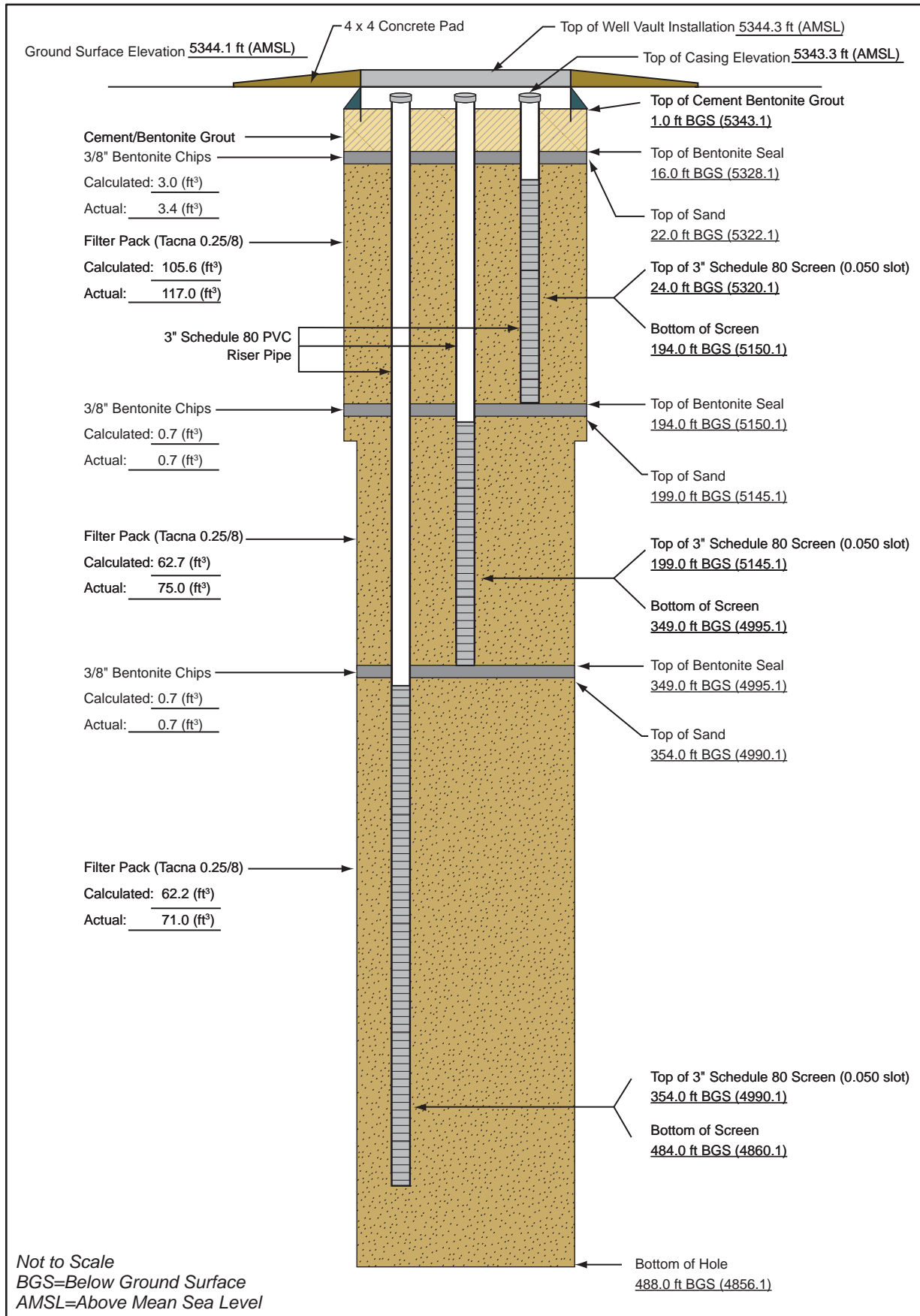
Completion Date: _____



PneuLog Well Completion Diagram KAFB-106148

Installation Start Date/Time: 9/08/2011 @10:00

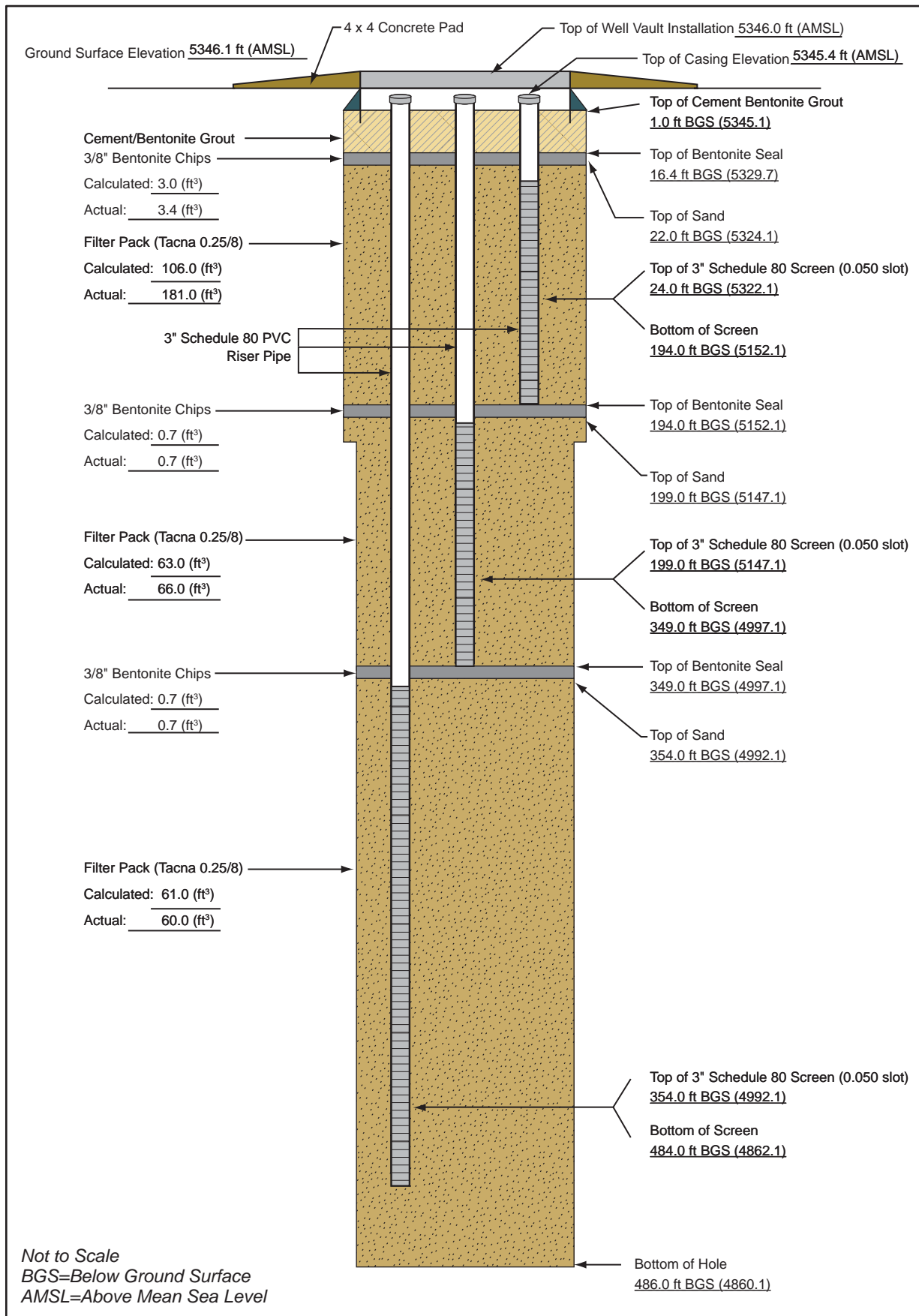
Installation End Date/Time: 9/12/2011 @10:20



PneuLog Well Completion Diagram KAFB-106149

Installation Start Date/Time: 9/15/2011 @08:40

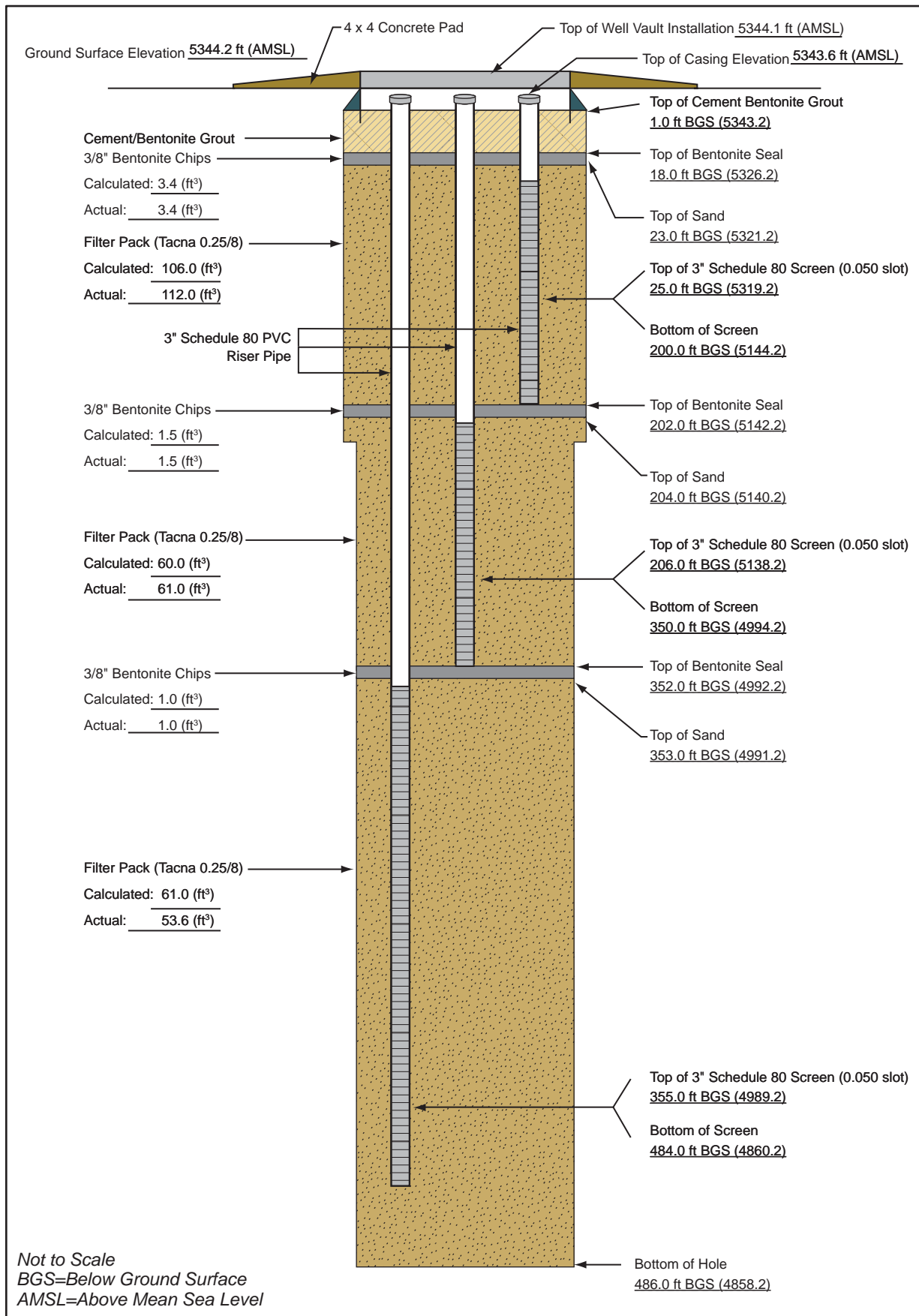
Installation End Date/Time: 9/16/2011 @13:15



PneuLog Well Completion Diagram KAFB-106150

Installation Start Date/Time: 9/21/2011 @12:00

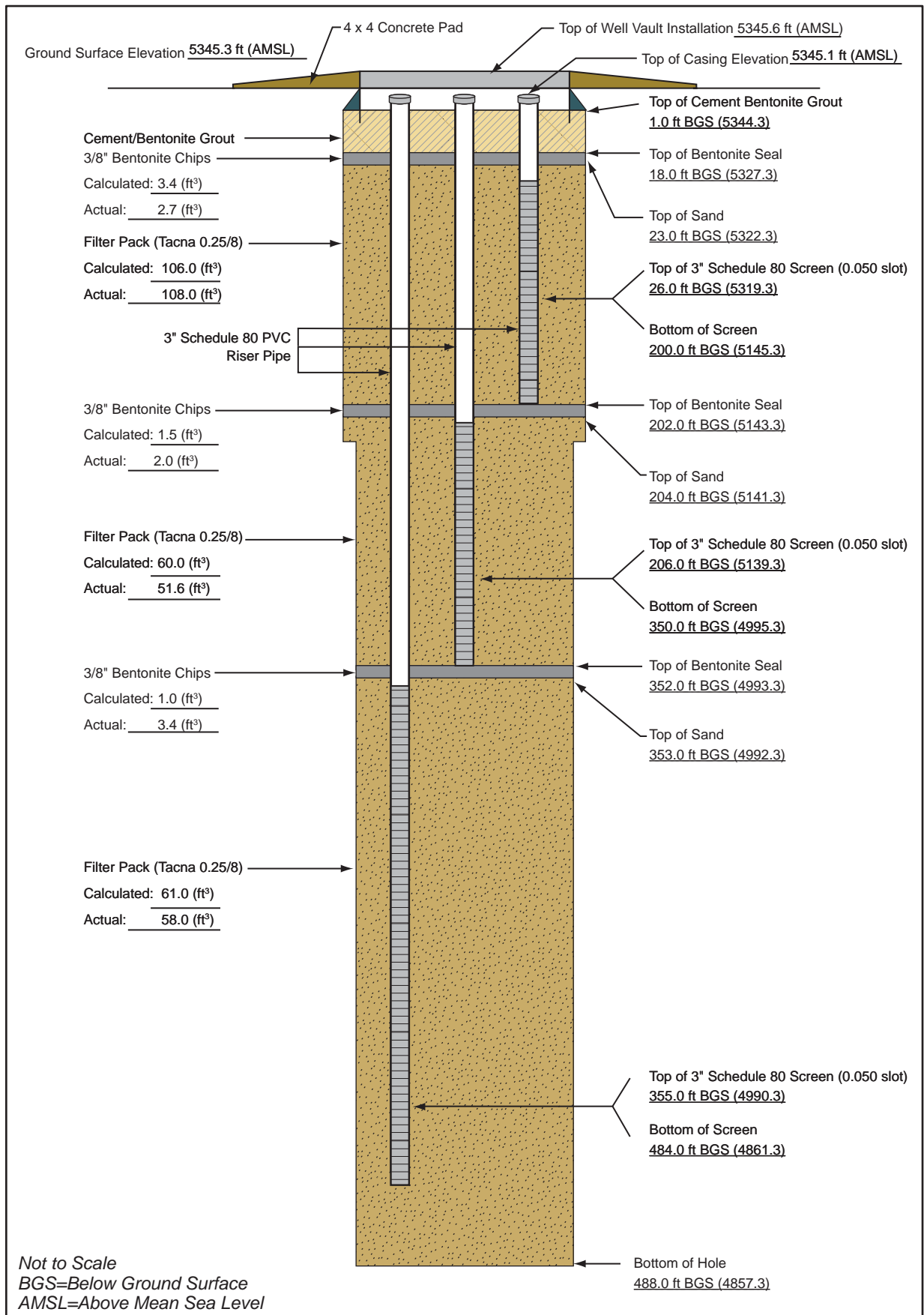
Installation End Date/Time: 9/23/2011 @12:00



PneuLog Well Completion Diagram KAFB-106151

Installation Start Date/Time: 9/28/2011 @08:00

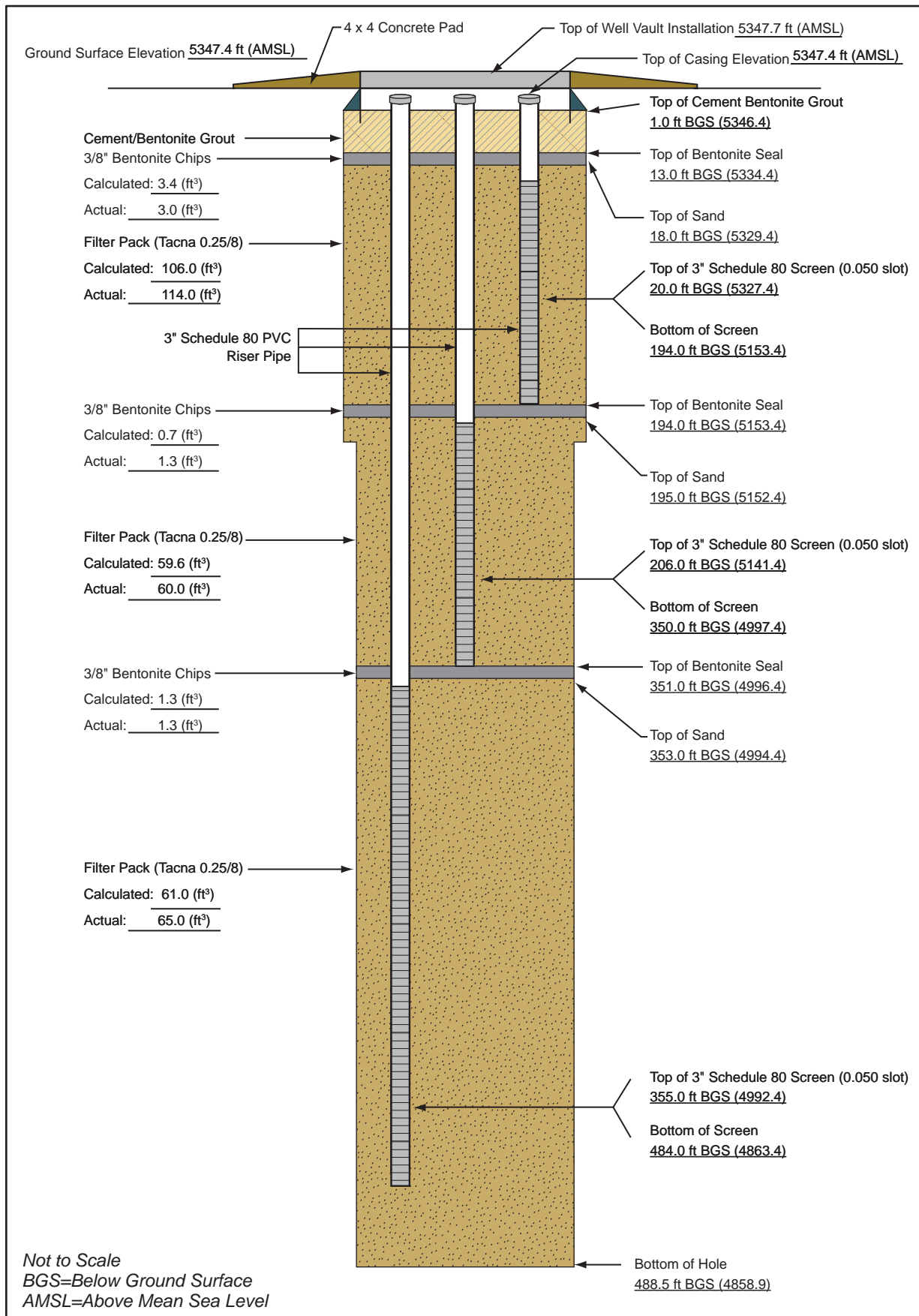
Installation End Date/Time: 9/30/2011 @12:00



PneuLog Well Completion Diagram KAFB-106152

Installation Start Date/Time: 10/05/2011@12:00

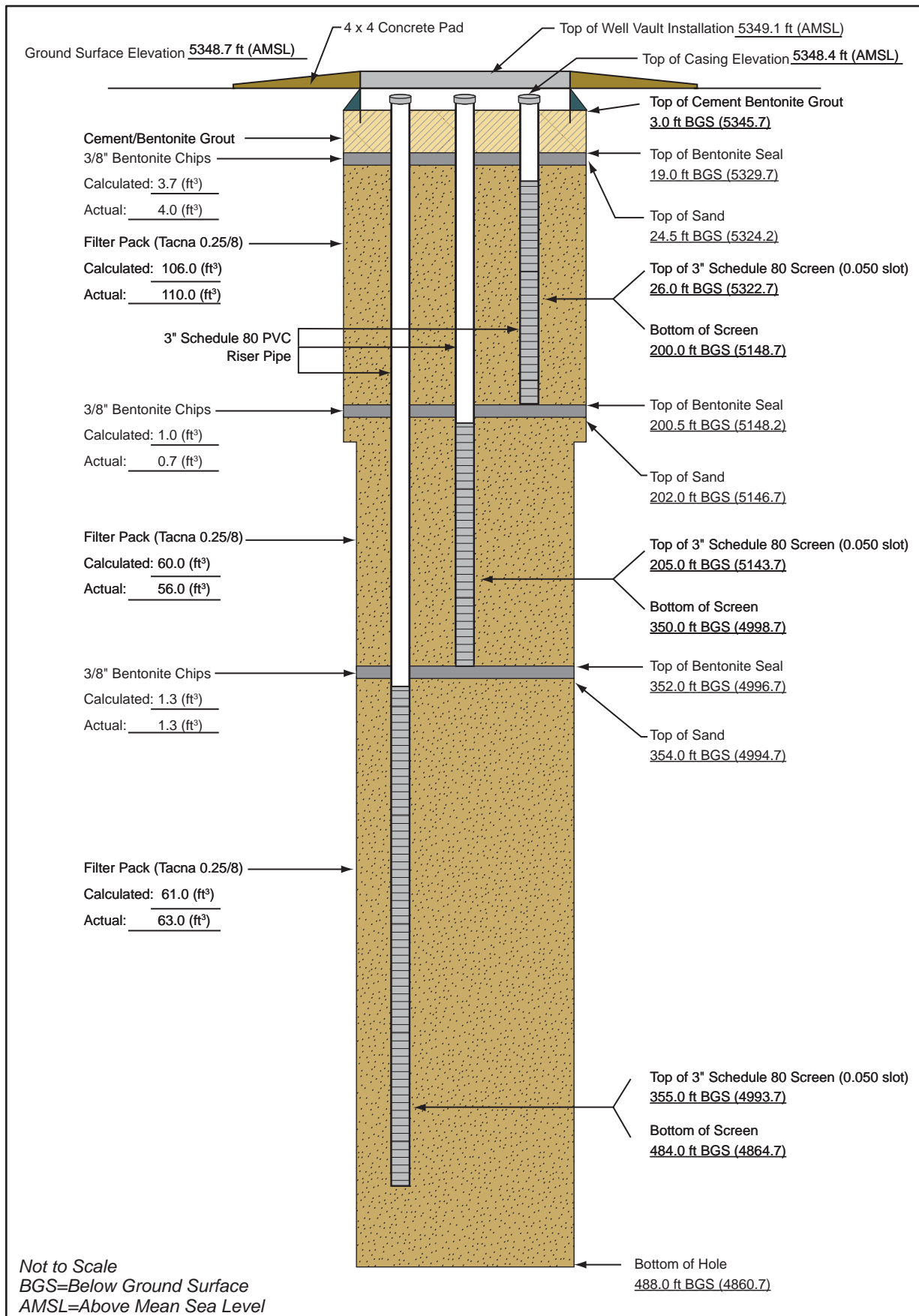
Installation End Date/Time: 10/07/2011@12:20



PneuLog Well Completion Diagram KAFB-106153

Installation Start Date/Time: 10/21/2011@11:00

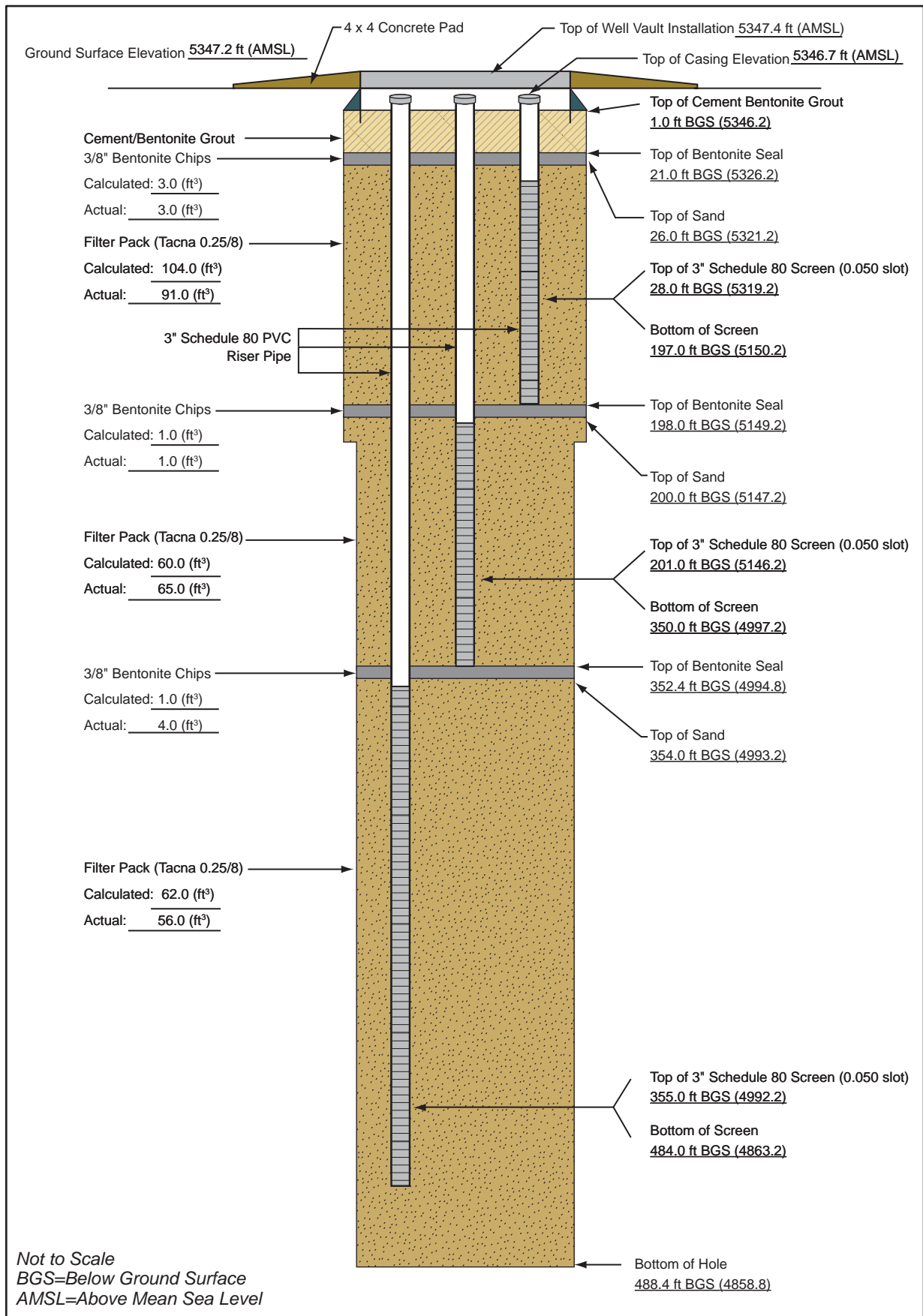
Installation End Date/Time: 10/25/2011@12:00



PneuLog Well Completion Diagram KAFB-106154

Installation Start Date/Time: 10/18/2011@08:00

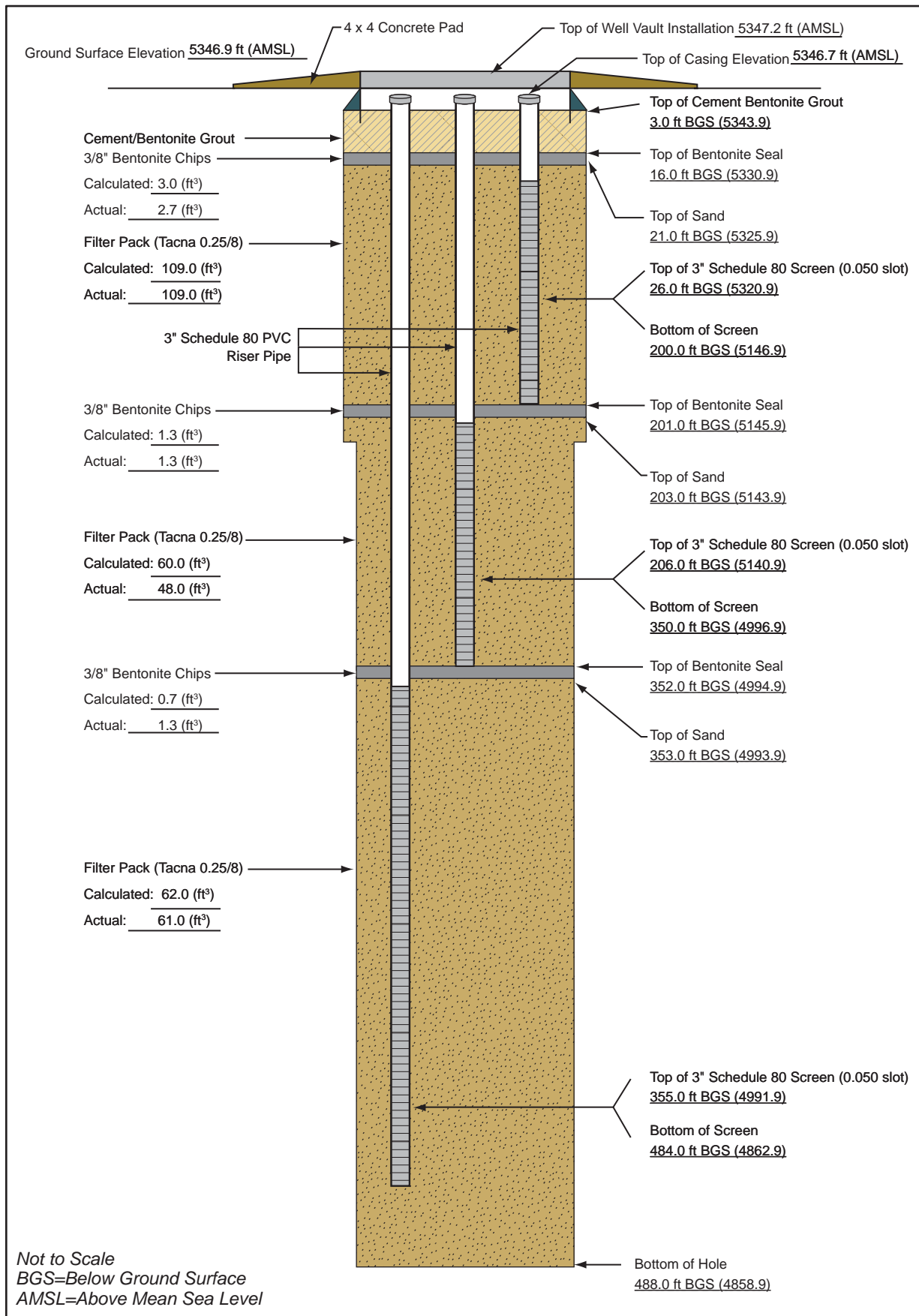
Installation End Date/Time: 10/20/2011@12:00



PneuLog Well Completion Diagram KAFB-106155

Installation Start Date/Time: 10/28/2011 @ 08:00

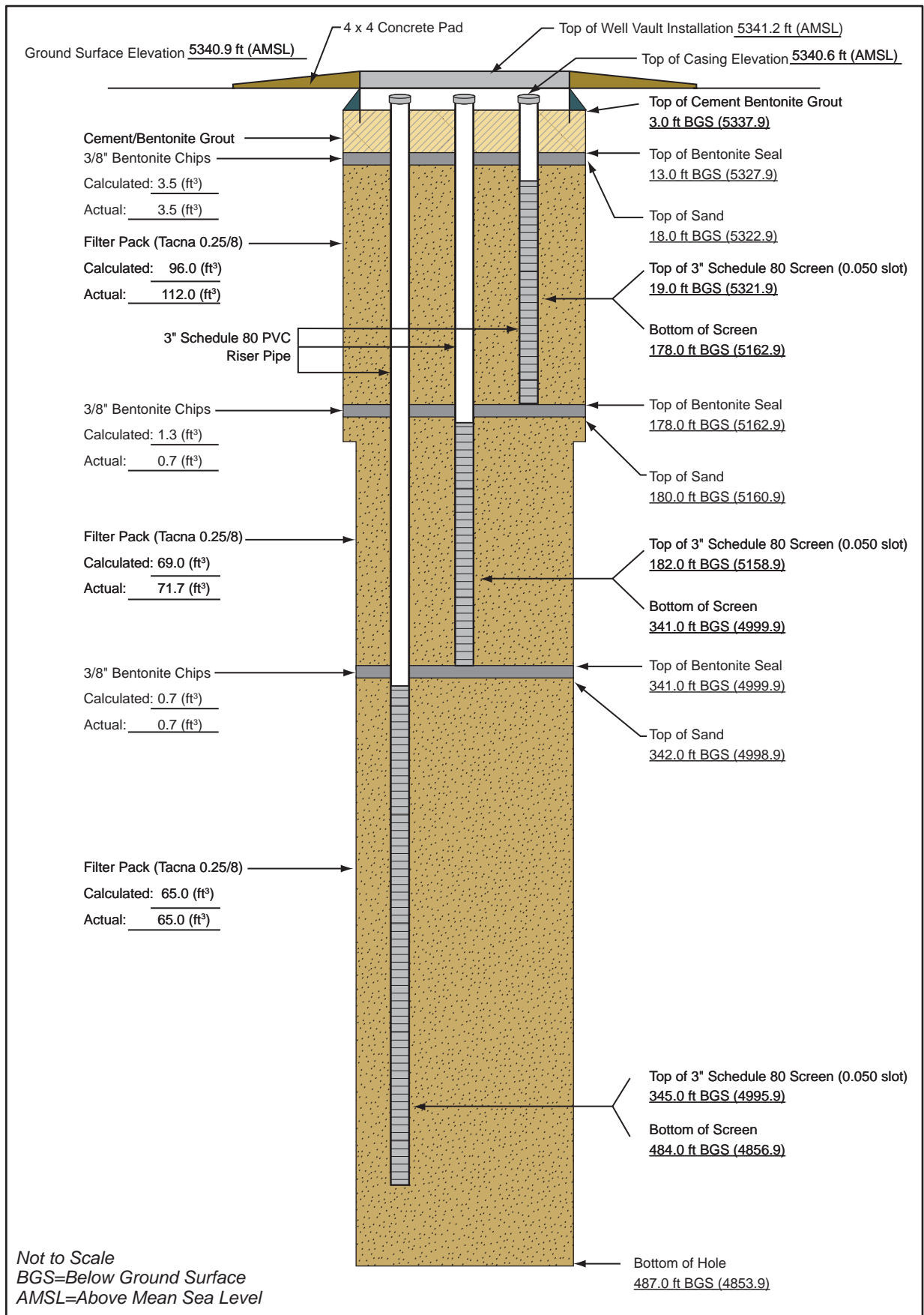
Installation End Date/Time: 11/01/2011 @ 12:00



PneuLog Well Completion Diagram KAFB-106156

Installation Start Date/Time: 11/04/2011 @ 08:00

Installation End Date/Time: 11/09/2011 @ 12:00



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APPENDIX C

Definition of Land Survey Objective/Measuring Points and Land Survey Campaign among the Kirtland Air Force Base Monitoring Well Network

Definition of Land Survey Objective / Measuring Points and Land Survey Campaign among the Kirtland Air Force Base Monitoring Well Network

Prepared for:

Kirtland AFB Fuel Leak Remediation Project: Hydrogeology Working Group

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Introduction

At the request of the Air Force, the U.S. Geological Survey (USGS) has prepared the following standard operating procedure (SOP) and preliminary work plan for completing a survey of 400 monitoring wells within and nearby the Kirtland Air Force base in southeastern Albuquerque. Reconnaissance, field investigations, and Base-Wide Plans for the Environmental Restoration Program (USACE, 2004) reveal two (2) monitoring well platforms:

Stick-up

Stick-up platforms represent an 8-inch by 5-ft protective round steel casing and a 4-ft by 4-ft by 4-inch concrete pad mounded in such a way as to direct surface runoff from the casing (USACE, 2004). Steel bollards filled with concrete (4-inch by 5-ft) exist on the outside of the concrete pad. The stick-up configuration maintains 3-ft of exposed casing and protective steel bollards above ground and 2-ft of casing and protective steel bollards below ground.

Due to long-term potential for frost heave or movement of the shallow mounted casing or mounded concrete platform, the primary land survey objective point (PLSOP) will reside at the top of the casing pipe (TOC). Location of the PLSOP will be a notch or mark at the north end of the TOC. Subsequent land-survey objective point (LSOP) elevations will be measured by a fixed rule and a standard 3-ft level (or differential level survey equipment) as follows (fig.1):

1. Rule up to a notch or mark on the north side of the top of the protective casing (TOPC) or top of protective casing collar (TOPCC).

2. Rule down from the TOPC or TOPCC to an installed small metal concrete marker (fig.2) representing the top of the concrete pad (TCP). Installation of this marker should be offset a minimum radius of 6" from the protective casing. Marker should be installed on the northern-most side.

3. Level and rule down from the TCP to the ambient land surface (ALS) at (3) sides (northern-most/eastern-most/western-most) of the concrete pad. An average will be used as this measurement.

Figure 1. Stick-up monitoring well, land-survey objective point locations and measurement identification.

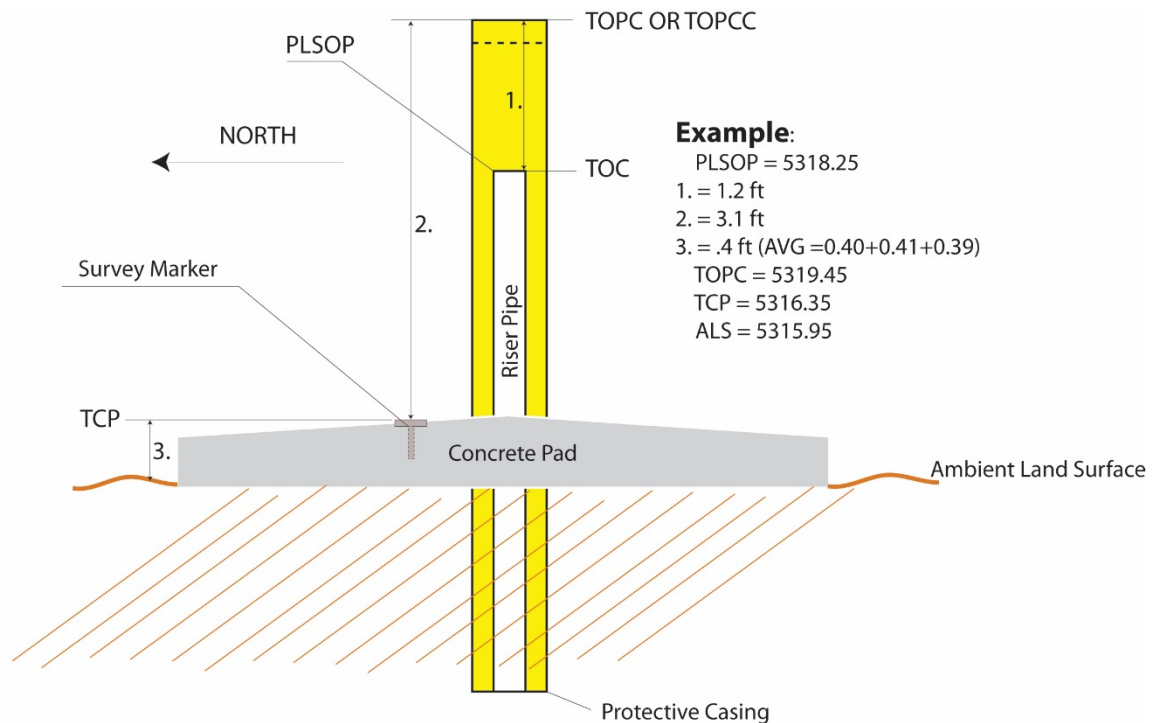


Figure 2a. Monument installation variations for independent origin per category I well cluster.

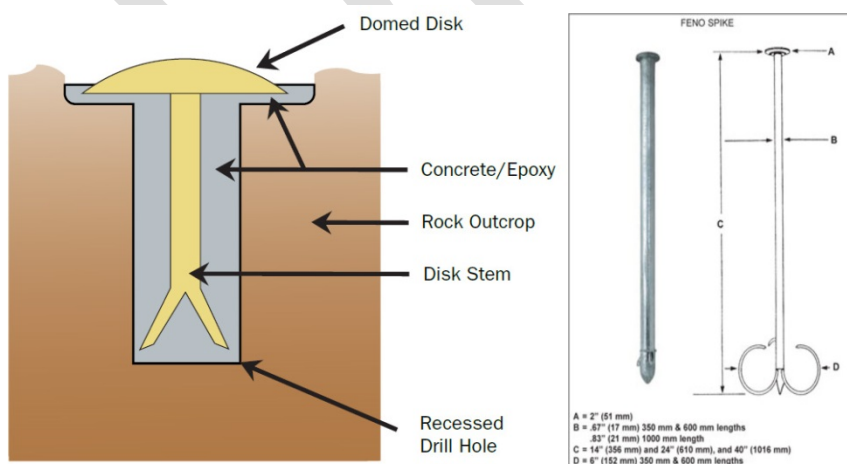
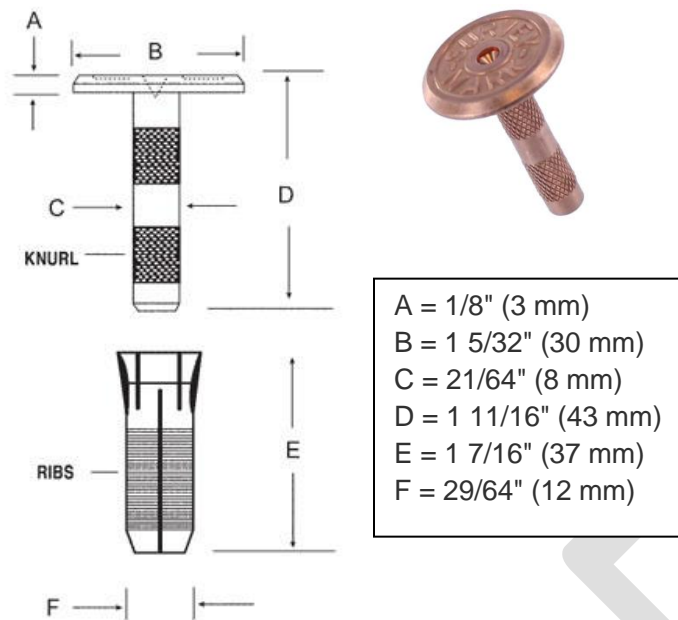


Figure 2b. Marker recommendation for top of concrete pad (TCP) installation. Bernsten, Inc., BP1-SM

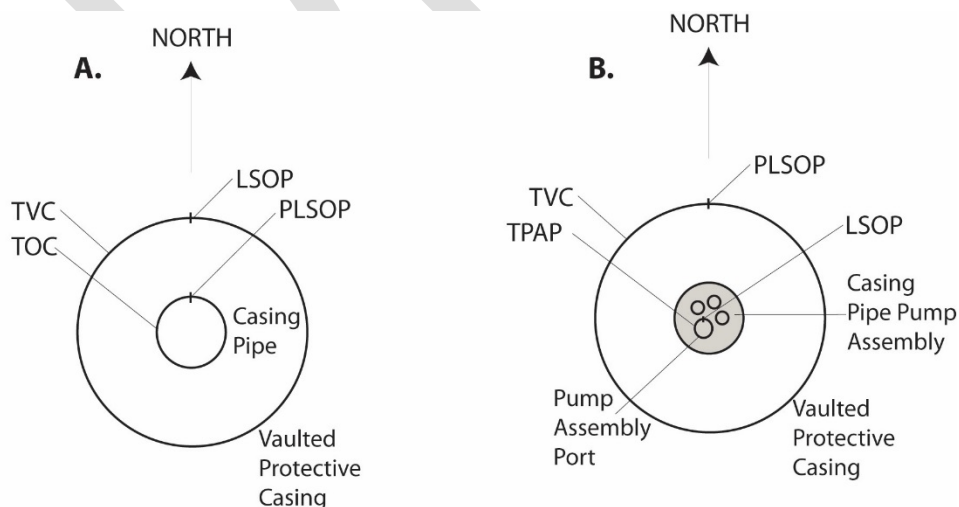


Flush Mount

Flush mount monitoring well platforms typically represent a 5-inch casing pipe inside of a 1-ft. vaulted casing. As a result of potential surface damage surrounding the flush mount well, the PLSOP will reside as a notch or mark on the north side of the top of the casing pipe (TOC) and a secondary LSOP will represent a notch or mark on the north end of the top of the vault casing (TVC) (fig.3). If a pump assembly is revealed in the casing pipe, a 1-inch threaded PVC cap is removed to reveal the pump assembly port. A notch or mark on the top (north side) of the pump assembly port (TPAP) will serve as the secondary LSOP and the TVC will serve as the PLSOP (fig.3).

For the flush mount configuration, the ALS elevation will be equal to the elevation of the TVC.

Figure 3. Flush mount monitoring well, land survey objective point identification for (A) casing pipe without a pump assembly and (B) casing pipe with pump assembly.



Special Case Monitoring Wells

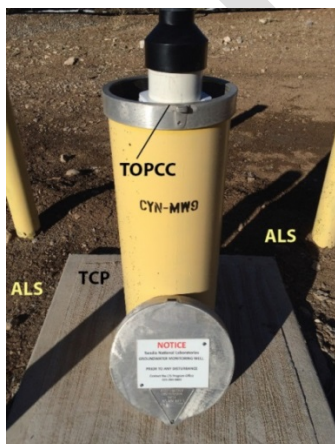
Stick-up wells with pump assemblies exist within the network at Kirtland AFB (fig.4). For this configuration, it is recommended the pump assembly be removed if possible prior to any survey campaign to expose the TOC and PLSOP thereof. If this is not feasible, the TOPC or TOPCC will provide the PLSOP. It is cautioned that potential long-term movement of the casing (TOPC) and/or independent movement of the collar (TOPCC) are not ideal for the PLSOP. Measurements made with fixed rule and level (or differential leveling equipment) are used to perpetuate elevation down to the TPAP in the well casing and installed marker serving as the TCP outside the casing. Similar to stick-up wells, the ALS (average) will be achieved by level and rule down (or differential leveling equipment) from the TCP to three (3) sides (northern-most/eastern-most/western-most) of the concrete pad.

Figure 4. Stick-up well with pump assembly



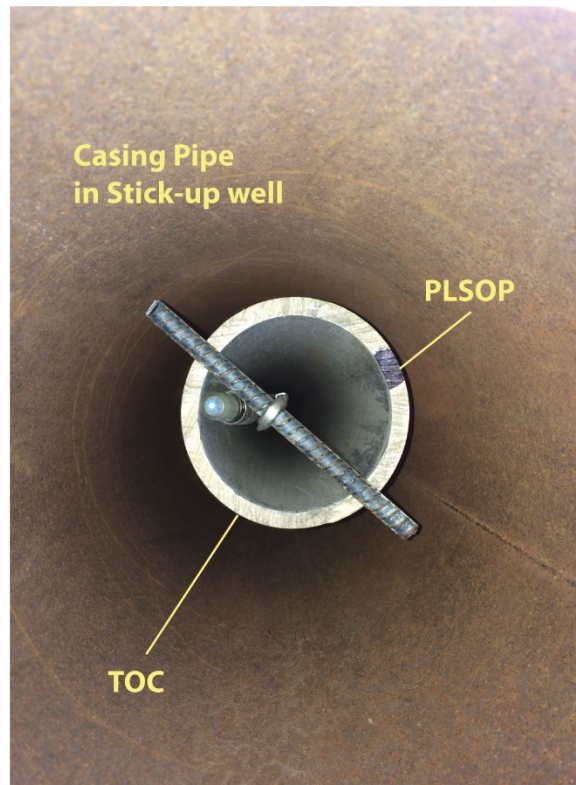
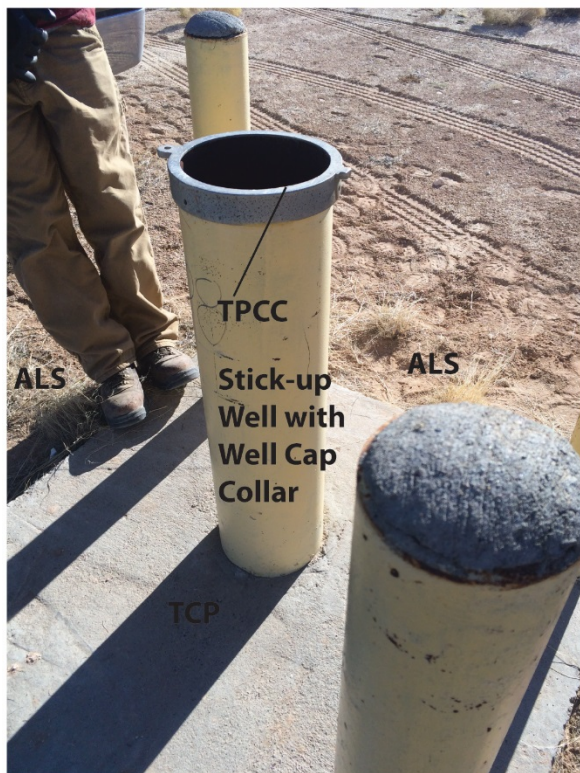
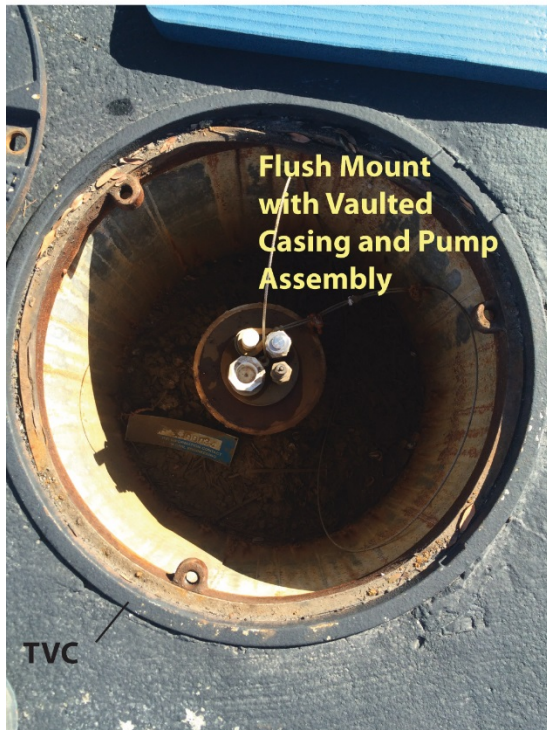
Another stick-up well with pump assembly configuration was recovered, ownership by Sandia National Laboratories within the network at Kirtland AFB (fig.5). For this configuration, it is recommended the pump assembly be removed if possible prior to any survey campaign to expose the TOC and PLSOP thereof. If this is not feasible, the TOPC or TOPCC will provide the PLSOP. Once again it is cautioned that potential long-term movement of the casing (TOPC) and/or independent movement of the collar (TOPCC) are not ideal for the PLSOP. Similar to the case demonstrated in fig.4, measurements made with fixed rule and level (or differential leveling equipment) are used to perpetuate elevation down to the installed marker serving as the TCP outside the casing. The ALS (average) will be achieved by level and rule down (or differential leveling equipment) from the TCP to three (3) sides (northern-most/eastern-most/western-most) of the concrete pad.

Figure 5. Stick-up well with pump assembly by Sandia



Appendix I. Example well configurations and LSOPs

Flush mount and stick up well examples with identified nomenclature



Acronyms

ERPIMS	Environmental Restoration Program Information Management System
ALS	Ambient land surface (also known within the USGS as the Land Surface Datum (LSD))
LSOP	Land-survey objective point
PLSOP	Primary land-survey objective point
TOPC	Top of protective casing
TOPCC	Top of protective casing collar
TOC	Top of casing pipe
TCP	Top of concrete pedestal
TVC	Top of vault casing
TPAP	Top of pump assembly port

Well Survey Campaign

Objective:

To establish accurate altitude among 400 monitoring wells within the Kirtland Air Force Base (KAFB), monitoring wells have been categorized based on their proximity to other wells and the expected groundwater potentiometric surface gradient. Monitoring wells have, therefore, been categorized into two representations. Category I wells includes groups or clusters of wells within close proximity and which, therefore, represent minimal groundwater potentiometric surface gradients. Category II wells represent wells that are more distal to one another with larger groundwater potentiometric surface gradients.

For the purpose of this survey, 328 wells have been grouped into 63 well clusters, identified herein as Category I wells (Table 1). The remaining 72 wells represent “stand alone” wells, identified herein as Category II wells. As a result of these two representations, the survey effort will be accomplished in two phases:

Phase I – Global Navigation Satellite System (GNSS)

Phase I includes the establishment of an estimated 135 benchmarks (monuments, rebar rods similar to that shown in fig. 2a), with 63 of these placed within the Category I well clusters and 72 of these located at the distal Category II wells. For each of the Category I well clusters and the distal Category II wells, one benchmark will be established with altitude derived by GNSS observation at an existing monument, a survey mark, or a newly established monument. Five (5) GNSS survey teams will approach this campaign with a Level II quality specification for altitude (Rydland and Densmore, 2012). The grouping of wells into clusters will, in part, be based on findings in the field at the time of the GNSS survey.

Phase I efforts among the five teams will also include survey mark installations (fig.2b) at the TCP exclusively for stick-up platforms among the Category II wells (72) targeted for altitude. Level and fixed rule (or differential leveling equipment) measurements for both stick-up and flush mount platforms will occur at the category II (72) wells identified with altitude.

The location and placement of the benchmark monuments and survey markers, described above, will be based upon findings in the field. Benchmark monuments (fig. 2a) will only be installed within areas where below ground utilities have previously been cleared and, when working on the Kirtland Air Force base, a dig permit has been issued. Therefore, during Phase I, the GNSS crews will limit installation of new monuments to within the area included within the bollards located at the monitoring wells, as a dig permit has been issued for this area. If new monuments cannot be installed within the area included within the bollards located at the monitoring well, a survey mark (fig. 2b) will be installed at the monitoring well pad (or in other nearby concrete) and will be used as the benchmark, in lieu of a rebar rod monument. In the event that a suitable location for a benchmark monument or survey mark isn't identified during the Phase I field

effort, the field crew may flag or mark a location outside the bollards for monument installation during Phase II, such that utilities may be cleared and a dig permit issued.

Required metadata for this effort is outlined in Rydlund and Densmore, 2012 for GNSS RT or Static surveys. All data will be stored electronically.

Phase II – Differential Leveling

Three hundred twenty eight (328) Category I wells, grouped into 63 well clusters, will have relative altitudes established by differential levels (Appendix I, Table 1). Monuments established within the 63 well clusters during Phase I, discussed above, will be used to perpetuate altitude with specifications outlined by Kenney, 2010.

Phase II efforts among these teams will also include survey mark installations (fig.2b) at the TCP exclusively for stick-up platforms among the category I (328) wells. Level and fixed rule (or differential leveling equipment) measurements for both stick-up and flush mount platforms will occur at all remaining wells to be leveled.

Required metadata for this effort is outlined in Kenny, 2010 and will be stored electronically.

A third phase will occur that includes processing, analysis, and summation of all survey data. Phase III will involve error analysis outlined by Rydlund and Densmore, 2012, for GNSS surveys and Kenny, 2010, for differential leveling. Results will be submitted to the Air Force in electronic (spreadsheet format).

Datum Specification:

- New Mexico State Plane Coordinate System, Central Zone, North American Datum of 1983
- Category I and II horizontal uncertainty at the PLSOP = $< 0.03'$
- North American Vertical Datum 1988 (NAVD88)
- Category I altitude uncertainty at the PLSOP = $< 0.01'$
- Category II altitude uncertainty at the PLSOP = $< 0.15'$

A survey of horizontal positions (x-y coordinates) will be completed in future years (FY2017) under subsequent authorizations. Analysis and summary tables will be included in a USGS Scientific Investigations Report (SIR) that outlines objective, approach, and error analysis with summary tables. The USGS SIR will be completed in FY2017.

Staffing and Schedule – see Appendix II

Appendix I. Table 1. Category I well groups identified with effort (may change based on findings in the field).

Well Group	Estimated Turns	Overall Uncertainty	Time (Day)	UNIQUE_DB_	CASING_DIA	CASING_TYP
1	1	0.003	0.1	KAFB-106207	5	PVC
				KAFB-106208	5	PVC
				KAFB-106209	5	PVC
2	4	0.006	0.3	KAFB-3	5	PVC
				KAFB-106201	5	PVC
				KAFB-106202	5	PVC
				KAFB-106203	5	PVC
3	5	0.007	0.3	KAFB-106204	5	PVC
				KAFB-106205	5	PVC
				KAFB-106206	5	PVC
				KAFB-106231	5	PVC
				KAFB-106232	5	PVC
4	16	0.012	1.0	KAFB-106042	5	PVC
				KAFB-106043	5	PVC
				KAFB-106049	5	PVC
				KAFB-106050	5	PVC
				KAFB-106051	5	PVC
				KAFB-106052	5	PVC
				KAFB-106053	5	PVC
				KAFB-106054	5	PVC
				KAFB-106105	5	PVC
				KAFB-106106	5	PVC
				KAFB-106107	5	PVC
5	8	0.008	0.5	KAFB-106026	5	PVC
				KAFB-106225	5	PVC
				KAFB-106226	5	PVC
				KAFB-106227	5	PVC
				KAFB-106230	5	PVC
6	9	0.009	0.6	KAFB-106219	5	PVC
				KAFB-106220	5	PVC
				KAFB-106221	5	PVC
				KAFB-106222	5	PVC
				KAFB-106223	5	PVC
				KAFB-106224	5	PVC
7	16	0.012	1.0	KAFB-106025	4	PVC
				KAFB-106029	5	PVC
				KAFB-106030	5	PVC
				KAFB-106031	5	PVC

				KAFB-106055	5	PVC
				KAFB-106057	5	PVC
				KAFB-106058	5	PVC
				KAFB-106091	5	PVC
				KAFB-106092	5	PVC
				KAFB-106093	5	PVC
8	7	0.008	0.4	KAFB-106015	4	PVC
				KAFB-106216	5	PVC
				KAFB-106217	5	PVC
				KAFB-106218	5	PVC
9	6	0.007	0.4	KAFB-106022	4	PVC
				KAFB-106035	5	PVC
				KAFB-106036	5	PVC
				KAFB-106037	5	PVC
				KAFB-106212	5	PVC
				KAFB-106213	5	PVC
				KAFB-106214	5	PVC
				KAFB-106215	5	PVC
10	8	0.008	0.5	KAFB-106021	4	PVC
				KAFB-106032	5	PVC
				KAFB-106033	5	PVC
				KAFB-106034	5	PVC
				KAFB-106085	5	PVC
				KAFB-106086	5	PVC
				KAFB-106087	5	PVC
11	30	0.016	1.9	KAFB-106023	4	PVC
				KAFB-106070	5	PVC
				KAFB-106071	5	PVC
				KAFB-106072	5	PVC
				KAFB-106088	5	PVC
				KAFB-106089	5	PVC
				KAFB-106090	5	PVC
				KAFB-106103	5	PVC
				KAFB-106104	5	PVC
12	16	0.012	1.0	KAFB-106017	4	PVC
				KAFB-106018	4	PVC
				KAFB-106020	4	PVC
				KAFB-106038	5	PVC
				KAFB-106039	5	PVC
				KAFB-106040	5	PVC
				KAFB-106073	5	PVC
				KAFB-106074	5	PVC
				KAFB-106075	5	PVC
				KAFB-106082	5	PVC
				KAFB-106083	5	PVC

				KAFB-106084	5	PVC
13	13	0.011	0.8	KAFB-106010	5	PVC
				KAFB-106013	5	PVC
				KAFB-106019	5	PVC
				KAFB-106067	5	PVC
				KAFB-106068	5	PVC
				KAFB-106069	5	PVC
				KAFB-106094	5	PVC
				KAFB-106095	5	PVC
				KAFB-106096	5	PVC
				KAFB-106097	5	PVC
				KAFB-106098	5	PVC
14	13	0.011	0.8	KAFB-106005	4	PVC
				KAFB-106009	4	PVC
				KAFB-106011	4	PVC
				KAFB-106014	4	PVC
				KAFB-106028-510	4	PVC
				KAFB-106065	5	PVC
				KAFB-106066	5	PVC
				KAFB-106079	5	PVC
				KAFB-106080	5	PVC
				KAFB-106081	5	PVC
15	17	0.012	1.1	KAFB-106002	4	PVC
				KAFB-106003	4	PVC
				KAFB-106004	4	PVC
				KAFB-106012R	5	PVC
				KAFB-106099	5	PVC
				KAFB-106100	5	PVC
				KAFB-106101	5	PVC
				KAFB-106102	5	PVC
16	27	0.016	1.7	KAFB-106001	4	PVC
				KAFB-106006	4	PVC
				KAFB-106007	4	PVC
				KAFB-106016	4	PVC
				KAFB-106024	4	PVC
				KAFB-106027	4	PVC
				KAFB-106044	5	PVC
				KAFB-106045	5	PVC
				KAFB-106076	5	PVC
				KAFB-106077	5	PVC
				KAFB-106078	5	PVC
				KAFB3411	5	PVC
17	20	0.013	1.3	KAFB-106008	4	PVC
				KAFB-106046	5	PVC

				KAFB-106047	5	PVC
				KAFB-106048	5	PVC
				KAFB-106059	5	PVC
				KAFB-106060	5	PVC
				KAFB-106061	5	PVC
				KAFB-106062	5	PVC
				KAFB-106063	5	PVC
				KAFB-106064	5	PVC
18	12	0.010	0.8	KAFB-0510	5	PVC
				KAFB-0519	5	PVC
				KAFB-16	5	PVC
19	53	0.022	3.3	KAFB-0213	5	PVC
				KAFB-0216	5	PVC
				KAFB-0219	5	PVC
				KAFB-0220	5	PVC
				KAFB-0221	5	PVC
				KAFB-0222	5	PVC
				KAFB-0223	5	PVC
				ST105MW001	5	PVC
				KAFB-0214	5	PVC
				KAFB-0217	5	PVC
				KAFB-0218	5	PVC
20	22	0.014	1.4	KAFB-0514	5	PVC
				KAFB-0516	5	PVC
				ST105MW011	5	PVC
				ST105MW022	5	PVC
21	8	0.008	0.5	KAFB-0525	5	PVC
				ST105MW018	5	PVC
22	15	0.012	0.9	KAFB-0517	5	PVC
				KAFB-0518	5	PVC
				ST105MW017	5	PVC
23	26	0.015	1.6	KAFB-0504	5	PVC
				KAFB-0506	5	PVC
				KAFB-2625	5	PVC
				KAFB-2629	5	PVC
				KAFB-2630	5	PVC
				KAFB-2631	5	PVC
				KAFB-2632	5	PVC
				KAFB-504	5	PVC
				KAFB-4	5	PVC
24	22	0.014	1.4	KAFB-0505	5	PVC
				KAFB-0509	5	PVC
				KAFB-2623	5	PVC
				KAFB-2624	5	PVC

				KAFB-2627	5	PVC
				KAFB-2628	5	PVC
25	30	0.016	1.9	KAFB-0507	5	PVC
				KAFB-0512	5	PVC
				KAFB-2602A	5	PVC
				KAFB-2622	5	PVC
				KAFB-2626	5	PVC
				KAFB-507R	5	PVC
				KAFB-512R	5	PVC
26	28	0.016	1.8	KAFB-0508	5	PVC
				KAFB-0521A	5	PVC
				KAFB-0521B	5	PVC
				KAFB-0521C	5	PVC
				KAFB-0523	5	PVC
				KAFB-0524	5	PVC
				KAFB-7	5	PVC
27	3	0.005	0.2	KAFB-8281	5	PVC
				KAFB-8282	5	PVC
28	1	0.003	0.1	TA1-W-05	5	PVC
				TA1-W-08	5	PVC
29	7	0.008	0.4	TA1-W-02	5	PVC
				TA1-W-06	5	PVC
				KAFB-6	5	PVC
30	21	0.014	1.3	KAFB-3391	5	PVC
				KAFB-3392	5	PVC
				TA1-W-01	5	PVC
				TA1-W-07	5	PVC
31	1	0.003	0.1	WYO-3	5	PVC
				WYO-4	5	PVC
32	18	0.013	1.1	TA2-NW1-325	5	PVC
				TA2-NW1-595	5	PVC
				TA2-SW1-320	5	PVC
				TA2-W-01	5	PVC
				TA2-W-28	5	PVC
33	30	0.016	1.9	KAFB-0307	5	PVC
				KAFB-0311	5	PVC
				TA2-W-19	5	PVC
				TA2-W-24	5	PVC
				TA2-W-27	5	PVC
				TJA-2	5	PVC
34	1	0.003	0.1	TJA-3	5	PVC
				TJA-7	5	PVC
35	17	0.012	1.1	KAFB-0901	5	PVC
				KAFB-0903	5	PVC

				ST105MW012	5	PVC
				TA2-W-25	5	PVC
				TA2-W-26	5	PVC
36	16	0.012	1.0	KAFB-8351	5	PVC
				KAFB-12	5	PVC
37	22	0.014	1.4	Burn Site Well	5	PVC
				CYN-MW10	5	PVC
				CYN-MW11	5	PVC
				CYN-MW12	5	PVC
				CYN-MW14A	5	PVC
				CYN-MW15	5	PVC
				CYN-MW3	5	PVC
				CYN-MW6	5	PVC
				CYN-MW9	5	PVC
38	10	0.009	0.6	CYN-MW13	5	PVC
				CYN-MW7	5	PVC
				CYN-MW8	5	PVC
39	8	0.008	0.5	KAFB-0904	5	PVC
				ST105MW002	5	PVC
40	24	0.015	1.5	KAFB-0613	5	PVC
				KAFB-0614	5	PVC
				ST105MW013	5	PVC
41	12	0.010	0.8	KAFB-0602	5	PVC
				KAFB-0608	5	PVC
				KAFB-0610	5	PVC
				RG-1589-S-4	5	PVC
				RG-1598-S-4	5	PVC
42	1	0.003	0.1	KAFB-0611	5	PVC
				KAFB-0612	5	PVC
43	50	0.021	3.1	AVN-1	5	PVC
				AVN-2	5	PVC
				TAV-MW10	5	PVC
				TAV-MW11	5	PVC
				TAV-MW12	5	PVC
				TAV-MW14	5	PVC
				TAV-MW3	5	PVC
				TAV-MW4	5	PVC
				TAV-MW6	5	PVC
				TAV-MW7	5	PVC
44	14	0.011	0.9	LWDS-MW1	5	PVC
				LWDS-MW2	5	PVC
				TAV-MW13	5	PVC
				TAV-MW2	5	PVC
				TAV-MW5	5	PVC

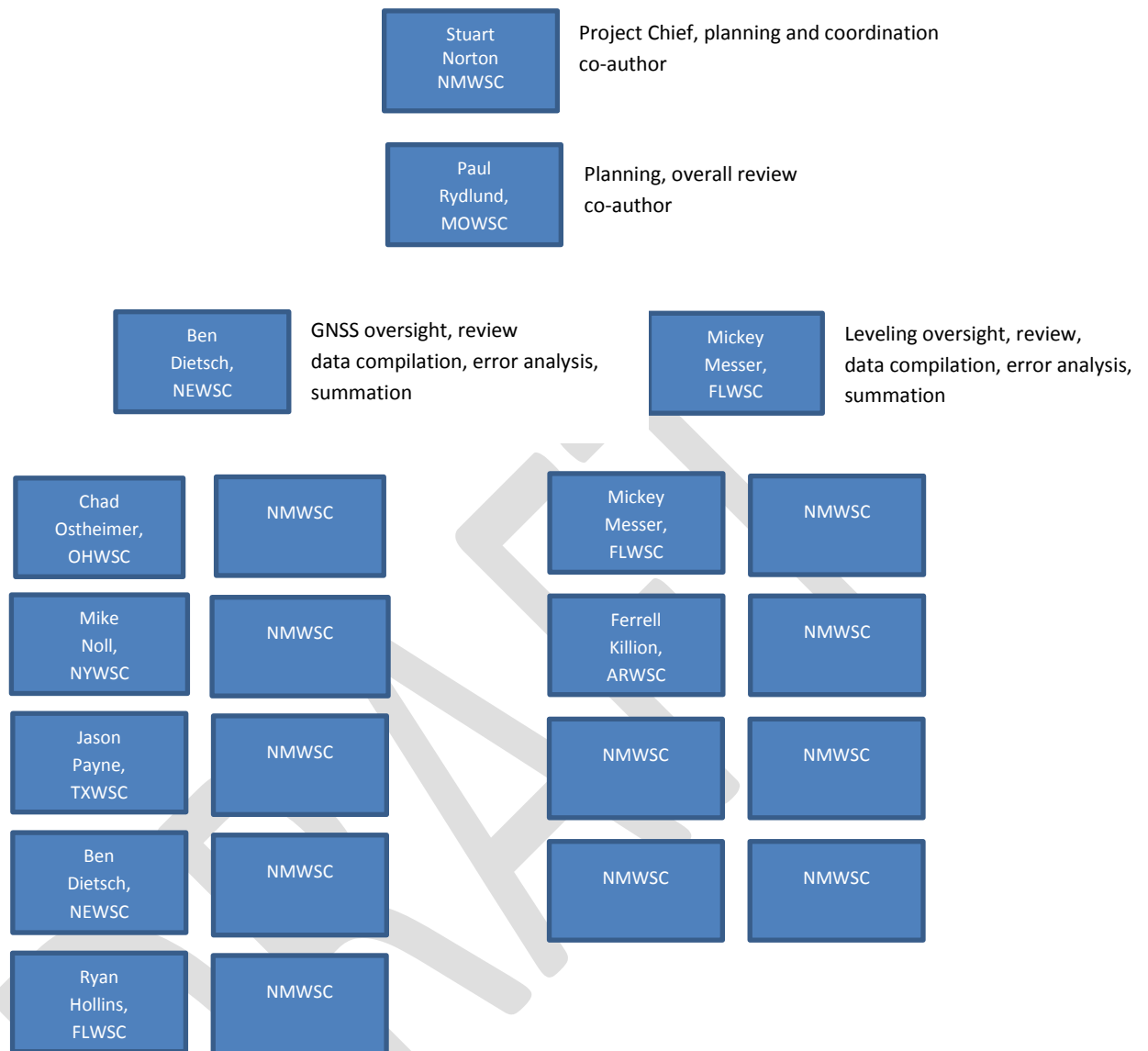
				TAV-MW8	5	PVC
				TAV-MW9	5	PVC
45	12	0.010	0.8	KAFB-2007	5	PVC
				KAFB-2008	5	PVC
				KAFB-2004	5	PVC
				KAFB-2006	5	PVC
46	4	0.006	0.3	KAFB-2005	5	PVC
				KAFB-2009	5	PVC
				KAFB-7201	5	PVC
				KAFB-7202	5	PVC
47	12	0.010	0.8	KAFB-6241	5	PVC
				KAFB-6301	5	PVC
48	14	0.011	0.9	MWL-BW2	5	PVC
				MWL-MW4	5	PVC
				MWL-MW5	5	PVC
				MWL-MW6	5	PVC
				MWL-MW7	5	PVC
				MWL-MW8	5	PVC
				MWL-MW9	5	PVC
49	1	0.003	0.1	NWTA3-MW2	5	PVC
				NWTA3-MW3D	5	PVC
50	1	0.003	0.1	PL-2	5	PVC
				PL-4	5	PVC
51	6	0.007	0.4	CWL-BW5	5	PVC
				CWL-MW10	5	PVC
				CWL-MW11	5	PVC
				CWL-MW9	5	PVC
52	2	0.004	0.1	MW-1	5	PVC
				MW-2	5	PVC
				MW-3	5	PVC
				MW-4	5	PVC
				MW-5	5	PVC
				MW-6	5	PVC
				MW-7	5	PVC
				RW-1	5	PVC
				RW-2	5	PVC
				RW-3	5	PVC
				RW-4	5	PVC
				RW-5	5	PVC
53	1	0.003	0.1	OBS-MW1	5	PVC
				OBS-MW2	5	PVC
				OBS-MW3	5	PVC
54	4	0.006	0.3	KAFB-1901	5	PVC
				KAFB-1902	5	PVC

				KAFB-1904	5	PVC
55	1	0.003	0.1	MRN-2	5	PVC
				MRN-3D	5	PVC
56	1	0.003	0.1	SWTA3-MW3	5	PVC
				SWTA3-MW4	5	PVC
57	1	0.003	0.1	KAFB-1007	5	PVC
				KAFB-1007R	5	PVC
58	2	0.004	0.1	SFR-3D	5	PVC
				SFR-3P	5	PVC
				SFR-3S	5	PVC
				SFR-3T	5	PVC
59	1	0.003	0.1	SFR-4P	5	PVC
				SFR-4T	5	PVC
60	11	0.010	0.7	KAFB-0118	5	PVC
				KAFB-0119	5	PVC
				KAFB-0121	5	PVC
61	8	0.008	0.5	ST105MW015	5	PVC
				KAFB-0110	5	PVC
62	2	0.004	0.1	KAFB-0623	5	PVC
				KAFB-0626A	5	PVC
				KAFB-0626B	5	PVC
				KAFB-0626C	5	PVC
				KAFB-0626D	5	PVC
63	1	0.003	0.1	KAFB-0618	5	PVC
				KAFB-0619	5	PVC

Appendix I. Table 2. Monument installation by phase.

	Monument Installation (Figure 2a)	Survey Point Installation (Figure 2b)	'At well' Level-Fixed Rule or Diff Leveling to other LSOPs (Figures 1 or 3)
Phase I	135 installations	72 stick-up wells	72 wells
Phase II		328 stick-up wells	328 wells

Appendix II. Staffing and responsibilities



Appendix II. Tentative Schedule (current authorization)

October 2015 – April 2016 – Develop SOP and Preliminary Work Plan

April 2016 – July 2016 – Complete Phase I, GNSS, and Phase II, Differential Level surveys

July 2016 – September 2016 – Complete Phase III, data reduction, review and submission to Air Force

Future phases (future authorization):

FY2017 – Survey horizontal (x,y) coordinates and complete SIR

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APPENDIX D

Relevant Standard Operating Procedures from Kirtland Air Force Base Base-Wide Plan (Appendix B) (U.S. Air Force, 2004)

SOP B1.3 Monitoring Well Installation

Different methods exist for the installation of monitoring wells. This SOP outlines the suggested procedure currently implemented on Base that is proven reliable for successful installation of problem-free monitoring wells. Any deviations from this procedure must be addressed in the project-specific plan must include an approved site-specific SOP..

The monitoring well program is designed to provide groundwater sampling points onsite as well as upgradient and downgradient of the site so that groundwater contamination may be characterized. Figures B1.3-1, B1.3-2, and B1.3-3 illustrate typical construction details for three types of monitoring wells, an overburden monitoring well, a double-cased monitoring well, and a double-cased open hole bedrock monitoring well.

Monitoring Well Installation Procedure

Proposed monitoring wells will be installed in accordance with the following procedure:

- Wear appropriate PPE as specified in the BWHSP (Appendix F of the BWP) and the SSHP.
- Drill borehole to the total depth using an air rotary casing hammer (ARCH) or drill rig (bit size of 8 or 10 inches). Temporary surface casing to the water table may be used to stabilize the upper portion of the drill hole, but casing must be removed as filter pack and bentonite-cement grout are installed.
- The appropriate depth will be determined in the field and is dependent on the occurrence of significant water. If significant groundwater is encountered during drilling, drilling will cease, and the hole will be allowed to equilibrate for approximately 1 hour. If a determination is made that the upper-most perched aquifer (or regional if it is determined to be the upper-most aquifer) has been reached, well installation will be completed within this zone.
- Soil samples will be collected at specified intervals as detailed in the project-specific addenda. Split-spoon samples may be screened for volatile organic compounds using the real-time air monitoring equipment. Saturated soil samples may be checked for permeability in order to establish the best interval for screen placement. One sample from each well in the screened depth may be collected for geotechnical parameters.
- Well construction will require flush-threaded Schedule 80 polyvinyl chloride (PVC) casing and 25 to 40 ft of 0.01-inch Schedule 80 slotted screen with a 5-ft sump. The length of the screen will be determined based on pending discussion with the New Mexico Environment Department (NMED). The well diameter will be specified in the project-specific plan.
- For a 4-inch diameter well the borehole will be drilled with 11 3/4-inch outer-diameter drive casing to 200 ft bgs. Collect and log soil cuttings at 5- to 10-ft intervals or at changes in lithology. Cutting samples will be collected from the cyclone. Install 200 ft of 9 5/8-inch casing inside the 11 3/4-inch casing and advance the 9 5/8-inch casing to approximately 400 ft bgs. Collect and log soil cuttings at 5- to 10-ft intervals or at changes in lithology.

- If the boring is overdrilled beyond the bottom of the proposed sump elevation by more than 10 ft, backfill the borehole with filter pack material to an elevation approximately 5 ft below the proposed bottom of sump elevation
- Use a 5-ft PVC sump, 25-40 ft of 0.01-inch PVC slotted screen, and blank casing to the top of the well stick-up. The top of the screened interval will be at least 5 ft above the existing water table. The sump will extend 5 ft below the bottom of the screened interval. Centralizers will be installed at 40-ft intervals and at the top and bottom of the screened interval in all wells deeper than 50 ft.
- Once the casing has been slowly removed from the borehole, backfill the borehole and annular space from a maximum of 1 ft below the bottom of the sump to a minimum of 2 ft above the well screen with a filter pack (10/20 silica sand). The filter pack will be placed using a tremie pipe to avoid bridging and ensure a continuous filter pack throughout the screened interval of the well. Next, a bentonite chip seal will be installed for a thickness of 10–20 ft and hydrated with potable water every 1 ft to ensure a competent seal. The thickness of the seal will be dependent on the lithology of the aquifer formation such that the bentonite seal extends from the top of the filter pack to within 5 ft of the most consolidated unit above the water table. The bentonite seal will be a minimum thickness of 5 ft. Installation of a thicker bentonite seal is currently used for monitoring wells at the Kirtland AFB to ensure that there will be no intrusion of grout from above the seal into the filter pack material below the seal.
- Install a 20 percent high solids bentonite grout mixture over the bentonite seal using a tremie pipe. The mixture will consist of 20 percent by weight of sodium bentonite powder. Install the bentonite grout to within 30 to 50 ft of the surface. The high-solids bentonite grout is currently and successfully used for well installation at the base to inhibit intrusion of grout into the well's filter pack and screen.
- To the surface, install a cement/bentonite grout mixture over the high-solids bentonite grout using a tremie pipe. The mixture will consist of 94 pounds of Portland cement to 7 gallons of approved water and 3 percent by weight of sodium bentonite powder.
- Install an 8-inch by 5-ft protective round steel casing and a 4-ft by 4-ft by 4-inch concrete pad mounded in such a way as to direct surface runoff from the casing. Install 4-inch by 5-ft steel bollards around each well on the outside of the concrete pad. Drill a drain hole in the protective casing above the concrete surface. In locations subject to freezing, the finished pad must be designed to resist damage caused by frost heaving.
- An approximate stick-up height of 3 ft is required for each well to accommodate the dedicated pump system.
- The well will be equipped with a security lock. All locks will be keyed alike. The well will be tagged with a corrosion-resistant identification stamped on the protective casing which identifies the well number, depth, date of installation, and the adjusted top of casing elevation. The well will also be clearly designated as a monitoring well. The casing will be coated with protective paint as required by the base.
- Some wells may have to be finished flush with the ground or pavement if they are in areas of heavy traffic. This requirement shall be stipulated in the project specific addenda. Flush

finished wells shall also be equipped with a lock and shall be protected from the entry of surface fluids into the well. Protective posts shall not be required on flush-finished wells.

- Continuously log soil cuttings throughout the drilling operation in accordance with SOP B1.1, Borehole and Sample Logging. Document the findings on the soil boring log sheet.
- After completion of the well a well alignment test to verify plumbness and integrity of well is recommended. The recommended method to test well plumbness and alignment is as follows:
 - A 10-ft long section of pipe, ½ inch less in diameter than the inner diameter of the well riser pipe, shall be run through the entire length of the well to check the alignment. The result of such test shall be recorded on the Daily Quality Control Reports (DQCRs) and the installation diagram. The pipe section shall be decontaminated with steam prior to the test. Adequate precautions shall be taken to prevent cross-contamination of wells with cable or rope used to conduct the test.
 - The pipe must pass freely for the entire depth of the well.

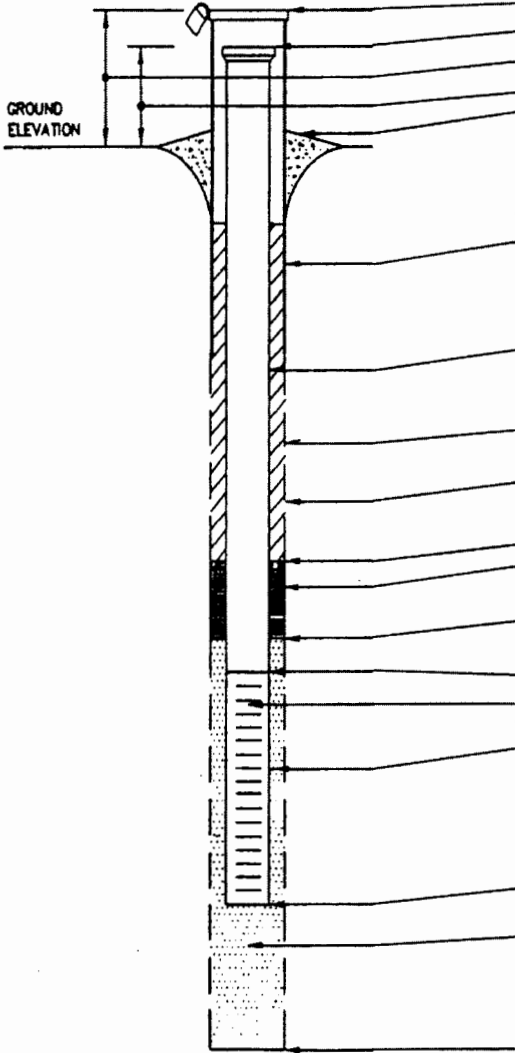
Well construction diagrams will be submitted to the client for approval. These forms will at a minimum include the following information:

- Project and site names, well number and the total depth of the well.
- Depth of any grouting or sealing, the amount of cement and/or bentonite used, and the total depth of the boring.
- Depth and type of well casing.
- Static water level upon completion of the well and after well development.
- Installation date or dates, and name of the driller and the geologist installing the well. Each installation diagram will be signed by the preparer.
- All pertinent construction details of the monitoring wells, such as depth to and description of all backfill materials installed (such as gravel pack, bentonite, and grout); gradation of gravel pack; length, location, diameter, slot size, material and manufacturer of well screen(s); position of centralizers; and location of any blank pipe installed in the well.
- Description of surface completion, including protective steel casing, protective pipes, and concrete surface seal.
- A description of any difficulties encountered during well installation.
- Survey coordinates and the elevation of top of ground and top of well riser.
- A brief stratigraphic log will be presented on the well installation diagram showing depths to and descriptions of major lithologic changes encountered in the boring.

References for Other Applicable ASTM Standards

ASTM D4750 – Determining Subsurface Liquid Levels in a Borehole or Monitoring Well

Figure B1.3-1. Overburden Monitoring Well Construction Diagram

OVERBURDEN MONITORING WELL CONSTRUCTION DIAGRAM		WELL NO. _____
PROJECT _____ PROJECT NO. _____ DATE _____ BORING NO.: _____ ELEVATION _____ FIELD _____ GEOLOGIST _____	DRILLER _____ DRILLING _____ METHOD _____ DEVELOPMENT _____ METHOD _____	
	ELEVATION OF TOP OF SURFACE CASING: _____ ELEVATION OF TOP OF RISER PIPE: _____ STICK-UP TOP OF SURFACE CASING: _____ STICK-UP RISER PIPE: _____ TYPE OF SURFACE SEAL: _____ I.D. OF SURFACE CASING: _____ TYPE OF SURFACE CASING: _____ RISER PIPE I.D. _____ TYPE OF RISER PIPE: _____ BOREHOLE DIAMETER: _____ TYPE OF BACKFILL: _____ ELEVATION/DEPTH TOP OF SEAL: _____ TYPE OF SEAL: _____ DEPTH TOP OF SAND PACK: _____ ELEVATION/DEPTH TOP OF SCREEN: _____ TYPE OF SCREEN: _____ SLOT SIZE X LENGTH: _____ TYPE OF SAND PACK: _____ ELEVATION/DEPTH BOTTOM OF SCREEN: _____ ELEVATION/DEPTH BOTTOM OF SAND PACK: _____ TYPE OF BACKFILL BELOW OBSERVATION WELL: _____ ELEVATION/DEPTH OF HOLE: _____	
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Figure B1.3-3. Double Cased Monitoring Well Construction Diagram

DOUBLE CASED OPEN HOLE BEDROCK MONITORING WELL CONSTRUCTION DIAGRAM		WELL NO. _____
PROJECT _____ PROJECT NO. _____ DATE _____ BORING NO.: _____ ELEVATION _____ FIELD _____ GEOLOGIST _____	DRILLER _____ DRILLING _____ METHOD _____ DEVELOPMENT _____ METHOD _____	
	ELEVATION OF TOP OF OUTER CASING: _____ ELEVATION OF TOP OF INNER CASING: _____ STICK-UP OF OUTER CASING: _____ STICK-UP OF INNER CASING: _____ GROUND SURFACE ELEVATION: _____ TYPE OF SURFACE SEAL: _____ _____ I.D. OF OUTER CASING: _____ TYPE OF CASING: _____ DEPTH OF OUTER CASING: _____ _____ I.D. OF INNER CASING: _____ TYPE OF CASING: _____ DEPTH OF INNER CASING: _____ TYPE OF CASING SEAL: _____ _____ ELEVATION/DEPTH TO TOP OF ROCK: _____ _____ DIAMETER OF HOLE IN BEDROCK: _____ DESCRIPTION OF BEDROCK: _____ _____ _____ _____ _____ ELEVATION/DEPTH OF HOLE: _____	

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Figure B1.3-4. Double Cased Monitoring Well Construction Diagram for Wells with a Flush-Mount Surface Completion

DOUBLE CASED MONITORING WELL CONSTRUCTION DIAGRAM		WELL NO. _____
PROJECT _____ PROJECT NO. _____ DATE _____ BORING NO.: _____ ELEVATION _____ FIELD _____ GEOLOGIST _____	DRILLER _____ DRILLING _____ METHOD _____ DEVELOPMENT _____ METHOD _____	
	ELEVATION OF TOP OF SURFACE CASING: _____ TYPE OF SURFACE SEAL: _____ I.D. OF SURFACE CASING: _____ TYPE OF SURFACE CASING: _____ ELEVATION OF TOP OF RISER: _____ TYPE OF BACKFILL: _____ I.D. OF UPPER AQUIFER CASING: _____ TYPE OF UPPER AQUIFER CASING: _____ BOREHOLE DIAMETER: _____ RISER PIPE I.D. _____ TYPE OF RISER PIPE: _____ DEPTH CASING IS SET IN CONFINING LAYER _____ APPROXIMATE THICKNESS OF CONFINING LAYER _____ ELEVATION/DEPTH TOP OF SEAL: _____ TYPE OF SEAL: _____ ELEVATION/DEPTH TOP OF SAND PACK: _____ TYPE OF SAND PACK: _____ BOREHOLE DIAMETER: _____ TYPE OF SCREEN: _____ SLOT SIZE X LENGTH: _____ I.D. OF SCREEN: _____ ELEVATION/DEPTH BOTTOM OF SCREEN: _____ TYPE OF BACKFILL BELOW OBSERVATION WELL: _____ ELEVATION/DEPTH OF HOLE: _____	
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SOP B2.3 Subsurface Soil Sampling

The following elements regarding soil borings should be considered when developing project-specific plans:

- All drilling will conform to state and local regulations. Permits, applications, and other documents required by state and local authorities will be obtained.
- The location of all borings will be approved in writing by the base before drilling commences.
- The drill rig will be decontaminated in accordance with SOP B1.10. Use of disposable equipment is preferred. If disposable equipment is unavailable, use of decontaminated equipment is allowed. Equipment shall be decontaminated per the requirements of SOP B1.10. All sampling equipment which may not be decontaminated should be disposed of in accordance with the project-specific addenda to the WMP (Appendix E of the BWP).
- The drill rig will not leak any fluids that may enter the hole or contaminate equipment that is placed in the hole. The use of rags or diapers to absorb leaking fluids is unacceptable. All leaking fluids will be caught in a proper container until the leak is repaired. If sample integrity could be comprised by leaking drill rig fluids, then sample operation may be shut down until the leak is repaired.
- No fluids will be used to advance soil borings.
- A standard penetration test will be performed each time a split spoon sample is taken. The test will be performed in accordance with ASTM D-1586. Sampling for lithologic logging should be continuous especially near ground surface in the area of potential contamination sources. The depth to which continuous lithologic sampling is completed will be determined on a site-by-site basis after review of site specific stratigraphic data collected during previous investigations. In most cases, the collection of continuous lithologic samples should begin at the ground surface and continue until the water table is encountered.

NOTE: If soil samples are being collected for VOC or total organic carbon (TOC) analysis, those samples should be collected from the sampler prior to lithologic logging and any disturbance to the sample core.

The method of continuous sample collection is dependent on the drilling method used. Common sampling methods include split-spoon samplers, thin-walled samplers, and core barrels. All of these sampling devices can be used with minimal disturbance of the sample.

- Sample collection for VOC and TOC analyses will be in accordance with U.S. EPA SW-846 Method 5035 and NMED requirements. Samples will be collected using EnCore[®] (or similar) samplers. If conditions exist that make the use of this type of sampler impractical (collection of samples from soil cuttings or dry or gravelly conditions), another method may be used and should be addressed in the project-specific work plan. If another method is used, such as a discrete grab sample collected in a 4-ounce jar, the sample should be collected prior to homogenization with as little disturbance as possible.
- Surface water and extraneous materials will not enter the boring.

- Boreholes will be abandoned as specified in project-specific addenda.
- All trash and drill cuttings will be disposed as dictated in project-specific addendum to the WMP (Appendix E of the BWP).
- Subsurface soil samples may also be collected using a stainless steel hand auger or split-spoon sampler. Project-specific addenda will specify the method to be used on the basis of field requirements.
- Lithologic logging is necessary to determine the physical characteristics of the subsurface. This information will be used in conjunction with contaminant chemical and physical data to determine how the contaminant will move from its source to potential receptors. This data will also be used for evaluating the feasibility of various remediation technologies for cleanup of subsurface contamination. The stratigraphy at Kirtland AFB is complex with lateral variation of highly heterogeneous alluvial fan and axial ancestral Rio Grande lithofacies. Small lenses of clay or sand present in these lithofacies can determine how a contaminant is transported from the source site. These lenses may be missed if lithologic sampling is not continuous.
- Before digging begins a digging permit, “*Base Civil Engineering Work Clearance Request*” form, needs to be completed and approved by the Chief of Operations or Chief of Engineering and Environmental Planning at the base in accordance with Appendix H, Permitting Plan. The work clearance request is processed just prior to the start of work and is valid for 30 days. If delays are encountered and the conditions at the job site change (or may have to be changed) or the project extends past 30 days, this work clearance request must be reprocessed. The type of information that must accompany this permit includes:
 - Location
 - Work order/job number
 - Contract number
 - If the area has been staked/clearly marked or not
 - A sketch of the excavation
 - Type of facility work involved, i.e. Pavements, drainage systems, railroad tracks, overhead or underground utility or communications, aircraft or vehicular traffic flow, security, etc.
 - Date clearance requested and terminated
 - Requesting official, phone number, and organization

Hand Auger Sampling

The following procedure will be used for hand auger sampling:

- Wear appropriate PPE as specified in the BWHSP (Appendix F of the BWP) and the SSHP. In addition, samplers will don new sampling gloves at each location.
- Use a decontaminated hand-driven 6-inch stainless steel bucket auger. The diameter of the auger may be modified to suit site-specific conditions and shall be specified in the project-specific addendum.
- Begin turning the auger in a clockwise direction and continue until the desired sampling depth is obtained.
- Remove the auger and collect samples for VOC and total organic carbon (TOC) analyses in accordance with U.S. EPA SW-846 Method 5035 and NMED requirements. Samples will be collected directly from the soil in the auger with as little disturbance as possible, using EnCore® (or similar) samplers. If conditions exist that make the use of this type of sampler impractical (such as dry or gravelly soil conditions), another method may be used and should be addressed in the project-specific work plan. If another method is used, such as a discrete grab sample collected in a 4-ounce jar, the sample should be collected prior to homogenization with as little disturbance as possible.
- Empty remaining contents of the auger into a decontaminated stainless steel pan. Homogenize samples according to the procedures specified in SOP B2.5, Sample Homogenization. Fill jars using a stainless steel spatula or spoon.
- If it is determined that the sample volume is insufficient to satisfy the analytical requirements, another sample must be obtained from a location immediately adjacent to the first sample.
- Decontaminate according to the procedures outlined in SOP B1.10.
- Place analytical samples into the shipping cooler and chill on ice to 4°C, if required. Prepare sample(s) for delivery to the laboratory for analysis within 24 hours of collection.
- Fill out field log book, sample log sheet, custody seals, labels, and C-O-C forms. Example copies of these forms are included in the QAPP (Appendix C of the BWP).

Split-Spoon Sampling Procedure

The following procedure will be used for split-spoon sampling:

- Wear appropriate PPE as outlined in the BWHSP (Appendix F of the BWP) and the SSHP. In addition, samplers will don new sampling gloves at each location.
- Drill borehole to the desired sampling depth. Drive split-spoon into the undisturbed soil, which is to be sampled.
- A stainless steel 2-inch (or 3-inch) outside diameter split-spoon sampler will be driven with blows from a 140-lb (or 300-lb) hammer falling 30 inches until either approximately 2 ft has been penetrated or 100 blows within a 6-inch interval have been applied. This process is referred to as the Standard Penetration Test (ASTM D 1586-74). A decontaminated split-spoon will be used for each sample collected for chemical analyses.

- Soil borings designated for engineering parameters such as Atterberg limits, permeability, sieve analysis, etc., will be obtained using a Shelby tube according to ASTM 1557. Shelby tubes can be used when cohesive materials are encountered, and when an undisturbed sample is required for testing.
- Record the number of blows required for each 6 inches of penetration or fraction thereof. The first 6 inches is considered to be a seating drive. The sum of the number of blows required for the second and third 6 inches of penetration is termed the penetration resistance. If the sampler is driven less than 2 ft, the penetration resistance is still the blows encountered for the second and third 6-inch intervals. If more than 50 blows have been counted for a particular 6-inch interval, then refusal shall be entered on the log.
- Bring the sampler to the surface and remove both ends and one-half of the split-spoon so that the recovered soil rests in the remaining half of the barrel. Place split-spoon on clean polyethylene sheeting. Describe thoroughly the approximate recovery (length), Unified Soil Classification System (USCS) classification, composition, color, moisture, etc., of the recovered soil. A copy of a typical bore log form is depicted in Figure B1.1-1.

NOTE: If soil samples are being collected for VOC or total organic carbon (TOC) analysis, those samples should be collected from the sampler prior to lithologic logging and any disturbance to the sample core.

- Sample collection for VOC and total organic carbon (TOC) analyses will be in accordance with U.S. EPA SW-846 Method 5035 and NMED requirements. Samples will be collected prior to homogenization from the split-spoon core, using EnCore[®] (or similar) samplers. If conditions exist that make the use of this type of sampler impractical (such as dry or gravelly soil conditions), another method may be used and should be addressed in the project-specific work plan. If another method is used, such as a discrete grab sample collected in a 4-ounce jar, the sample should be collected prior to homogenization with as little disturbance as possible.
- Empty remaining contents of the split-spoon into a disposable sample tray/pan or decontaminated stainless steel pan. Homogenize samples according to the procedures specified in SOP B2.5, Sample Homogenization. Fill remaining jars with soil using stainless steel spatulas or spoons.
- Decontaminate split-spoon sampler according to the procedures outlined in SOP B1.10.
- Place analytical samples in sample cooler and chill to 4°C. Samples will be shipped to the laboratory within 24 hours.
- Fill out field log book, sample log sheet, labels, custody seals, and C-O-C forms for analytical samples. Example copies of these forms are included in the QAPP (Appendix C of the BWP).

Rock Core Sampling

After rock coring has been completed and the core recovered, the rock core will be carefully removed from the barrel, placed in a core tray (previously labeled “top” and “bottom” to avoid confusion), classified, and measured for percentage of recovery as well as the rock quality designation (RQD). See

the Classification of Rocks section in SOP B1.1 for a description of how to measure the RQD of a core. Each core will be described and classified in the field log book or on appropriate forms described in SOP B1.1, Borehole and Sample Logging.

After sampling, rock cores must be placed in the sequence of recovery in well-constructed wooden boxes or manufactured plastic core boxes provided by the drilling contractor. Rock cores from two different borings will not be placed in the same core box unless accepted by the Field Geologist. The core boxes should be constructed to accommodate at least 20 linear ft of core in rows of approximately 5 ft each and should be constructed with hinged tops secured with screws and a latch to keep the top securely fastened down. Wood partitions will be placed at the end of each core run and between rows. The depth from the surface of the boring to the top and bottom of the drill run and run number will be marked on the wooden partitions with indelible ink. Any core loss areas will be spaced with wooden blocks, polyvinyl chloride (PVC) pipe, or other sturdy material so that the entire core run is represented. The order of placing cores will be the same in all core boxes. The top of each core obtained should be clearly and permanently marked on each box. The width of each row must be compatible with the core diameter to prevent lateral movement of the core in the box. Similarly any empty space in a row will be filled with an appropriate filler material or spacers to prevent longitudinal movement of the core in the box.

The inside and outside of the core-box lid will be marked by indelible ink to show all pertinent data on the box's contents. At a minimum, the following information must be included:

- Project name
- Project number
- Boring number
- Footage (depths)
- Run number(s)
- Recovery
- Box number (x of y)

It is also useful to draw a large diagram of the core in the box, on the inside of the box top. This provides more room for elevations, run numbers, recoveries, comments, etc., than could be entered on the upper edges of partitions or spaces in the core box.

For easy retrieval when core boxes are stacked, the sides and ends of the box should also be labeled and include project number, boring number, top and bottom depths of core, and box number.

A photograph of the recovered core and the labeling on the inside cover will be taken. If moisture content is not critical, the core should be wetted with potable tap water and wiped clean for the photograph (This will help to show true colors and bedding features in the cores).

Due to the weight of the core, two people should always handle a filled core box. Core boxes temporarily stored onsite should be protected from the weather. The core boxes should be removed from the site in a careful manner as soon as possible.

Thin Wall (Shelby Tube) Sampling

When it is desired to take undisturbed samples of soil, thin-walled seamless tube samplers (Shelby tubes) will be used. These samples are not recommended by the EPA for environmental samples. Tube samplers, whether of carbon steel or stainless steel, should not be used for taking VOC samples. The following method applies:

- Clean out the hole to the sampling elevation being careful to minimize the chance for disturbance or contamination of the material to be sampled. In saturated materials, withdraw the drill bit slowly to prevent loosening of the soil around the hole and maintain the water level, if present, in the hole at or above groundwater level.
- The use of bottom discharge bits or jetting through an open-tube sampler to clean out the hole will not be allowed. Any side discharge bits are permitted.
- The sampler must be of a stationary piston-type to limit sample disturbance and aid in retaining the sample. Either the hydraulically operated or control rod-activated type of stationary piston sampler may be used. Prior to inserting the tube sampler in the hole, check to insure that the sampler head contains a check valve. The check valve is necessary to keep water in the rods from pushing the sample out of the tube sampler during sample withdrawal and to maintain suction within the tube to help retain the sample.
- With the sampling tube resting on the bottom of the hole and any water level in the boring at the natural groundwater level or above, push the tube into the soil by a continuous and rapid motion, without impacting or twisting. In no case will the tube be pushed further than the length provided for the soil sample. Allow a free space in the tube for cuttings and sludge. Data to be recorded on the sampling tube when sampling with Shelby Tubes include the maximum pressure exerted for the push, and duration in seconds of the push.
- After pushing the tube, the sampler should sit from 5 to 15 minutes in the borehole prior to removal. Immediately before removal, the sample must be sheared by rotating the rods with a pipe wrench a minimum of two revolutions.
- Upon removal of the sampler tube from the hole, measure the length of sample in the tube and also the length penetrated. Remove disturbed material at both ends of the tube and measure the length of sample again. After removing at least 1-inch of soil from the lower end and after inserting an impervious disk, seal both ends of the tube with at least ½-inch of wax applied in a way that will prevent the wax from entering the sample. Newspaper or other types of filler must be placed in voids at either end of the sampler prior to sealing with wax. Place plastic caps on the ends of the sampler, tape them into place, and dip the ends in wax to seal them.
- Affix labels to the tubes, as required, and record sample number, depth, penetration, and recovery length on the label. Mark the same information and “up” direction on the tube with indelible ink, and mark the end of the sample. Complete C-O-C and other required forms. Do not allow tubes to freeze, and store the samples vertically (with the same orientation they had in the ground, i.e., top of sample is up) in a cool place out of the sun at all times. Ship samples protected with suitable resilient packing material to reduce shock, vibration, and disturbance.

- Using soil removed from the ends of the tube, carefully describe the sample using the methods presented in SOP B1.1.
- When thin-wall tube samplers are used to collect soil for certain chemical analyses, it may be necessary to avoid using wax, newspaper, or other fillers. Project-specific addendum will address specific materials allowed dependent on analytes being tested.

Thin-walled undisturbed sampling are sometimes difficult to collect because thin-walled tube samplers are restricted in their usage by the consistency of the soil to be sampled. Often very loose and/or wet samples cannot be retrieved by the samplers, and soils with a consistency in excess of very stiff cannot be penetrated by the sampler. Devices such as Dension or Pitcher cores can be used in conjunction with the tube samplers to obtain undisturbed samples of stiff soils. Using these devices normally increases sampling costs and therefore their use should be weighed against the increased cost and the need for an undisturbed sample. In any case, if a sample cannot be obtained with a tube sampler, an attempt should be made with a split-spoon sampler at the same depth so that at least a sample can be obtained for classification purposes.

Direct Push Sampling for Soil and Groundwater

Direct push technology (DPT) will be used to rapidly collect soil and water samples whenever possible. This technique provides for collection of undisturbed samples and does not generate soil cuttings. This section discusses the DPT method only.

The contractor will need a copy of the DPT subcontractor work plan, waste containers, and appropriate health and safety gear. All additional equipment and materials will be provided by the DPT subcontractor. The DPT subcontractor should be equipped with a rig capable of pushing 30 ft and collecting soil and groundwater samples from any interval within that depth. Equipment should include at minimum the following items:

- Hydraulic ram with hammer assembly
- 1- to 1.5-inch diameter drill rods
- Stainless steel piston-type, split-spoon, or equivalent soil sampling device that allows for lithologic characterization and retrieval of at least 400 milliliters (mL) of sample volume
- Geoprobe[®], Hydrocone[®], bailer, Teflon[®] tubing and peristaltic pump, or equivalent water sampling device
- Small diameter PVC riser and screen to make temporary wells if recovery is too slow
- Decontamination equipment
- Health and safety equipment

If a situation arises in which the groundwater recharge is too slow to allow for efficient sampling, a temporary PVC well can be installed for sampling at a later time. This well, however, must be installed according to the following specifications:

- The well will be narrower in diameter than the DPT borehole, leaving annular space around the casing
- The well will be installed between 2 and 5 ft into the water table
- New PVC casing and screen will be used, decontaminated with a stream cleaner and rinsed with copious quantities of deionized water
- Installation of well materials will occur with clean decontaminated gloves
- The well will be sampled and removed within 48 hours of installation
- If left unattended or overnight, locking well caps should be used, or a seal should be used that can indicate tampering
- One volume of the sampling device will be purged prior to sampling

General Methodology

- Verify that the subcontractor has the necessary drilling and sampling equipment, as well as proper decontamination supplies.
- Confirm that sampling locations are staked and that the clearances from all on-Base and off-Base utilities have been obtained. Do not begin the sampling until proper digging permits have been obtained and all of the utilities have been marked.
- Locate the sample location and position the DPT rig. If the sample point is on thick asphalt or concrete, the DPT subcontractor will use a hammer-drill or equivalent to drill a hole through the pavement.
- Verify that the sampling tip has been properly decontaminated, as specified in SOP B1.10 before beginning penetration.

Soil Sampling Methodology

- For soil sampling, hydraulically advance the sampler to above the target sample interval, unlock the piston point, and advance the sampling device through the sampling interval.
 - Pull the rods using the hydraulic apparatus and remove the sample insert or split spoon.
 - Log the soil and collect the required samples as specified in the project specific addendum.
- Continue sampling at additional depth intervals or abandon the borehole, as appropriate for the location

Groundwater Sampling Methodology

- If groundwater sampling is necessary, advance the sampler into the water table and collect a sample with the sampling device as specified in SOP B4.1.

- Collect and manage all wastes as specified in the project-specific addenda to the WMP (Appendix E of the BWP).
- Abandon all boreholes and repair pavement before moving to a new site as specified in SOP B1.4.

Comments

- If a buried object impedes the DPT sampler or if an insufficient sample volume is recovered, reposition the rig in a location to satisfy the intent of the original sample point and try again. Note this on the borehole logging form.
- If the total recovered sample volume is insufficient for both screening and laboratory analysis, a second hole will be pushed as close as possible to the original hole and an additional sample will be taken from the same depth interval. The two samples will be composited prior to sampling for chemical analysis.

References for Other Applicable ASTM Standards

ASTM D1452 – Soil Investigation and Sampling by Auger Borings

ASTM D1586 – Penetration Test and Split-Barrel Sampling of Soils

ASTM D4220 – Preserving and Transporting Soil Samples

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SOP B5.1 pH

The following procedure is used for measuring groundwater pH with a pH meter:

- The instrument and batteries should be checked and calibrated in the laboratory prior to initiation of the field effort.
- The accuracy of the buffer solutions used for field and laboratory calibration should be checked. Buffer solutions need to be changed due to degradation upon exposure to the atmosphere. The date of preparation of each buffer should be included on the bottle label.
- Immerse the tip of the electrodes in water overnight. If this is not possible due to field conditions, immerse the electrode tip in water for at least an hour before use. The electrode tip may be immersed in a rubber or plastic sack containing buffer solution for field transport or storage. This is not applicable for all electrodes as some must be stored dry.
- Make sure all electrolyte solutions within the electrode(s) are at their proper levels and that no air bubbles are present within the electrode(s).
- Immerse the electrode(s) in a pH-7 buffer solution.
- Adjust the temperature compensator to the proper temperature (on models with automatic temperature adjustment, immerse the temperature probe into the buffer solution). Alternately, the buffer solution may be immersed in the sample and allowed to reach temperature equilibrium before equipment calibration. It is best to maintain buffer solution at or near expected sample temperature before calibration.
- Adjust the pH meter to read 7.0.
- Remove the electrode(s) from the buffer and rinse well with deionized water. Immerse the electrode(s) in pH-4 (for water with pH of 1 to 7) or pH-10 (for water with pH of 7 to 12) buffer solution and adjust the slope control to read the appropriate pH. At least three successive readings during calibration, one minute apart, should be within +0.1 pH unit. For best results, the standardization and slope adjustments should be repeated at least once daily before use.
- Immerse the electrode(s) in the unknown solution, slowly stirring the probe until the pH stabilizes. Stabilization may take several seconds to minutes. If the pH continues to drift, the sample temperature may not be stable, a chemical reaction (e.g., degassing) may be taking place in the sample, or the meter or electrode may be malfunctioning. This must be clearly noted in the log book.
- Read and record the pH of the solution, after adjusting the temperature compensator to the sample temperature. pH should be recorded to the nearest 0.1 pH unit. Also record the sample temperature.
- Rinse the electrode(s) with deionized water.
- Keep the electrode(s) immersed in water when not in use.

The sample used for pH measurement should never be saved for subsequent conductivity or chemical analysis. All pH electrodes leak small quantities of electrolytes (e.g., sodium or potassium chloride) into the solution. Precipitation of saturated electrolyte solution, especially at colder temperatures, or in cold water, may result in slow electrode response. Any visual observation of conditions that may interfere with pH measurement, such as oily materials, or turbidity, should be noted in the field log book.

SOP B5.2 Specific Conductance

The steps involved in taking specific conductance measurements are listed below:

- Check batteries and calibrate instrument before going into the field.
- Immerse the electrode in water overnight. If this is not possible due to field conditions, immerse the electrode at least one hour before use.
- Calibrate the instrument between each measurement or groups of closely spaced measurements. Potassium chloride standard solutions with a specific conductance closest to the values expected in the field should be used.
- Rinse the electrode with one or more portions of the sample to be tested.
- Immerse the electrode in the sample and measure the conductivity.
- Read and record the results in a field log book. Report the results to the nearest ten units for readings under 1000 micromhos per centimeter ($\mu\text{mhos/cm}$) and the nearest 100 units for readings over 1000 $\mu\text{mhos/cm}$. Adjust the temperature setting to the sample temperature.
- Repeat the procedure with fresh sample until reproducible (i.e., ± 5 percent) results are obtained.

If the specific conductance measurements become erratic, or inspection shows that any platinum black has flaked off the electrode, replatinization of the electrode is necessary. See the manufacturer's instructions for details.

Note that specific conductance is occasionally reported at temperatures other than ambient.

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SOP B5.3 Water Temperature

Water temperature may be measured with either a thermometer or temperature meter. The following procedure is applicable to both instruments:

- Rinse the thermometer or temperature probe with a portion of the collected sample.
- Immerse the thermometer or probe in the sample until temperature equilibrium is obtained (1- to 3-minutes). To avoid the possibility of contamination, the thermometer should not be inserted into samples which will undergo subsequent chemical analysis.
- Record values in a field log book to the nearest 0.5°C.
- If a temperature meter or probe is to be used, the instrument should be calibrated according to the manufacturer's recommendations and a National Bureau of Standards (NBS) certified thermometer or one that is traceable to NBS certification before field use. Cross-checking and duplicate field analyses should agree within $\pm 0.5^{\circ}\text{C}$. A cross-check with a calibrated NBS certified thermometer will be made at least semiannually.
- Rinse the thermometer or probe with distilled water.

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SOP B5.4 Dissolved Oxygen

Probes differ as to specifics of use. Follow the manufacturer's instructions to obtain an accurate reading. The following general steps should be used to measure the dissolved oxygen concentration:

- The equipment should be calibrated and its batteries checked in the laboratory before going to the field.
- The probe should be conditioned in a water sample for as long a period as practical before its use in the field. Long periods of dry storage followed by short periods of use in the field may result in inaccurate readings.
- The instrument should be calibrated in the field before each measurement or group of closely spaced measurements by placing the probe in a water sample of known dissolved oxygen concentration (i.e., determined by Winkler method) or in a freshly air-saturated water sample of known temperature. Dissolved oxygen values for air-saturated water can be determined by consulting a table listing oxygen solubility as a function of temperature and salinity.
- The instrument probe should be immersed in a flow-through cell or directly into the water column of the well for the most accurate measurement.
- Record the dissolved oxygen content and temperature of the sample in a field log book. Read the dissolved oxygen dial to the nearest 0.1 milligram per liter (mg/L).
- Recalibrate the probe when the membrane is replaced, or as needed. Follow the manufacturer's instructions. Duplicate analyses should agree within ± 0.1 mg/L.

Note that although *in-situ* placement of the probe is preferable, since sample handling is not involved, this may not always be practical. Be sure to record whether the liquid was analyzed *in-situ*, or if a sample was taken. If a sample is taken special care should be taken during collection to avoid turbulence, which can lead to increased oxygen solubility and positive test interference.

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SOP B5.5 Oxidation-Reduction Potential

The following procedure is used for measuring oxidation-reduction potential:

- The equipment should be calibrated and its batteries checked in the laboratory before going to the field.
- Check that the platinum probe is clean and the platinum bond or tip is unoxidized. If dirty, polish with emery paper or, if necessary, clean the electrode using aquaregia, nitric acid, or chromic acid, in accordance with manufacturer's instructions.
- Thoroughly rinse the electrode with distilled water.
- Verify the sensitivity of the electrodes in accordance with the manufacturer's instructions.
- After the assembly has been checked for sensitivity, wash the electrodes with three changes of deionized water or with a flowing stream of water from a wash bottle. Place the sample in a clean glass beaker or sample cup and insert the electrodes. Set temperature compensator to the sample temperature. Provide adequate agitation throughout the measurement period. Read the millivolt (mV) potential of the solution, allowing sufficient time for the system to stabilize and reach temperature equilibrium. Measure successive portions of the sample until readings on two successive portions differ by no more than 10 mV. A system that is very slow to stabilize properly will not yield a meaningful oxidation-reduction potential. Record all results in a field log book, including oxidation-reduction potential (to nearest 10 mV), sample temperature, and pH at the time of measurement.

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SOP B6.2 Tank Sampling

Field sampling procedures for collecting samples of tank contents using a Teflon[®] bailer with a Teflon[®]-coated stainless steel wire cord or an open-tube sampler are as follows:

Teflon[®] Bailer

- Wear appropriate PPE as required in the BWHSP (Appendix F of the BWP) and the SSHP.
- Gain access (e.g., steps, ladder, man-lift, etc.) to the top of the tank.
- Slowly open release valve (if any) to bring the tank to atmospheric pressure. Properly control all sources of hazardous energy in accordance with BWHSP (Appendix F of the BWP) and the SSHP.
- Loosen access port/cover bolts and remove port/cover.
- If no access port/cover is available, unscrew cap of top opening.
- Use of disposable sample equipment is preferred. If disposable sample equipment is unavailable, use of decontaminated sample equipment is allowed. Sample equipment shall be decontaminated per the requirements of SOP B1.10, Equipment Decontamination. Insert a Teflon[®] bailer into tank slowly to allow stratified content (if any) to fill the bailer.
- Retrieve the bailer and wipe it with a disposable absorbent pad (place the pad in a 55-gallon drum).
- Transfer the sample(s) into appropriate containers as required by the project-specific addenda.
- Repeat the previous step until enough sample volume is obtained, as required.
- If using bottom valve, place the sample container below the valve and turn the valve slowly and easy to ensure a slow, controlled flow of sampling material.
- Cap the sampler container, place in double plastic bag, attach label, record all pertinent data in the field log book and complete the C-O-C form.
- Preserve and/or place sample(s) on ice, if required.
- Prepare sample(s) for delivery to the laboratory within 24 hours of collection.

Open Tube Sampler

- Use of disposable sample equipment is preferred. If disposable sample equipment is unavailable, use of decontaminated sample equipment is allowed. Sample equipment shall be decontaminated per the requirements of SOP B1.10. Insert a sampler into tank until it reaches the bottom.
- Place thumb securely over open end of tube and carefully retrieve the sampler.

- Transfer the sample(s) directly into appropriate containers.
- Repeat the previous step until enough sample volume is obtained, as required.
- Cap the sampler container, place in double plastic bag, attach label, record all pertinent data in the field log book, and complete the C-O-C form.
- Preserve and/or place sample(s) on ice, if required.
- Prepare sample(s) for delivery to the laboratory within 24 hours of collection.

If tanks are found to contain solid materials, the following sampling procedures will be followed using a rust-free carbon steel sample trier.

Sample Trier

Follow the first five steps as for a Teflon[®] bailer sampler.

- Use of disposable sample equipment is preferred. If disposable sample equipment is unavailable, use of decontaminated sample equipment is allowed. Sample equipment shall be decontaminated per the requirements of SOP B1.10. Insert a trier into the tank and into the solid material.
- Rotate the trier once or twice to cut a core of the material.
- Slowly retrieve the trier, making sure that the slot is facing upward.
- Transfer the sample into appropriate container with the aid of a stainless steel spatula.
- Repeat the previous step at two or more different points inside the tank until enough sample volume is obtained, as required.
- Cap the sample container, place in a double plastic bag, attach label, record all pertinent data in the field log book, and complete the C-O-C form.
- Preserve and/or place sample(s) or ice, if required.
- Prepare sample(s) for delivery to the laboratory within 24 hours of collection.

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APPENDIX E

Field Forms



Project Number: 62599DM01.1017.04

Start Time/Date:

Completion Time/Date:

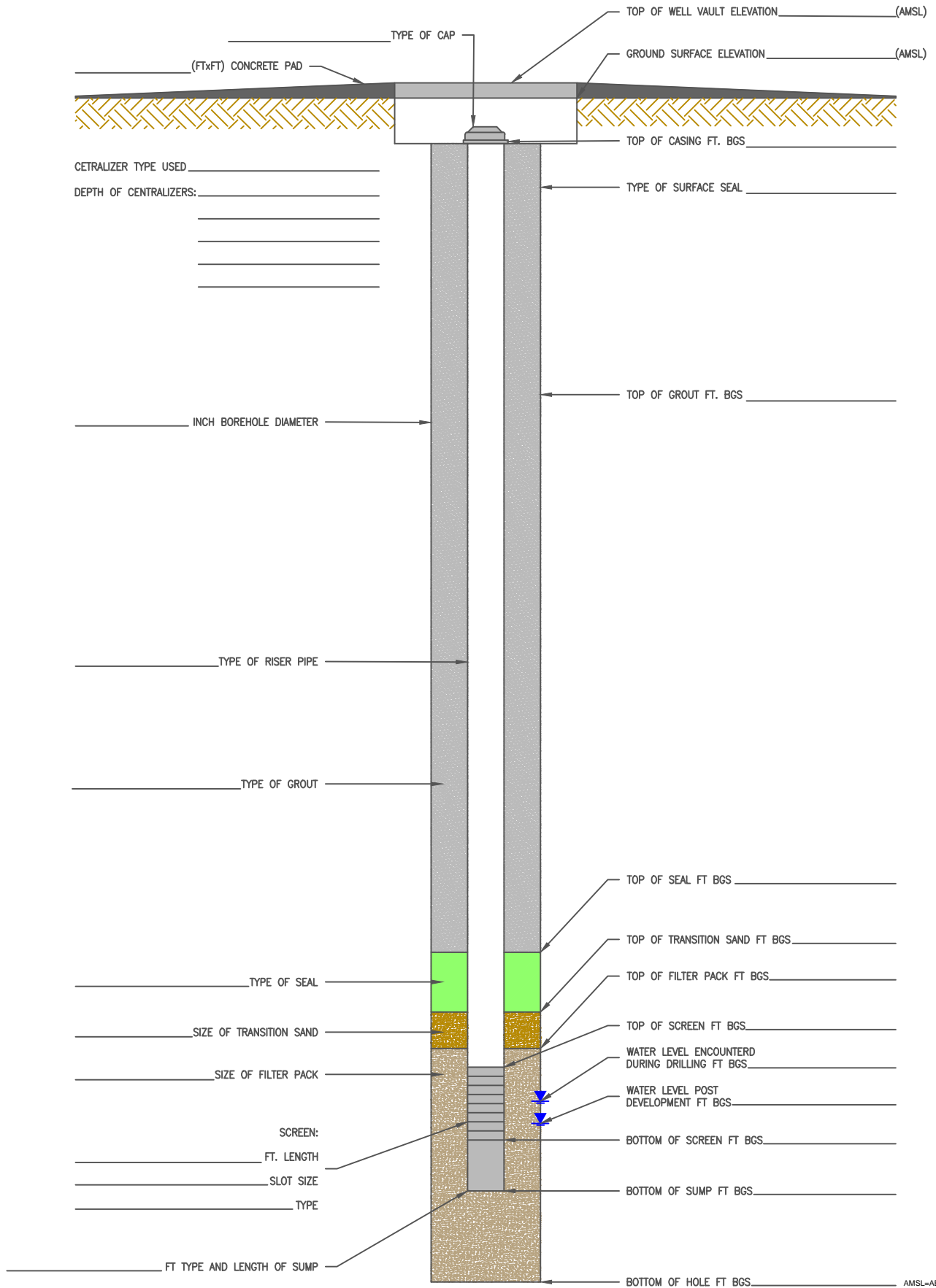
Final Depth:

Bit Type and Outer Diameter

Logged By:

Page ____ of ____

Additional Comments:
R=Rounded, SR=Subrounded, SA=Subangular, A=Angular



NOT TO SCALE
AMSL=ABOVE MEAN SEA LEVEL
BGS=BELOW GROUND SURFACE
FT=FEET



WELL COMPLETION DIAGRAM

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC., PBC

KIRTLAND AIR FORCE BASE

PROJECT NO.:

WELL ID:

INSTALLATION START DATE/TIME:

INSTALLATION END DATE/TIME:

GEOLOGIST:

DRILLER:



FIELD RECORD OF WELL DEVELOPMENT

Project Name:	Project No:	Date/Time:
EA Personnel:	Development Method:	
Equipment Used:	Equipment Calibrated: Y N	
Weather/Temperature/Barometric Pressure:	Date/Time:	

Well No.:	Well Condition:
Well Diameter:	Measurement Reference:
Well Volume Calculations	
A. Depth To Water (ft):	D. Well Volume/ft:
B. Total Well Depth (ft):	E. Total Well Volume (gal)[C*D]:
C. Water Column Height (ft):	F. Five Well Volumes (gal):

Parameter	Beginning	1 Volume	2 Volumes	3 Volumes	4 Volumes	5 Volumes
Time (min)						
Depth to Water (ft)						
Purge Rate (gpm)						
Volume Purged (gal)						
pH ($\Delta < 0.2$)						
Temperature ($^{\circ}\text{F}$) ($\Delta < 10\%$)						
Conductivity ($\mu\text{mhos/cm}$) ($\Delta < 10\%$)						
Turbidity (NTU) ($< 10 \text{ NTU}^*$)						
Parameter	6 Volumes	7 Volumes	8 Volumes	9 Volumes	10 Volumes	End
Time (min)						
Depth to Water (ft)						
Purge Rate (gpm)						
Volume Purged (gal)						
pH ($\Delta < 0.2$)						
Temperature ($^{\circ}\text{F}$) ($\Delta < 10\%$)						
Conductivity ($\mu\text{mhos/cm}$) ($\Delta < 10\%$)						
Turbidity (NTU) ($< 10 \text{ NTU}^*$)						
<p>NOTE: NTU = Nephelometric turbidity unit. ORP = Oxidation-reduction potential. * = If $< 10 \text{ NTU}$ is not able to be achieved, $< 100 \text{ NTU}$ is acceptable Parameter stabilization requires four consecutive readings [four consecutive differences (Δ)] to meet parameter stabilization requirements listed.</p>						
COMMENTS AND OBSERVATIONS: _____						



**Kirtland AFB BFF Expansion Project # 62599DM01
Groundwater Well Inspection Form**

Well ID: _____ PID: _____ ppm Date: _____

Stick up: ☐ Flush Mount: ☐

Well Pad Condition:	Below Grade <input type="checkbox"/>	Functional <input type="checkbox"/>	Repair Required <input type="checkbox"/>
Bollards:	Not Applicable <input type="checkbox"/>	Functional <input type="checkbox"/>	Repair Required <input type="checkbox"/>
Protective Casing:	Not Applicable <input type="checkbox"/>	Functional <input type="checkbox"/>	Repair Required <input type="checkbox"/>
Lock/Cover Bolt:	Not Applicable <input type="checkbox"/>	Functional <input type="checkbox"/>	Replacement Required <input type="checkbox"/>
Vault Threads:	Not Applicable <input type="checkbox"/>	Functional <input type="checkbox"/>	Cleaning Required <input type="checkbox"/>
Vault Cover:	Not Applicable <input type="checkbox"/>	Functional <input type="checkbox"/>	Repair Required <input type="checkbox"/> <small>(Excessive Corrosion on Threads)</small>
Vault Seal:	Missing <input type="checkbox"/>	Functional <input type="checkbox"/>	Replacement Required <input type="checkbox"/> <small>(Excessive Corrosion at Seal Surface)</small>
Water in Vault:	Yes <input type="checkbox"/> No <input type="checkbox"/>	If yes, Depth of Water: _____ Ft.	
Debris in Vault:	Yes <input type="checkbox"/> No <input type="checkbox"/>	If yes, Type of Debris: _____	
Pump Present:	Yes <input type="checkbox"/> No <input type="checkbox"/>	If no pump, J-Plug Present: Yes <input type="checkbox"/> No <input type="checkbox"/>	

Bennett Pump Inventory:

Drop Pipe Plug:	Missing <input type="checkbox"/>	Functional <input type="checkbox"/>	Replacement Required <input type="checkbox"/>
Exhaust Line Plug:	Missing <input type="checkbox"/>	Functional <input type="checkbox"/>	Replacement Required <input type="checkbox"/>
Pump Line Plug:	Missing <input type="checkbox"/>	Functional <input type="checkbox"/>	Replacement Required <input type="checkbox"/>
Well Sounder Plug:	Missing <input type="checkbox"/>	Functional <input type="checkbox"/>	Replacement Required <input type="checkbox"/>

Additional Comments: _____

Work Performed: _____

Photographs of Damaged/Missing Parts Taken: Yes ☐

Recorded By: _____

For serious problems, contact Earl Morse at (505) 238-4410



			Well Gauging Form Team Extra			Total Wells 12		Year
			Project: <u>Kirtland AFB BFF ST-106/SS-111</u>					Quarter :
Well ID	Previous DTW (ft MRP)		Date	PID (ppm)	Depth to NAPL (ft MRP)	DTW (ft MRP)	Initials	Reference Point
	Depth to NAPL	DTW						
KAFB-106148-484								TWV
KAFB-106149-484								TWV
KAFB-106150-484								TWV
KAFB-106151-484								TWV
KAFB-106152-484								TWV
KAFB-106153-484								TWV
KAFB-106154-484								TWV
KAFB-106155-484								TWV
KAFB-106156-484								TWV
KAFB-106041								TWV
KAFB-106211								TOPC
KAFB-106229								TWV

Potentially Hazardous



Ground Water Sampling Data Sheet

Well Location ID:

Deployment

Year:

Quarter:

Sample ID:

Well Information

Screen Interval Length (ft):

Previous Depth to Water (MRP):

Well Depth: _____ ft MRP

Top of Screen: _____ ft MRP

Bottom of Screen: _____ ft MRP

Deployment Team: _____

Date Deployed: _____ Time Deployed: _____

PID: MiniRAE 3000 Serial No: _____

Water Level Meter: Solinst 500 ft Serial No: _____

PID Reading: _____ ppm

Depth to Water: _____

DMS Tether and Reel ID match Well ID? ☐ *Check box to confirm*

Notes: _____

***QC sample notes.
(If blank, no QC samples required):***

**Sampler
Number:**

**Top of Sampler
Depth (MRP)**

1

2

3

4

5

6

7

8

9

10

*Underlined depths represent submerged
samplers during previous deployment*

Reviewed by: _____

Initials: _____

Review Date: _____

Primary Samples
(3 DMS)

DMS1:
VOCs, EDB, Metal (Dissolved)
120 mL + 80 mL + 250 mL = 450

DMS 2:
Metal (Total), Alkalinity
250 mL + 250 mL = 500 mL

DMS 3:
Anions and Nitrate/Nitrite Nitrogen
80 mL + 250 mL = 330 mL

220 mL Spare

Primary and Duplicate Samples
(6 DMS)

DMS1:
VOCs and EDB + dup
240 mL + 160 mL = 400

DMS 2:
Metals (Total and Dissolved)
250 mL + 250 mL = 500 mL

DMS 3:
Metals (Total and Dissolved)
250 mL + 250 mL = 500 mL

DMS4:
Anions and Nitrate/Nitrite Nitrogen
80 mL + 250 mL = 330 mL

DMS 5:
Anions and Nitrate/Nitrite Nitrogen
80 mL + 250 mL = 330 mL

DMS 6:
Alkalinity + dup
250 mL + 250 mL = 500 mL

440 mL Spare

Primary and MS/MSD Samples
(6 DMS)

DMS1:
VOCs + MS/MSD
360 mL

DMS 2:
EDB + MS/MSD
240 mL

DMS 3:
Dissolved Metals
250 mL + 250 mL = 500 mL

DMS 4:
Metals (Total and Dissolved)
250 mL + 250 mL = 500 mL

DMS 5:
Total Metals
250 mL + 250 mL = 500 mL

DMS 6:
Alkalinity and Nitrate/Nitrite Nitrogen
250 mL + 250 mL = 500

320 mL Spare



Ground Water Sampling Data Sheet

Well Location ID:

Sampling

Year:

Quarter:

Sample ID:

Date Sampled: _____ Time Sampled: _____ Sampling Team: _____

PID Reading: _____ DMS Tether and Reel ID match Well ID? ☐ Check box to confirm

Sampler Number:
(shallow to deep)

Type of Analysis (circle appropriate)

Document in notes

Dup? MS/MSD?

Choose only one

1	Metals (Total)	Metals (Dissolved)	Anions	Nitrate / Nitrite	VOCs	BTEX (N)	EDB	Alkalinity	<input type="checkbox"/>	<input type="checkbox"/>
2	Metals (Total)	Metals (Dissolved)	Anions	Nitrate / Nitrite	VOCs	BTEX (N)	EDB	Alkalinity	<input type="checkbox"/>	<input type="checkbox"/>
3	Metals (Total)	Metals (Dissolved)	Anions	Nitrate / Nitrite	VOCs	BTEX (N)	EDB	Alkalinity	<input type="checkbox"/>	<input type="checkbox"/>
4	Metals (Total)	Metals (Dissolved)	Anions	Nitrate / Nitrite	VOCs	BTEX (N)	EDB	Alkalinity	<input type="checkbox"/>	<input type="checkbox"/>
5	Metals (Total)	Metals (Dissolved)	Anions	Nitrate / Nitrite	VOCs	BTEX (N)	EDB	Alkalinity	<input type="checkbox"/>	<input type="checkbox"/>
6	Metals (Total)	Metals (Dissolved)	Anions	Nitrate / Nitrite	VOCs	BTEX (N)	EDB	Alkalinity	<input type="checkbox"/>	<input type="checkbox"/>

6mm

pH, Conductivity, ORP,
DO, Temperature

YSI Professional Plus

Serial No: _____

Water Level Meter:

Solinst 500 ft

Serial No: _____

PID:

MiniRAE 3000

Serial No: _____

Turbidity Meter:

Hach 2100Q

Serial No: _____

IDW will be taken to:

Notes:

Sample ID:

Duplicate ID:
(if applicable)

COC#:

Reviewed by: _____

Initials: _____

Review Date: _____

Primary Samples
(3 DMS)

DMS1:
VOCs, EDB, Metal (Dissolved)
120 mL + 80 mL + 250 mL = 450

DMS 2:
Metal (Total), Alkalinity
250 mL + 250 mL = 500 mL

DMS 3:
Anions and Nitrate/Nitrite Nitrogen
80 mL + 250 mL = 330 mL

220 mL Spare

Primary and Duplicate Samples
(6 DMS)

DMS1:
VOCs and EDB + dup
240 mL + 160 mL = 400

DMS 2:
Metals (Total and Dissolved)
250 mL + 250 mL = 500 mL

DMS 3:
Metals (Total and Dissolved)
250 mL + 250 mL = 500 mL

DMS4:
Anions and Nitrate/Nitrite Nitrogen
80 mL + 250 mL = 330 mL

DMS 5:
Anions and Nitrate/Nitrite Nitrogen
80 mL + 250 mL = 330 mL

DMS 6:
Alkalinity + dup
250 mL + 250 mL = 500 mL

440 mL Spare

Primary and MS/MSD Samples
(6 DMS)

DMS1:
VOCs + MS/MSD
360 mL

DMS 2:
EDB + MS/MSD
240 mL

DMS 3:
Dissolved Metals
250 mL + 250 mL = 500 mL

DMS 4:
Metals (Total and Dissolved)
250 mL + 250 mL = 500 mL

DMS 5:
Total Metals
250 mL + 250 mL = 500 mL

DMS 6:
Alkalinity and Nitrate/Nitrite Nitrogen
250 mL + 250 mL = 500

320 mL Spare



15K101396

(WH0001)

Year: 2016

Project: Kirtland AFB BFF ST-106/SS-111

Quarter : 3rd

* Calibrate all parameters weekly. Bump check all parameters daily and re-calibrate if values are out of tolerance.

* 100% DO Sat = $100 \times (\text{Barometric Pressure in mmHg} / 760)$



YSI Professional Plus Log

Serial #

15L100541

(WH0002)

Year: 2016

Quarter : 3rd

Project: Kirtland AFB BFF ST-106/SS-111[illegible]

* Calibrate all parameters weekly. Bump check all parameters daily and re-calibrate if values are out of tolerance.

* 100% DO Sat = $100 \times (\text{Barometric Pressure in mmHg} / 760)$

* Calibrate all parameters weekly. Bump check all parameters daily and re-calibrate if values are out of tolerance.

* Calibrate all parameters weekly. Bump check all parameters daily and re-calibrate if values are out of tolerance.



Rae Systems MiniRAE 3000 PID Log
Serial # 592-915579 (WH0006)

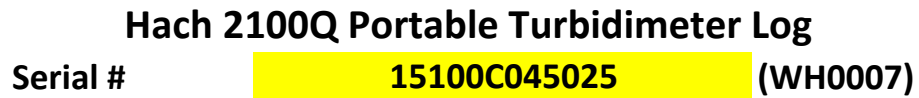
Year: 2016

Project: Kirtland AFB BFF ST-106/SS-111

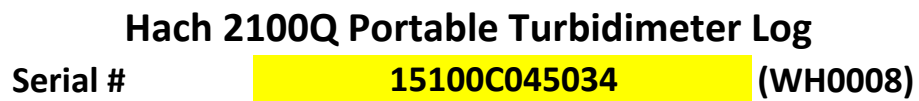
Quarter : 3rd

Date	Cal or Bump	0 ppm	100 ppm	Initials
Calibration Tolerances:		+/- 3% of standard value		N/A

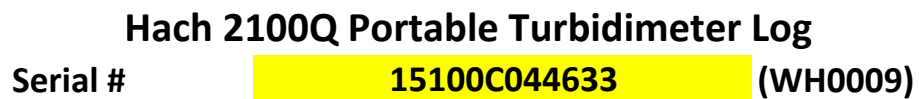
* Calibrate all parameters weekly. Bump check all parameters daily and re-calibrate if values are out of tolerance.

Project: Kirtland AFB BFF ST-106/SS-111[illegible]

*Calibrate Instrument every three months, bump check weekly and re-calibrate if values are out of tolerance.

Project: Kirtland AFB BFF ST-106/SS-111[illegible]

*Calibrate Instrument every three months, bump check weekly and re-calibrate if values are out of tolerance.



Quarter : 3rd

*Calibrate Instrument every three months, bump check weekly and re-calibrate if values are out of tolerance.



QRAE II Multi-Gas Detector Log

Serial #

181-217279

(WH0027)

Year: 2016

Project: Kirtland AFB BFF ST-106/SS-111

Quarter : 3rd

Date	Test	O ₂ (18%)	CH ₄ (2.5% [50% LEL])	H ₂ S (10 ppm)	CO (50 ppm)	Initials

Test: Mark if calibration or bump test was performed.



Refrigerator Temperature Log


Year: 2016

Project: Kirtland AFB BFF ST-106/SS-111

Quarter : 3rd

Date/Time	Temperature 1 (Internal 1)	Temperature 2 (Internal 2)	Date/Time	Temperature 1 (Internal 1)	Temperature 2 (Internal 2)

Test: Mark if calibration or bump test was performed.

 <div>225 Schilling Circle Suite 400 Hunt Valley MD Tel No: (410) 584-7000 Fax No: (410) 771-1625</div>		CHAIN-OF-CUSTODY RECORD										COC NUMBER			
PROJECT NAME: Kirtland AFB Bulk Fuels Facility		PROJECT NUMBER: 62599DM01		LABORATORY NAME AND CONTACT: Eurofins Lancaster Laboratories 2425 New Holland Pike Lancaster PA 17601				FAX AND MAIL REPORTS/EDD TO: Tara Lamond: tlamond@eaest.com EA				YEAR:			
								Amanda Smith: asmith@eaest.com EA							
								FAX AND MAIL REPORTS/EDD TO: Pam Moss: pmoss@eaest.com EA				QUARTER:			
PROJECT SITE AND PHASE: ST106/SS110				LAB PO NUMBER: 14800				LAB CONTACT: Kay Hower KayHower@eurofinsUS.com Eurofins 1 (717) 556-7258							
				ANALYSIS REQUIRED (Specify number of bottles)										COMMENTS	
ITEM	SAMPLE IDENTIFIER	DATE COLLECTED	TIME COLLECTED	Total Number of Bottles	VOCs (8260C)	BTEX (8260C)	BTEXN (8260C)	EDB (8011)	Total As,Pb,Ca,K,Na,Mg (6020A/6010C)	Dissolved Fe, Mn (6010C)	Chloride, bromide, sulfate (300.0)	Nitrate-Nitrite (353.2)	Alkalinity (SM2320B)		
1										*					
2															
3															
4															
5															
6															
COMMENTS: *Dissolved Fe, Mn aliquot was field filtered.															
SAMPLER(S):															
COURIER AND SHIPPING NUMBER:															
RELINQUISHED BY:				DATE	TIME	RECEIVED BY:				DATE	TIME				
Printed Name and Signature:						Printed Name and Signature:									
Printed Name and Signature:						Printed Name and Signature:									
Printed Name and Signature:						Printed Name and Signature:									
Printed Name and Signature:						Printed Name and Signature:									



SAMPLE COOLER

SHIPPING CHECKLIST

Site Name: Kirtland BFF (62599DM01)

Date: _____

Fedex Tracking Number: _____

Matrix: Groundwater

Lab: Eurofins (Lancaster, PA)

Cooler Sealed: _____ (Time)

Delivered to FedEx: _____ (Time)

Sampler 1 (Initials)

Sampler 2 (Initials)

☐

Two (2) Plastic Bag Liners Included

☐☐

Temperature Blank Included at Bottom of Cooler Surrounded by Ice

☐☐

Trip Blank Included (2 for EDB, 2 for BTEX if present)

☐☐

Samples Checked Against Chain of Custody

☐☐

Chain of Custody Originals Included

☐☐

All Void Space in Cooler filled with Ice

☐☐

Custody Seals On Plastic Bag Liner And Outside Of Cooler

☐

(Print)Name: _____

(Print)Name: _____

Signature: _____

Signature: _____

Date/Time: _____

Date/Time: _____

COC's in Cooler:

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