DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 49TH WING (ACC)
HOLLOMAN AIR FORCE BASE, NEW MEXICO

RECEIVED
JAN -2 2014
NMED
Hazardous Waste Bureau

DeAnna Rothhaupt
Chief, Holloman AFB Environmental
550 Tabosa Avenue
Holloman AFB, NM 88330

23 Dec 13

New Mexico Environment Department
Attn: Mr. John Kieling
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

Dear Mr. Kieling

Attached are the Draft Final Work Plan, Draft Final Health and Safety Plan, Draft Final Quality Assurance Project Plan, and Draft Final Field Sampling Plan for the Holloman AFB RCRA Facility Closure of the Hazardous Waste Container Storage Unit, SWMU #75. All of the documents are dated 23 Dec 13.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

If you have any questions, please contact me at (575) 572-3931 or by e-mail at deanna.rothhaupt@holloman.af.mil.

Sincerely

DEANNA ROTHHAUPT, GS-12, DAFC

Attachments:

1) Draft Final Work Plan for RCRA Facility Closure, Hazardous Waste Container Storage Unit, SWMU #75.

2) Draft Final Health and Safety Plan for RCRA Facility Closure, Hazardous Waste Container Storage Unit, SWMU #75.

3) Draft Final Quality Assurance Project Plan for RCRA Facility Closure, Hazardous Waste Container Storage, SWMU #75.

4) Draft Final Field Sampling Plan for RCRA Facility Closure, Hazardous Waste Container Storage Unit, SWMU #75.

cc:

(w/Atch)	(w/o Atch)	(w/CD)
Mr. David Strasser	Mr. Will Moats	Mr. Chuck Hendrickson
Hazardous Waste Bureau	Hazardous Waste Bureau	USEPA, Region 6 (6PD-F)
5500 San Antonio Dr, NE	5500 San Antonio Dr, NE	1445 Ross Ave, Ste 1200
Albuquerque NM 87109-4127	Albuquerque NM 87109-4127	Dallas TX 75202-2750

DRAFT FINAL

WORK PLAN

FOR

RCRA FACILITY CLOSURE
HAZARDOUS WASTE CONTAINER STORAGE UNIT FACILITY
(SWMU #75)
HOLLOMAN AFB, NEW MEXICO

Prepared For

Air Force Civil Engineer Center (AFCEC)
and
Holloman Air Force Base

Prepared By

112 East Pecan Street, Suite #400
San Antonio, Texas 78205

Contract Number: FA8903-08-D-8770
Task Order: 0281
Project: 80001Y0000

December 2013

DRAFT FINAL

WORK PLAN

FOR

RCRA FACILITY CLOSURE
HAZARDOUS WASTE CONTAINER STORAGE UNIT FACILITY
(SWMU #75)
HOLLOMAN AFB, NEW MEXICO

Prepared For

Air Force Civil Engineer Center (AFCEC)
and
Holloman Air Force Base

Prepared By

AECOM
112 East Pecan Street, Suite #400
San Antonio, Texas 78205

Contract Number: FA8903-08-D-8770
Task Order: 0281
Project: 80001Y0000

December 2013

TABLE OF CONTENTS

Section **Page No.**

1 INTRODUCTION 1-1
1.1 PROJECT BACKGROUND 1-1
1.2 PURPOSE AND SCOPE 1-1

2 PROJECT ORGANIZATION 2-1
2.1 PROJECT TEAM 2-1
2.2 SUBCONTRACTORS 2-1
2.2.1 Laboratory 2-2
2.2.2 Investigation Derived Waste Transportation and Disposal 2-2
2.2.3 Field Technical Support and Labor 2-2

3 SITE LOCATION AND HISTORY 3-1
3.1 HOLLOMAN AFB LOCATION AND DESCRIPTION 3-1
3.2 SITE LOCATION AND DESCRIPTION 3-1
3.3 SITE HISTORY 3-1
3.3.1 Major Waste Categories 3-1
3.4 PREVIOUS INVESTIGATIONS 3-2

4 SCOPE OF WORK 4-1
4.1 PROJECT MANAGEMENT, PLANNING AND REPORTING 4-1
4.1.1 Project Planning Documents 4-2
4.2 SUBCONTRACTOR MANAGEMENT 4-3
4.2.1 Management of the Analytical Laboratory 4-3
4.2.2 Management of IDW Transport/Disposal Subcontractor 4-4
4.2.3 Management of Technical Field Labor Subcontractor 4-4
4.3 PRELIMINARY ASSESSMENT/SITE INSPECTION 4-4
4.4 FIELD ACTIVITIES 4-4
4.4.1 Facility Decontamination 4-4
4.4.2 Decontamination Water Collection, Analysis and Disposal 4-5
4.4.3 Soil Assessment 4-6
4.5 PROJECT REPORTING 4-6
4.5.1 Technical Report 4-6
4.5.2 Laboratory Data Packages 4-6
4.5.3 Certification of Clean Closure 4-7

5 PROJECT SCHEDULE 5-1

6 REFERENCES 6-1

LIST OF FIGURES

Figure 1-1: Holloman AFB Map
Figure 1-2: Site Location and Vicinity Map
Figure 1-3: CSU Map
Figure 2-1: Organization Chart
Figure 4-1: Soil Sampling Location Map
Figure 5-1: Project Schedule

LIST OF TABLES

Table 2-1: Project Contact list
Table 3-1: NMED vs Background Soil Screening Levels

LIST OF ATTACHMENTS

ATTACHMENT A: Statement of Work
ATTACHMENT B: Site Inspection Photograph Log

ACRONYMS AND ABBREVIATIONS

AECOM	AECOM Technical Services, Inc.
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
bgs	below ground surface
CDUT	Contractor Data Upload Tool
CO	Contracting Officer
COR	Contracting Officer's Representative
CSU	container storage unit
DLA	Defense Logistics Agency
DQO	data quality objective
ft^2	square feet
FSP	Field Sampling Plan
GCAL	Gulf Coast Analytical Laboratory
GEITA	Global Engineering, Integration, And Technical Assistance
HASP	Health And Safety Plan
IDQTF	Intergovernmental Data Quality Task Force
IDW	investigation derived waste
NMED	New Mexico Environment Department
PCB	polychlorinated biphenyl
POC	point of contact
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RCRA	Resource Conservation And Recovery Act
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
SOW	Statement of Work
TSCA	Toxic Substances Control Act
UFP	Uniform Federal Policy
DoD	U.S. Department of Defense
U.S.	United States
USEPA	U.S. Environmental Protection Agency
WP	Work Plan

1 INTRODUCTION

This Work Plan (WP) provides the scope of work, schedule, field methods and procedures that will be used during the Resource Conservation and Recovery Act (RCRA) Facility Closure of a hazardous waste container storage unit (CSU) (SWMU #75) located at Holloman Air Force Base (AFB), New Mexico (See Figure 1-1 and Figure 1-2). The CSU Facility consists of an indoor covered building (Building 118), a staging area, and an outdoor covered area (See Figure 1-3).

The work is being performed by AECOM Technical Services, Inc. (AECOM) for the Air Force Civil Engineer Center (AFCEC), Department of the Air Force/772 Enterprise Sourcing Squadron/PKA under 4PAE08 Contract Number FA8903-08-D-8770, Task Order 0281, Project 80001Y0000.

1.1 PROJECT BACKGROUND

The Statement of Work (SOW) (See Attachment A), defines the requirements for closure of the CSU permitted by the State of New Mexico Environment Department (NMED) under the New Mexico Hazardous Waste Act and RCRA, Subtitle C. The CSU Facility at Holloman AFB operates under Permit Number NM6572124422-2 dated 24 February 2004 to accept, manage and store on-base generated hazardous waste before transfer to a permitted treatment or disposal facility. AECOM has been contracted by the AFCEC to perform clean closure of the CSU Facility in accordance with performance standards established in the approved Closure Plan (See Appendix A within Attachment A) consistent with applicable federal, state, and local laws and regulations, as well as Air Force and Defense Logistics Agency (DLA) requirements.

1.2 PURPOSE AND SCOPE

The primary objective of this project is to obtain clean closure of the CSU Facility at Holloman AFB, New Mexico. AECOM shall support clean closure the CSU Facility in accordance with NMED requirements identified in the Closure Plan (See Appendix A within Attachment A) for the Holloman AFB CSU Facility.

Facility closure activities will meet the following performance standards:

- Protect human health and the environment
- Decontaminate CSU structures, equipment, and related items using trained personnel wearing appropriate personal protective equipment as required by 40 CFR 1910.120, Appendix B
- Conduct soil sampling to demonstrate achievement of clean closure standards thus eliminating the need for future maintenance/monitoring
- Achieve closure criteria for rinsate and soil specified under 20.4.1.500 NMAC, incorporating 40 CFR §264, Appendix IX
- Develop closure report and coordinate approval in coordination with Holloman AFB Defense Re-utilization and Marketing Office, Defense Re-utilization and Marketing Service/Battle Creek, Holloman AFB Civil Engineering Squadron/Environmental Flight, Holloman AFB Bio-environmental Engineering Office, NMED, and AFCEC

AECOM will successfully complete the work in a timely manner, while satisfying client and regulatory concerns, sampling protocol requirements, quality assurance requirements, health and safety protocols, and guidelines established within this WP.

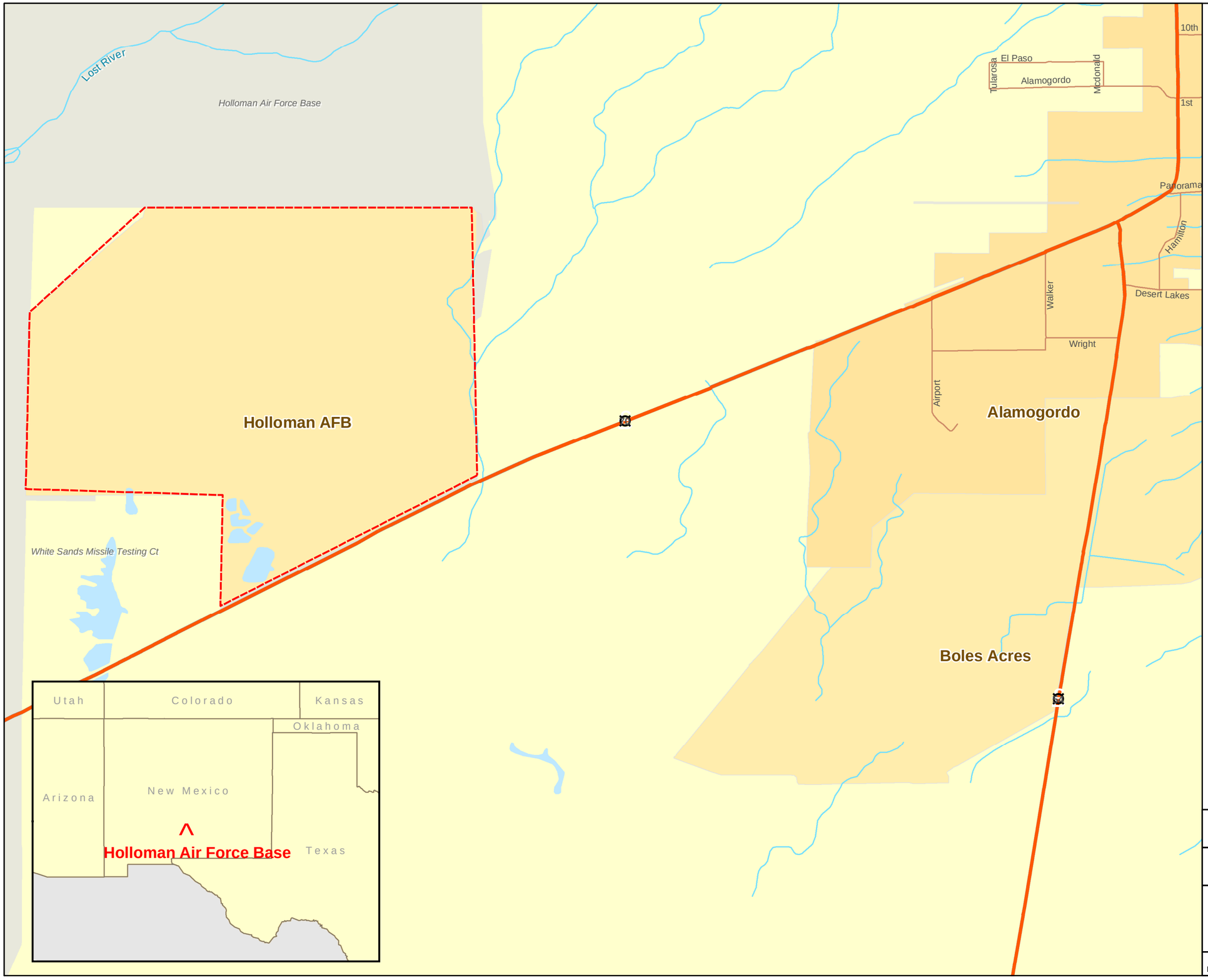
The final closure will be completed in compliance with the applicable portions of the following plans and regulations:

- The SOW for RCRA Facility Closure of the Hazardous Waste Container Storage Unit Facility, Holloman AFB, NM (Contract FA8903-08-D-8770, Task Order No. 0281), dated 22 May 2013 (Attachment A);
- RCRA Hazardous Waste Permit Number NM6572124422-2 dated 24 February 2004;
- The Facility Closure Plan (Appendix A in Attachment A);
- United States (U.S.) Environmental Protection Agency (USEPA) Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (EPA publication SW-846 Update 3, 1997);
- NMDEQ Waste Regulations (HW-1);
- Sampling and Analysis Plan (SAP), which includes the Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP);
- Verification of polychlorinated biphenyls (PCB) Spill Cleanup by Sampling and Analysis, EPA 560/5-85-026 (USEPA, 1985);
- Cleanup goals for demonstrating clean closure:
    - NMED Hazardous Waste Bureau and Ground Water Quality Bureau Voluntary Remediation Program, Technical Background Document For Development of Soil Screening Levels, Revision 4.0 (NMED, 2006);
    - PCB Site Revitalization Guidance Under the Toxic Substance Control Act (TSCA) (USEPA, 2005);
    - USEPA Hazardous Waste Regulations (40 CFR 260-299); and
- Health and Safety Plan (HASP).

The fieldwork will consist of four main tasks:

- Facility decontamination (including storage racks and secondary containment structures)
- Collection of wash and rinse waste, assessment and disposal
- Soil assessment
- PCB Assessment

The planned activities to successfully complete the SOW are outlined in Section 4 of this WP.



Legend

Holloman AFB

Miles

0 0.5 1 2

U.S. AIR FORCE

RCRA Facility Closure

Holloman Air Force Base

AECOM

AECOM Technical Services, Inc.
112 East Pecan, Suite 400
San Antonio, TX 78205
www.aecom.com
TBPE Reg. No. F-3580

Date	September 2013	Project	60304917	Figure	1-1

Legend

- CSULocation
- Sanitary Sewer Junction Point
- HollomanAFB

Feet
0 100 200 400

U.S. AIR FORCE

RCRA Facility Closure

Site Location and Vicinity map

AECOM

AECOM Technical Services, Inc.
112 East Pecan, Suite 400
San Antonio, TX 78205
www.aecom.com
TBPE Reg. No. F-3580

Date	Project	Figure
September 2013	60304917	1-2

Legend

CSU Location

Holloman AFB

Feet

0 25 50 100

U.S. AIR FORCE

RCRA Facility Closure

CSU Map

AECOM

AECOM Technical Services, Inc.
112 East Pecan, Suite 400
San Antonio, TX 78205
www.aecom.com
TBPE Reg. No. F-3580

Date	Project	Figure
September 2013	60304917	1-3

2 PROJECT ORGANIZATION

2.1 PROJECT TEAM

AECOM will provide a team of professionals to complete this scope of work. The anticipated team and their responsibilities, along with client and other stakeholder contacts are listed in Table 2-1. The project management team and lines of authority are presented in the Organization Chart shown in Figure 2-1.

Table 2-1: Project Contact list

Position	Name	Phone Number	email
Engineering and Environmental Services POC, DLA Installation Support Battle Creek, MI	Ronald Scherer	(269) 961-5911	Ron.Scherer@dla.mil
Contracting Officer 772 ESS/PKA	Greg Santiago	(210)395-8052	gregory.santiago.2@us.af.mil
AFCEC Project Manager/COR	Kent Rohlof	(210) 395-8665	kent.rohlof@us.af.mil
AFCEC Alternate COR	John Hill	(210) 395-8662	john.hill.3@us.af.mil
AFCEC GEITA Support	Malini Lyman	(210) 395-8661	Malini.lyman.1.ctr@us.af.mil
DLA, Holloman CSU Facility POC	Mark Phillips	(575) 572-7860	Mark.Phillips@dla.mil
Hazardous Waste Manager USAF ACC 49 CES/CEAN Holloman AFB, NM	John Hamann	(575) 572-6655	John.Hamann@holloman.af.mil
AECOM Program Manager	Judy Gallagher	(703) 706-0555	judy.gallagher@aecom.com
AECOM Project Manager	Josh Miller	(210) 253-7517 (Work) (972) 922-9974 (Cell)	josh.miller@aecom.com
AECOM Professional Engineer	Charles Moyers	(508) 889-4309	charles.moyers@aecom.com
AECOM Field Team Leader/HSO	Raymond Castillo	(210) 253-7520 (Work) (210) 724-3118 (Cell)	raymond.castillo2@aecom.com

Notes:

AECOM AECOM Technical Services, Inc.
AFCEC Air Force Civil Engineer Center
COR Contracting Officer's Representative
DLA Defense Logistics Agency
GEITA Global Engineering, Integration, and Technical Assistance
HSO Health and Safety Officer
POC point of contact

2.2 SUBCONTRACTORS

AECOM will use subcontractors for laboratory services, off-site disposal of investigation and decontamination derived materials, and field technical support and labor. The following sections provide subcontractor details.

2.2.1 Laboratory

Gulf Coast Analytical Laboratory (GCAL) will perform soil, wipe and wash/rinsate water sample laboratory analysis. The point of contact (POC) for GCAL is Ms. Kimberly Drag. The contact information for Ms. Drag and GCAL are listed below.

Laboratory samples will be submitted to the GCAL under chain-of-custody. The AECOM POC on the chain-of-custody is Mrs. Linda Raabe. The contact information for Mrs. Raabe is listed below.

Kimberly Drag
Gulf Coast Analytical Laboratory
7979 GSRI Avenue
Baton Rouge, Louisiana 70820
Telephone: 225-769-4900
Cell: 704-607-7735
Fax: 225-769-5717
kimberly.drag@gcal.com

Linda Raabe
AECOM Technical Services, Inc.
112 East Pecan Street
Suite 400
San Antonio, Texas 78205
Telephone: 210-296-2000
Fax: 210-296-2025
linda.raabe@aecom.com

2.2.2 Investigation Derived Waste Transportation and Disposal

Capitol Environmental Services Inc. will perform an evaluation of IDW water and soil sampling results to determine the proper classification of materials and to designate the appropriate receiver facility. The POC contact information for Capital Environmental Services Inc. is listed below.

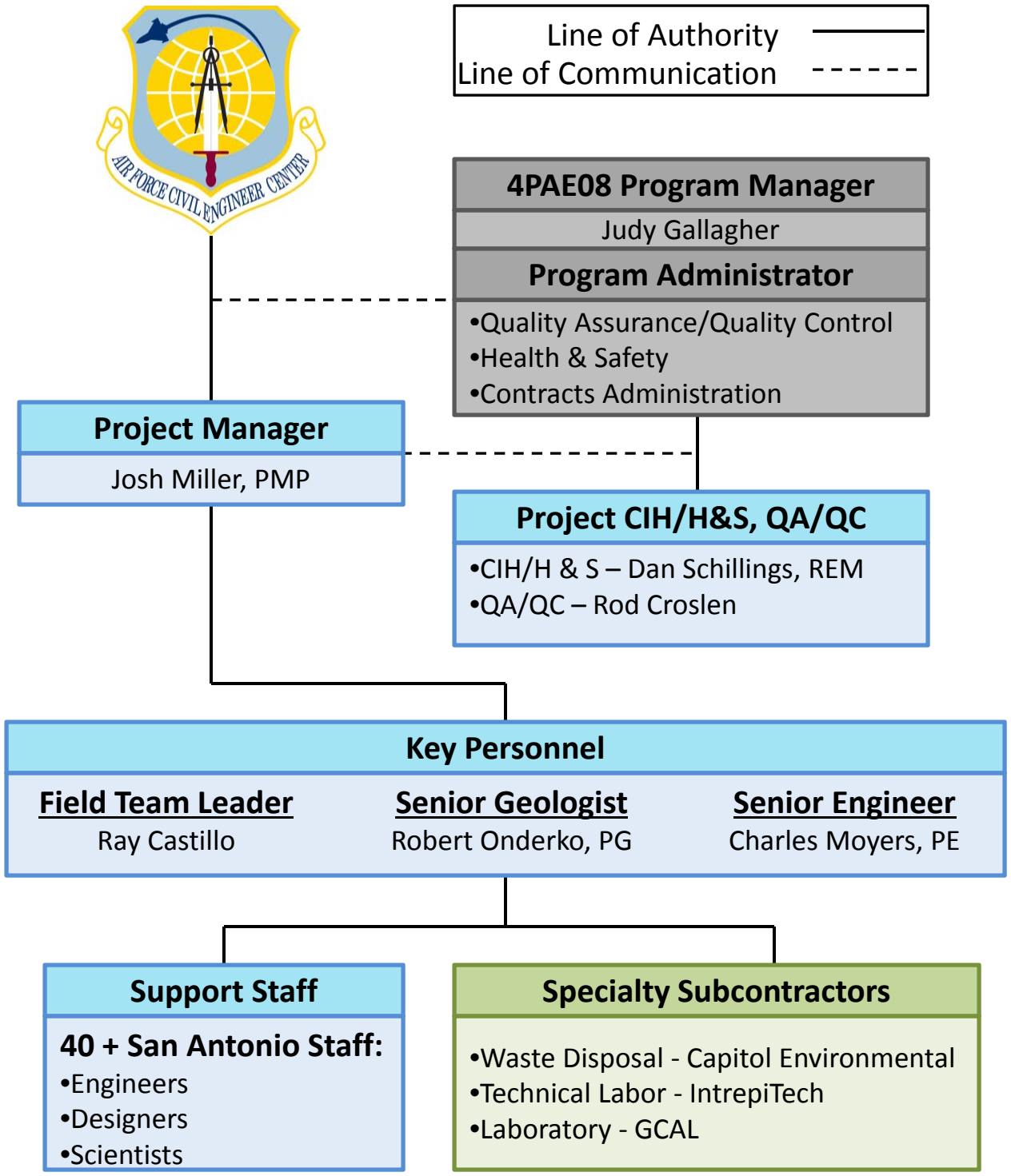
Susan M. Schult
Capitol Environmental Services, Inc.
Telephone: 301-218-6607
Cell: 703-407-2402
Fax: 301-850-4964
sschult@capitolenv.com

2.2.3 Field Technical Support and Labor

IntrepiTech Environmental, LLC. will provide mid-level technical field labor, to support AECOM during all field activities. The POC contact information for IntrepiTech Environmental, LLC. is listed below.

Joseph Cruz
IntrepiTech Environmental, LLC.
Cell: 210-362-8530
joseph.cruz@intrepitech.com

Figure 2-1: Organization Chart
AFCEC / AECOM



3 SITE LOCATION AND HISTORY

This section presents the locations and descriptions of Holloman AFB and the CSU Facility, site history, physiographic setting, and previous investigations.

3.1 HOLLOMAN AFB LOCATION AND DESCRIPTION

Holloman AFB is located on approximately 59,827 acres of land about seven miles west of the City of Alamogordo in Otero County in south central New Mexico (See Figure 1-1). Base activities necessitated the use of a variety of products to maintain and repair aircraft and aerospace ground equipment, as well as base structures and roads. The use of these products results in the potential for generating wastes classified as hazardous waste under RCRA due to exhibiting characteristics of ignitability, corrosivity, reactivity or toxicity, or conformance to the definition of listed waste under 40 CFR Part 261 Subpart D.

3.2 SITE LOCATION AND DESCRIPTION

The CSU Facility is located on the east side of the base, approximately 1,400 feet inside the eastern base boundary on roughly 400,000 square feet (ft^2) of land designated for use by the DLA Disposition Service, a Holloman AFB tenant. The CSU Facility consists of an indoor covered building (Building 118) covering approximately 2,000 ft^2, a staging area covering approximately 1,200 ft^2, and an outdoor covered area occupying approximately 5,000 ft^2.

The majority of the surface of the site area is covered by asphalt or concrete. The area to the southwest of the CSU is covered by native soils, with little to no vegetation present. The site is overall relatively flat, and storm water in the area of the CSU flows to a storm water drain to the northeast of the site.

3.3 SITE HISTORY

The CSU Facility operated under permit number NM6572124422-2 dated 24 February, 2004. The permit allowed for the storage of hazardous waste in as many as 788 55-gallon drums or equivalent (43,340 gallons), including Toxic Substances Control Act (TSCA) regulated materials, wastes, and equipment containing PCBs. Presently, the facility no longer accepts hazardous waste, and all stored hazardous waste containers and hazardous materials including PCB containing equipment, materials and wastes have been removed from all areas of the CSU Facility.

3.3.1 Major Waste Categories

Major waste categories and parameters of concern for the CSU Facility are provided in Appendix A, Table Ci-1 of the SOW (See Attachment A). A summary of the different types of wastes handled at the facility are listed below:

- Waste paint, thinner, solvents and alodine
- Respirator and booth filter elements
- Fuel filters and absorbent
- Parts cleaning sludge
- Expired or off-specification medical waste
- Spent fluorescent bulbs and batteries

3.4 PREVIOUS INVESTIGATIONS

A base wide background study was conducted at the CSU in 2005 (Bhate, 2005). The background study was performed to establish naturally occurring levels of metals surrounding the CSU in areas not impacted by historic waste management practices. The establishment of the baseline will assist in characterizing the current soil conditions at the CSU and its proximity and the baseline data will be used for reference during closure of the CSU.

During the 2005 investigation, composite subsurface soil samples were obtained from depths of 0.5 to 2 feet below ground surface (bgs) at seven locations adjacent to Buildings 117 and 118. The soil samples were analyzed for metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver).

Table 3-1 compares NMED Soil Screening Level (NMED, 2006) constituents to the highest recorded analysis of each of the eight metals recorded in the basewide background study (Bhate, 2005).

Table 3-1: NMED vs Background Soil Screening Levels

Analyte	Industrial/Occupational NMED Soil Screening Levels (mg/kg)	Bhate Background Study Analysis (mg/kg)
Arsenic	17.7	5.21
Barium	100,000	87.4
Cadmium	564	0.519
Chromium	NA	6.96
Lead	800	14
Mercury	100,000	0.015
Selenium	5,680	-1.2
Silver	5,680	1.36

4 SCOPE OF WORK

AECOM shall close the CSU Facility in accordance with NMED requirements identified in the Closure Plan provided in Appendix A of the SOW (See Attachment A) for the Holloman AFB CSU Facility. Performance standards for RCRA facility closures include:

- Protection of human health and the environment;
- Removal of hazardous waste and hazardous waste residues;
- Decontamination of CSU structures, equipment and related items, and;
- Eliminate the need for future maintenance or monitoring.

Work requirements shall include: development and approval of planning documents; dismantling of outdoor storage racks, and movement to the indoor facility; decontamination and rinsing of indoor and outdoor storage equipment; optional movement of storage racks back to the outdoor storage area after decontamination, to allow for better space management inside the indoor facility; decontamination and rinsing of indoor, outdoor and staging areas; sampling and analysis of affected media, waste liquids and material generated from closure activities; PCB wipe sampling; investigation derived waste (IDW) handling and disposal; and certification of clean closure by a Professional Engineer certified in the State of New Mexico. Environmental remediation activities leading to CSU Facility closure shall be closely coordinated with appropriate Holloman AFB-environmental, DLA Disposition Service-Holloman AFB, DLA Installation Support-Battle Creek-Michigan, NMED, and AFCEC personnel.

The following activities will occur to successfully complete the project objectives.

4.1 PROJECT MANAGEMENT, PLANNING AND REPORTING

AECOM will plan project activities, including the development, implementation, and maintenance of project planning documents, project schedules, events, status of resources, reports on the activities, and progress toward accomplishing project objectives.

AECOM will send all deliverables and/or submittals, weekly status progress reports, Final Inspection Requests, and Contractor's posted website address to the Contracting Officer (CO), Contract Specialist, Contracting Officer’s Representative (COR), Base POC, and Global Engineering, Integration, and Technical Assistance (GEITA) support team representative in addition to the AFCEC/CFSN distribution email address (afcec.cfsd.1@us.af.mil). AECOM shall upload all deliverables/submittals to the AFCEC SharePoint using the Contractor Data Upload Tool (CDUT).

AECOM will attend and/or support meetings and teleconferences as required by the COR with the client and/or AFCEC, or GEITA representatives. The purpose of the meetings include, but are not limited to: contract discussions, progress reviews, project scoping, planning, design reviews, planning/programming charrette activities, project definition charrette activities, design charrette activities, construction reviews, project status, and the general exchange of information concerning current and future activities.

AECOM will assist with oral/written interaction with interested parties related to the project. Forums may include administrative proceedings, judicial proceedings, formal meetings, or informal meetings. Requirements include, but are not limited to: presentation materials, agendas, minutes, publications, news releases, public notices, and the maintenance of mailing lists. AECOM will also assist in project technical review, analysis, and discussions to integrate comments from interested parties on programs and related data and studies. AECOM will develop options for responses and prepare reports to communicate government priorities to regulatory agencies and other interested parties. AECOM will assist with the

review and interpretation of new statutory and regulatory requirements and make recommendations for government facility planning and policy integration as it applies to the assigned project.

4.1.1 Project Planning Documents

Development of project planning documents that are required under this Task Order include this WP; a Sampling and Analysis Plan (SAP), consisting of a Field Sampling Plan (FSP) and a Uniform Federal Policy (UFP) QAPP, and a Health and Safety Plan (HASP). All plans will comply with the specifications, procedures, and methodologies in the site/project specific plans. All documents will be reviewed and approved by base POCs, DLA Installation Support POC, NMED, and AFCEC and/or their representatives prior to implementation of the field program. The COR shall approve (in writing) any proposed modification to, or deviation from, any activity described in these documents, following approval by the CO.

4.1.1.1 Work Plan

AECOM has prepared this WP to comply with U.S. Department of Defense (DoD), Air Force, USEPA (epa.gov/quality), State, and local regulations regarding the proposed work effort. The WP shall adhere to project data quality objectives (DQOs) and performance objectives established in the RCRA permit and other applicable NMED regulations.

4.1.1.2 Environmental Sampling and Analysis Plan

The SAP will consist of a FSP and a QAPP, described below.

4.1.1.2.1 Field Sampling Plan

AECOM will prepare a FSP that outlines protocols for all activities planned during the field investigation. The FSP will include procedures for all field activities presented in Section 4.4 of this WP.

4.1.1.2.2 QAPP

The QAPP will describe the field investigation planned in conjunction with closure of the CSU Facility at Holloman AFB. The QAPP will provide quality assurance (QA), quality control (QC), and other technical activities that will ensure confidence in the quality of data generated from the field investigation.

The QAPP will be prepared in accordance with the requirements of the following documents:

- Intergovernmental Data Quality Task Force (IDQTF) *UFP-QAPPs; Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs, Part 1: UFP-QAPP Manual* (IDQTF, March 2005a), USEPA publication number EPA-505-B-04-900A or DoD publication number DTIC ADA 427785;
- IDQTF Workbooks for *UFP-QAPPs, Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs, Part 2A: UFP-QAPP Workbook* (IDQTF, March 2005b), USEPA publication number EPA-505-B-04-900C or DoD publication number DTIC ADA 427486;
- IDQTF, *UFP-QAPPs, Part 2B: Quality Assurance/Quality Control Compendium: Minimum QA/QC Activities* (IDQTF, March 2005c), EPA publication number *EPA-505-B-04-900B* or DoD publication number *DTIC ADA 426957;* and

- DoD Quality Systems Manual (QSM) for Environmental Laboratories, Version 4.0 (DoD, June 2003).

The QAPP will include at a minimum, the following elements:

- Project description;
- Conceptual Site Model (CSM);
- Problem Statement(s);
- Project DQOs;
- Measurement performance criteria;
- Summary of project tasks;
- Project schedule;
- Sampling design and rationale;
- Field sampling Standard Operating Procedures (SOPs);
- Laboratory analytical and QA/QC SOPs;
- Sample collection, handling and custody SOPs;
- Data usability assessment procedures; and
- Comparison of laboratory method detection limits, project reporting limits, and NMED screening levels/residential and industrial cleanup goals or clean closure performance standards.

4.1.1.3 Health and Safety Plan

AECOM will prepare a HASP to comply with Air Force, Occupational Safety and Health Administration, USEPA, State, and local health and safety regulations regarding the proposed work effort. The HASP will utilize to the fullest extent possible any existing related HASP, tailored specifically to the current effort and will follow USEPA guidelines for designating the appropriate levels of protection needed at the study site as applicable. AECOM will maintain a written certification that the approved HASP has been reviewed by all personnel that work at the project site prior to their beginning work.

4.2 SUBCONTRACTOR MANAGEMENT

AECOM will manage subcontractors to ensure all activities are conducted in accordance with project specific guidelines. Subcontractors will include an off-site analytical laboratory, an IDW transport/disposal company, and a provider for technical support field personnel. See Section 2.2 for subcontractor detail.

4.2.1 Management of the Analytical Laboratory

AECOM will use GCAL, which is a laboratory that complies with the requirements of the current version of the DoD QSM (website: http://www.navylabs.navy.mil/). GCAL also has analytical capabilities sufficient for the methods specified in the QAPP and adequate throughput capacity to handle the project's analytical workload during all field activities. AECOM will ensure that GCAL meets all state and federal requirements including state and federal certification/accreditation programs where appropriate. AECOM will administer a proficiency testing program, verify and validate data, and perform corrective actions in accordance with the project QAPP and the 4PAE Contract Guidance and Resource List.

AECOM will also verify that all hard copy and electronic data deliverables supplied by GCAL are complete and adequate to support the quality and usability of the data. Raw data packages shall be submitted to AFCEC upon request. Data packages shall include all information required to re-create the analysis, including correspondence with the laboratory regarding QA/QC exceedances and documentation of corrective actions.

4.2.2 Management of IDW Transport/Disposal Subcontractor

AECOM will use Capitol Environmental Services, Inc as an IDW subcontractor to properly transport and dispose of decontamination/rinsate water that cannot be disposed of on-site. AECOM will verify the subcontractor is licensed to transport and dispose of all wastes generated under Department of Transportation, State of New Mexico and USEPA guidelines. AECOM will also provide AFCEC all applicable waste manifests and lading documents associated with the waste disposal.

4.2.3 Management of Technical Field Labor Subcontractor

AECOM will use IntrepiTech Environmental, LLC. as a technical field labor subcontractor that will provide assistance to AECOM during all field activities. All subcontracted labor personnel will have proper training and certifications, wear appropriate personal protective equipment, adhere to all AECOM Field Team Leader direction, and all approved AECOM project planning documentation.

4.3 PRELIMINARY ASSESSMENT/SITE INSPECTION

AECOM has conducted a site visit and Base POC interview on August 19, 2013 as part of the planning process leading to the development of this WP and other planning documents. The site visit was coordinated through the Base POC and included a visual inspection of the CSU facility, photo documentation of the site and identification of potential issues to be addressed during preparation of the task planning documents. A Site Inspection Photograph Log is included in Attachment B.

4.4 FIELD ACTIVITIES

Field activities planned to achieve the objectives of this task order are described in the following paragraphs. SOPs for the planned field activities are presented in the SAP.

4.4.1 Facility Decontamination

The primary scope of work includes the decontamination of the CSU Facility (See Figure 1-3). The decontamination process, as described below in Section 4.4.1.1, will be performed on all material storage handling equipment, the outdoor storage facility and the indoor storage facility. Every effort will be made to minimize the quantity of wastewater generated during the facility decontamination process.

4.4.1.1 Storage and Handling Equipment Decontamination.

Storage racks from the outdoor facility will be dismantled and taken into Building 118 for decontamination. Outdoor and indoor storage area curbs, pad basins and secondary containment structures, and storage and handling equipment will be decontaminated by the following four-step process:

- An initial wash using a non-phosphate surfactant (Hotsy Breakthrough®) will be applied using a high pressure steam cleaner. Inspection will take place, and all surfaces requiring more intensive

cleaning, will be scrubbed with cleaning brushes. The cleaning procedure will be repeated until a satisfactory result can be reached.

- The detergent will then be removed using a steam pressure washer. The surfaces will be rinsed until the rinse water has no visible signs of dirt or detergent.
- After completion of the initial wash and first rinse, a second rinse using hot water or steam will be applied.
- A third rinse using cold water will then be applied.

During the decontamination process, the water generated from the initial wash, the first rinse, the second rinse, and the third rinse will be collected and segregated as outlined in Section 4.4.2.

4.4.1.2 PCB Bay Decontamination and Segregation

In order to define the extent of possible PCB contamination within the indoor facility, rinsate from Bay 11 and 12 (former PCB storage area) will be collected and segregated separately. To ensure Bay 11 and 12 rinsate is segregated and does not cross contaminate with other rinsate, the following controls will be implemented during the decontamination process:

- Pressure washing spray will be directed to ensure all rinsate is being pushed to the center of the Bays and to the sump. Upward spraying will be avoided to keep contamination from escaping over the Bay walls
- Personnel secondary to the pressure washer operator will use a wet operation capable vacuum or sump pump to catch any rinsate that may run out of the Bays on the floor
- If necessary, sandbags (or equivilant) will be placed on the floor as a cofferdam to ensure rinsate does not escape the Bays

4.4.1.3 PCB Wipe Sampling

Prior to the completion of the facility decontamination activities, wipe samples for PCB contamination will be collected from Bay 11 and 12 of the indoor storage facility. The sampling methodology for PCB wipe samples is the 7-point hexagonal grid technique delineated in the Verification of PCB Spill Cleanup by Sampling and Analysis, EPA 560/5-85-026 (USEPA, 1985). The containment sump will also be sampled using a single wipe taken along each wall and the sump bottom. Wipe samples will be collected following the four-step decontamination process. Wipe samples will be sent to the off-site laboratory for PCB analysis as outlined in the SAP.

4.4.2 Decontamination Water Collection, Analysis and Disposal

The rinsate from each of the four cleaning phases (initial wash and rinse; second, third, and final rinse) will be segregated and moved to four separate polyethylene tanks (labeled appropriately) for sampling, analysis and characterization using portable sump pumps and associated equipment. A composite sample will be collected from the rinsate from each of the tanks using a glass thief or composite liquid waste sampler (COLIWASA), for a total of four composite rinsate investigation derived waste (IDW) samples (See Table 3-1). The glass thief method provides a quick, relatively inexpensive means of collecting liquid wastes, while the COLIWASA permits the representative sampling of wastes having a wide range of viscosity, corrosivity, volatility, and solids content.

Rinsate samples will be analyzed for volatiles, semi-volatiles, herbicides, RCRA 8 metals, pesticides, PCBs, ignitability, and reactivity. The samples will then be handled as specified in Table 3-2 and Section

4. Rinsate not exceeding New Mexico Water Quality Control Commission (NMWQC) groundwater standards for contaminants per 20.6.2.3103 New Mexico Administrative Code and United States Environmental Protection Agency's (USEPA's) National Primary Drinking Water Standards maximum contamination level (MCL) criteria will be disposed of in a sanitary sewer adjacent to the outdoor storage facility (See Figure 1-2). Rinsate exceeding NMWQC and MCL criteria, but not exceeding TSCA/RCRA criteria will be disposed of off-site as non-hazardous waste by a subcontractor managed by AECOM, as outlined in the Work Plan (AECOM, 2013a). Rinsate exceeding TSCA/RCRA criteria will be disposed of off-site as hazardous waste by the subcontractor.

If the water from all four cleaning phases exceeds TSCA/RCRA criteria, facility decontamination (Section 4.4.1) will be repeated until effluent wash and rinse water meets TSCA/RCRA criteria. If the exceeded criterion involves PCBs, additional wipe samples shall be taken in the same fashion as outlined in Section 4.4.1.2. This procedure shall be repeated until the criteria are met in the rinsate and wipe samples.

4.4.3 Soil Assessment

A soil assessment of the area surrounding the CSU Facility will be performed using hand auger drilling method, as specified in the Permit Closure Plan, and detailed in the SAP. Surface and subsurface soil samples will be collected from up to 19 locations surrounding the CSU Facility (See Figure 4-1) using a hand auger. The soil boring will extend to a depth of three feet bgs. One surface soil sample, and three subsurface soil samples will be collected from one foot intervals at each sampling location. Each soil log shall be composited from the surface at one-foot intervals. Soil samples will be shipped to an off-site laboratory and analyzed for NMED Soil Screening Level (NMED, 2006) constituents as outlined in the QAPP, to include: PCBs, volatiles, semi-volatiles, pesticides, mercury, and ICP-MS Target Analyte List metals. Soil sampling, handling and analysis procedures are outlined in the SAP.

Coring of asphalt/concrete will be required at some soil boring locations. Coring will be achieved using a concrete core drill operated by AECOM personnel. The removed concrete cores will be place back into the removed location and sealed with concrete polymer patching, or the available equivalent. Locations where the asphalt was cored, asphalt patch material, or the available equivalent, will be used to backfill the cores and will be compacted using hand tools.

Excess soils generated during hand auguring will be placed back into each respective borehole in the reverse order in which they are generated; therefore, no soil IDW generation is anticipated.

4.5 PROJECT REPORTING

Project reporting will include a technical report, uploading of analytical data packages, and a certification of clean closure from a Professional Engineer certified by the State of New Mexico.

4.5.1 Technical Report

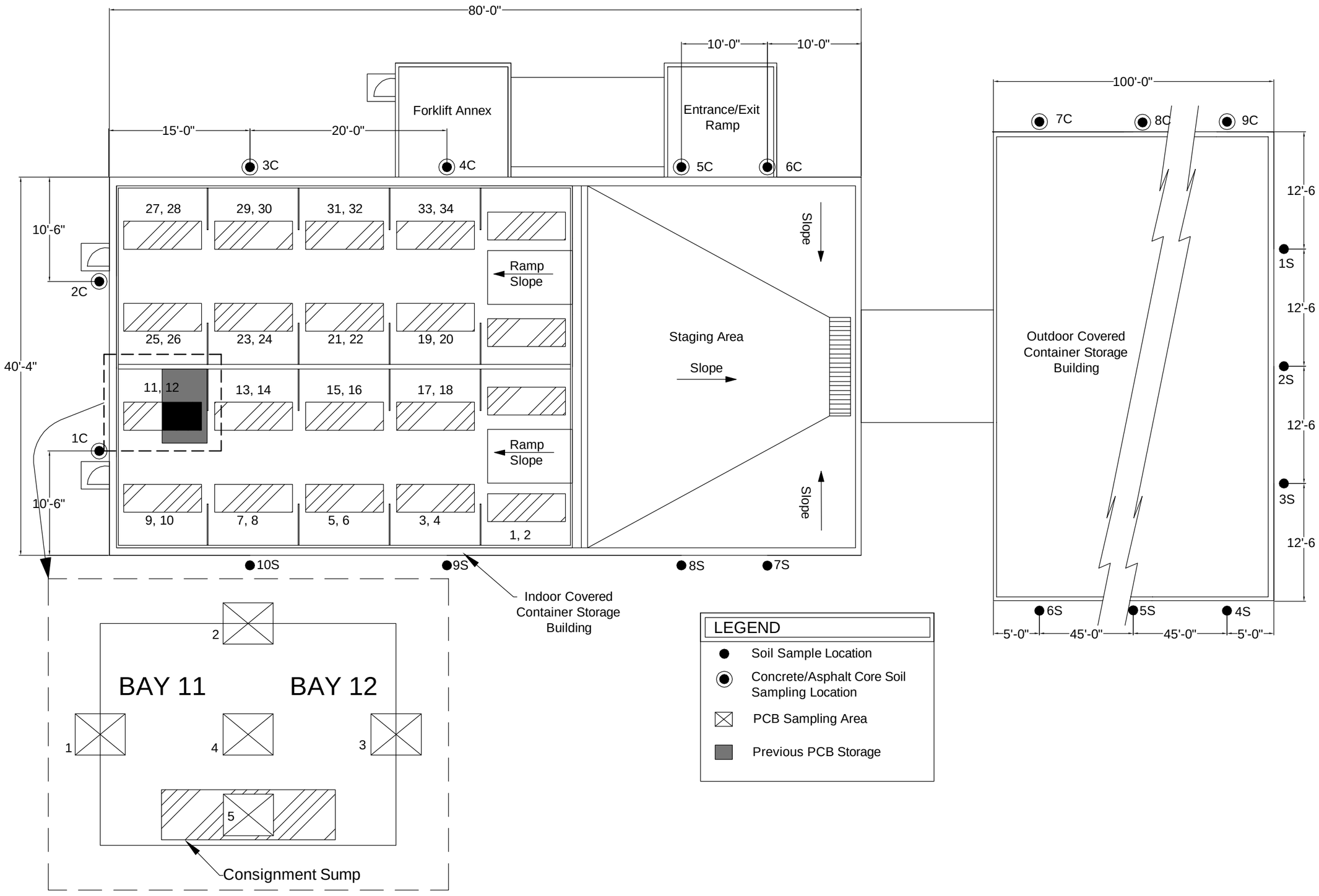
AECOM will prepare a technical report summarizing the field activities and results of the waste disposal, PCB sampling and soil sampling activities to allow for RCRA closure of the CSU Facility. AECOM will ensure that all hard copy and electronic data packages supplied by the subcontract laboratory have been uploaded to the CDUT SharePoint Site.

4.5.2 Laboratory Data Packages

AECOM will prepare data usability summary reports that will present the precision, accuracy, representativeness, comparibility, and completeness of the laboratory data and detail any laboratory excursions or quality control issues. The summary reports will be appended to the laboratory analytical results of the waste disposal, PCB sampling and soil sampling activities to support the RCRA closure of the CSU Facility.

4.5.3 Certification of Clean Closure

An AECOM Professional Engineer certified by the State of New Mexico will prepare a certification of clean closure for the CSU Facility.



AECOM

CSU Sampling Map

PROJECT NO:	60304917
FIGURE	4–1
DRAWN BY:	AECOM, Brittany Meloni
SCALE:	1:10

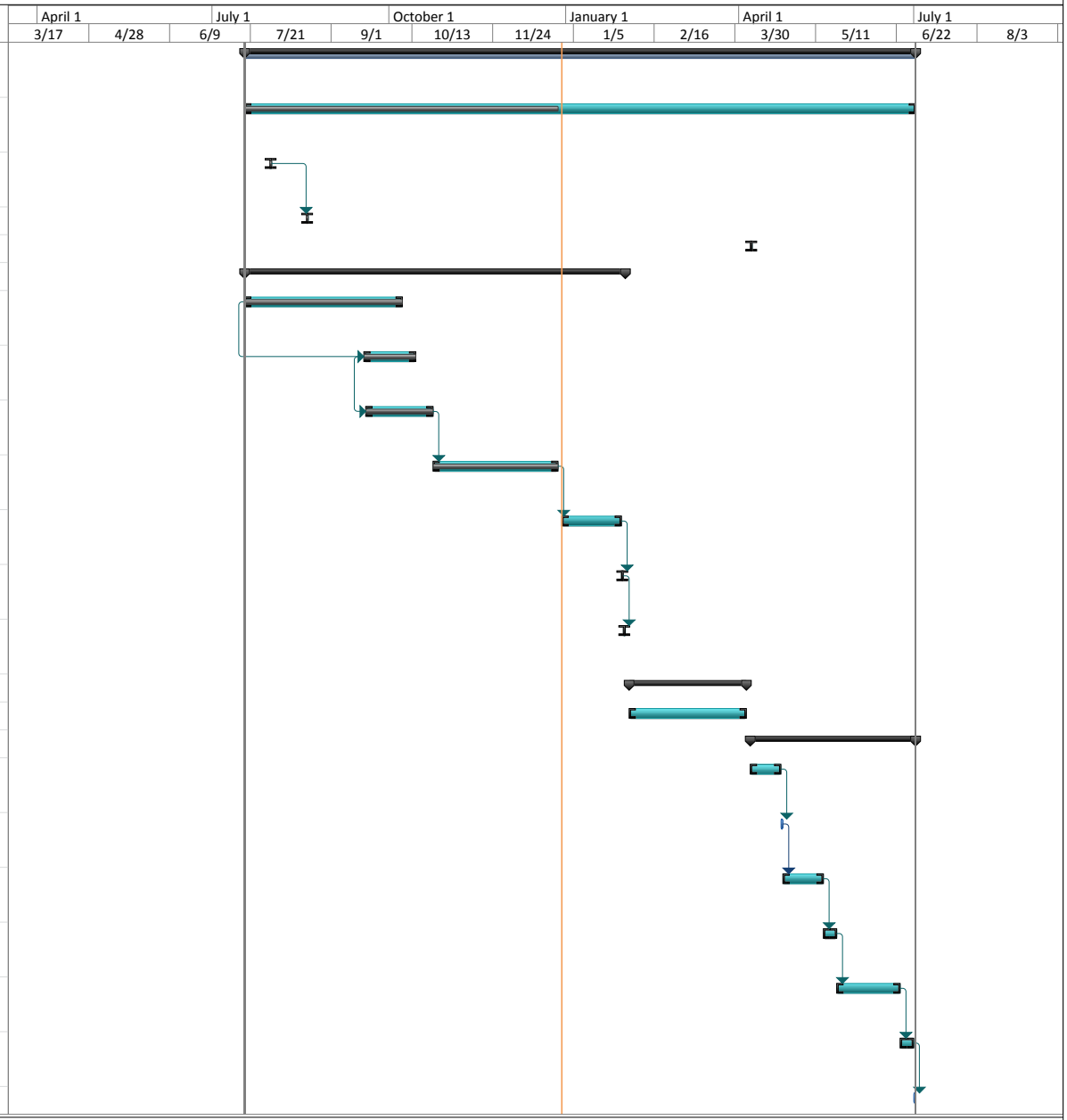
4-1

5 PROJECT SCHEDULE

A schedule of the anticipated work tasks is provided as Figure 5-1. The schedule assumes a field work mobilization date of November 18th 2013. The schedule will be appropriately revised if the start date is delayed.

Contract No. FA8903-08-D-8770, Task Order 0281
RCRA Facility Closure Haz Waste CSU Facility (SWMU #75) - Holloman AFB, NM

ID	Task Name	Duration	Start	Finish	% Complete
1	**Project Management and Meetings**	**249 days**	**Thu 7/18/13**	**Tue 7/1/14**	**47%**
2	Project Management and Meetings	249 days	Thu 7/18/13	Tue 7/1/14	47%
3	Kick-Off Meeting (Telecon)	1 day	Wed 7/31/13	Wed 7/31/13	100%
4	Site Visit	1 day	Mon 8/19/13	Mon 8/19/13	100%
5	Results Meeting	1 day	Mon 4/7/14	Mon 4/7/14	0%
6	**Planning Documents**	**142 days**	**Thu 7/18/13**	**Fri 1/31/14**	**86%**
7	Prepare draft planning documents	58 days	Thu 7/18/13	Mon 10/7/13	100%
8	Submit draft planning documents	19 days	Wed 9/18/13	Mon 10/14/13	100%
9	AFCEC document review	25 days	Thu 9/19/13	Wed 10/23/13	100%
10	Prepare draft final documents	47 days	Thu 10/24/13	Fri 12/27/13	100%
11	Regulatory document review	23 days	Mon 12/30/13	Wed 1/29/14	0%
12	Prepare final planning documents	1 day	Thu 1/30/14	Thu 1/30/14	0%
13	Submit final planning documents	1 day	Fri 1/31/14	Fri 1/31/14	0%
14	**Field Activities**	**45 days**	**Mon 2/3/14**	**Fri 4/4/14**	**0%**
15	Field Activities	45 days	Mon 2/3/14	Fri 4/4/14	0%
16	**Technical Report**	**62 days**	**Mon 4/7/14**	**Tue 7/1/14**	**0%**
17	Prepare draft technical report	12 days	Mon 4/7/14	Tue 4/22/14	0%
18	Submit draft technical report	1 day	Wed 4/23/14	Wed 4/23/14	0%
19	AFCEC document review	15 days	Thu 4/24/14	Wed 5/14/14	0%
20	Prepare draft final documents	5 days	Thu 5/15/14	Wed 5/21/14	0%
21	Regulatory document review	23 days	Thu 5/22/14	Mon 6/23/14	0%
22	Prepare final technical report	5 days	Tue 6/24/14	Mon 6/30/14	0%
23	Submit technical report	1 day	Tue 7/1/14	Tue 7/1/14	0%



Project: 4PAE08 TO281_090913
Date: Mon 12/30/13

Task		Project Summary		Inactive Milestone		Manual Summary Rollup		Deadline	
Split		External Tasks		Inactive Summary		Manual Summary		Progress	
Milestone		External Milestone		Manual Task		Start-only			
Summary		Inactive Task		Duration-only		Finish-only			

6 REFERENCES

Bhate, 2005. *Background Study Container Storage Unit, Holloman Air Force Base, New Mexico*, October.

Department of Defense (DoD), 2003. *U.S. DoD Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0*, June.

Intergovernmental Data Quality Task Force (IDQTF), 2005a. *Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPPs); Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs, Part 1: UFP-QAPP Manual*, March.

IDQTF 2005b. *IDQTF Workbooks for UFP-QAPPs, Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs, Part 2A: UFP-QAPP Workbook*, March.

IDQTF, 2005c. *UFP-QAPPs, Part 2B: Quality Assurance/Quality Control Compendium: Minimum QA/QC Activities*, March.

New Mexico Environment Department (NMED), 2006. *New Mexico Environment Department Hazardous Waste Bureau and Ground Water Quality Bureau Voluntary Remediation Program, Technical Background Document For Development of Soil Screening Levels, Revision 4.0*, June.

United States Environmental Protection Agency (USEPA), 1985. *Verification of PCB Spill Cleanup by Sampling and Analysis*, EPA 560/5-85-026, June.

USEPA, 2005. *Polychlorinated biphenyl (PCB) Site Revitalization Guidance Under the Toxic Substance Control Act (TSCA)*, November.

ATTACHMENT A: Statement of Work

ORDER FOR SUPPLIES OR SERVICES

1. CONTRACT/PURCH ORDER/AGREEMENT NO.	2. DELIVERY ORDER/ CALL NO.	3. DATE OF ORDER/CALL (YYYYMMMDD)	4. REQUISITION/PURCH REQUEST NO.	5. PRIORITY
FA8903-08-D-8770	0281	18 JUL 2013	SEE SCHEDULE	DO-C9

6. ISSUED BY 772ESS/PKA CODE FA8903
772D ENTERPRISE SOURCING SQUADRON
2261 HUGHES AVE STE 163
JBSA LACKLAND TX 78236-9853
KATIE B. COCKERILL 210-395-8107
katie.cockerill@us.af.mil

7. ADMINISTERED BY *(If Other than 6)* CODE FA8903
772D ENTERPRISE SOURCING SQUADRON
772 ESS/PKA
2261 HUGHES AVE STE 163
JBSA LACKLAND TX 78236-9853

SCD: C PAS: (NONE)

8. DELIVERY FOB
X DESTINATION
OTHER *(See Schedule if other)*

9. CONTRACTOR CODE 4L767 FACILITY
NAME AND ADDRESS
AECOM TECHNICAL SERVICES, INC.
CORPORATE OFFICE
515 S FLOWER ST FL 4
LOS ANGELES CA 90071-2201
(904) 271-2901

10. DELIVER TO FOB POINT BY *(Date)* (YYYYMMMDD) SEE SCHEDULE

11. X IF BUSINESS IS
SMALL
SMALL DISAD-VANTAGED
WOMEN-OWNED

12. DISCOUNT ITEMS
N

13. MAIL INVOICES TO ADDRESS IN BLOCK
SEE BLOCK 15 (PAYMENT OFFICE)

14. SHIP TO CODE
SEE SCHEDULE

15. PAYMENT WILL BE MADE BY CODE SL4701
DFAS-BSM
P O BOX 369031
COLUMBUS OH 43236-9031

EFT:T

MARK ALL PACKAGES AND PAPERS WITH IDENTIFICATION NUMBERS IN BLOCKS 1 AND 2.

16. TYPE OF ORDER
DELIVERY/ CALL X — This delivery order/call is issued on another Government agency or in accordance with and subject to terms and conditions of above numbered contract.
PURCHASE — Reference your furnish the following on items specified herein.

ACCEPTANCE. THE CONTRACTOR HEREBY ACCEPTS THE OFFER REPRESENTED BY THE NUMBERED PURCHASE ORDER AS IT MAY PREVIOUSLY HAVE BEEN OR IS NOW MODIFIED, SUBJECT TO ALL OF THE TERMS AND CONDITIONS SET FORTH, AND AGREES TO PERFORM THE SAME.

NAME OF CONTRACTOR | SIGNATURE | TYPED NAME AND TITLE | DATE SIGNED(YYYYMMMDD)

If this box is marked, supplier must sign Acceptance and return the following number of copies:

17. ACCOUNTING AND APPROPRIATION DATA/LOCAL USE
SEE SCHEDULE

18. ITEM NO.	19. SCHEDULE OF SUPPLIES/SERVICES	20. QUANTITY ORDERED/ ACCEPTED*	21. UNIT	22. UNIT PRICE	23. AMOUNT

**If quantity accepted by the Government is same as quantity ordered, indicate by X. If different, enter actual quantity accepted below quantity ordered and encircle.*

24. UNITED STATES OF AMERICA
//signed//
BY: GREGORY SANTIAGO 18 JUL 2013
CONTRACTING/ORDERING OFFICER

25. TOTAL $249,859.00

29. DIFFERENCES

26. QUANTITY IN COLUMN 20 HAS BEEN
INSPECTED RECEIVED ACCEPTED, AND CONFORMS TO THE CONTRACT EXCEPT AS NOTED

DATE SIGNATURE AND TITLE OF AUTHORIZED GOVERNMENT REPRESENTATIVE

27. SHIP NO. PARTIAL FINAL

28. D.O. VOUCHER NO.

30. INITIALS

32. PAID BY

33. AMOUNT VERIFIED CORRECT FOR

32. PAYMENT COMPLETE PARTIAL FINAL

34. CHECK NUMBER

36. I CERTIFY THIS ACCOUNT IS CORRECT AND PROPER FOR PAYMENT.

DATE SIGNATURE AND TITLE OF CERTIFYING OFFICER

35. BILL OF LADING

37. RECEIVED AT	38. RECEIVED BY *(Print)*	39. DATE RECEIVED *(YYYYMMMDD)*	40. TOTAL CONTAINERS	41. S/R ACCOUNT NO.	42. S/R VOUCHER NO.

1. In accordance with the provisions and authority of FAR Clause 52.216-18 "Ordering" of the Basic Contract FA8903-08-D-8770 and this Task Order 0281, the contractor shall accomplish all the effort described in the Statement of Work (SOW) entitled "RCRA Facility Closure Hazardous Waste Container Storage Unit Facility, Holloman AFB, New Mexico, Project: 8001Y0000" dated 22 May 2013, attached hereto at Section J as Attachment 1 for a total Firm Fixed Price of $249,859.00.

2. **SECTION B - SUPPLIES OR SERVICES AND PRICES/COSTS:**

ITEM	SUPPLIES OR SERVICES	Qty Purch Unit	Unit Price Total Item Amount
INVESTIGATION, ASSESSMENT, SURVEY AND ANALYSIS			
0001		1	$249,859.00
		Lot	$249,859.00

Noun: INVESTIGATION, ASSESSMENT, SURVEY AND ANALYSIS
NSN: N - Not Applicable
Contract type: J - FIRM FIXED PRICE
Inspection: DESTINATION
Acceptance: DESTINATION
FOB: DESTINATION
Item project mgr.: CFS
Descriptive Data:
THE CONTRACTOR SHALL PERFORM STUDIES IN ACCORDANCE WITH ATTACHMENT 1, STATEMENT OF WORK-A (SOW) DATED 22 MAY 2013.

INVESTIGATION, ASSESSMENT, SURVEY AND ANALYSIS

000101

Noun: Funding Info Only
ACRN: AA $249,859.00
PR/MIPR: F2MUAA3106B001 $249,859.00

ITEM	SUPPLIES OR SERVICES	Qty Purch Unit	Unit Price Total Item Amount
DATA			
0007		1 Lot	NSP NSP

Noun: DATA NOT SEPARATELY PRICED (NSP)
ACRN: U
NSN: N - Not Applicable
DD1423 is Exhibit: AB
Contract type: J - FIRM FIXED PRICE
Inspection: DESTINATION
Acceptance: DESTINATION
FOB: DESTINATION
Item project mgr.: CFS
Descriptive Data:
THE CONTRACTOR SHALL PROVIDE DATA IAW DD FORMS 1423 DATED 22 MAY 2013 CONTAINED IN EXHIBIT A, CONTRACT DATA REQUIREMENTS LIST (CDRL).

3. SECTION C - DESCRIPTION/SPECS/WORK STATEMENT:

The work to be performed will be in accordance with the Statement of Work (SOW), dated 22 May 2013, set forth as Attachment 1 entitled "RCRA Facility Closure Hazardous Waste Container Storage Unit Facility, Holloman AFB, New Mexico, Project: 8001Y0000".

4. SECTION D - PACKAGING AND MARKING:

AC-D001 MARKING OF SHIPMENTS (AUG 2007)

(a) The contractor shall mark all shipments under this contract in accordance with MIL-STD-129 entitled, "Marking for Shipment and Storage."
(b) Each shipment of material and/or data shall be clearly marked to show the following information:

SHIP TO (USPS): AFCEC/ CFSN, Bldg. 171
2261 Hughes Ave, Ste 155
JBSA Lackland, Texas 78236-9853

SHIP TO (FedEx, UPS, DHL): AFCEC/ CFSN
3515 S. General McMullen
San Antonio TX 78226-2018

MARK FOR: Contract Number: **FA8903-08-D-8770**
Task Order: **0281**
Data Item Number: (see block 1 of the CDRL Table for data item no.)
Title/ Subtitle (as applicable): (see blocks 2 & 3 for title and/or subtitle)

5. SECTION E - INSPECTION AND ACCEPTANCE:

Inspection and acceptance will be performed by the appointed Contracting Officer's Representative (COR).

6. SECTION F - DELIVERIES OR PERFORMANCE:

"RCRA Facility Closure Hazardous Waste Container Storage Unit Facility, Holloman AFB, New Mexico, Project: 8001Y0000" dated 22 May 2013.

7. PREPARATION OF PROGRESS SCHEDULES AND REPORTS: The reports contemplated by the clause titled "Schedules for Construction Contracts" shall be accomplished on and in accordance with the instructions pertaining to AF Form 3064, Contract Progress Schedule, and AF Form 3065, Contract Progress Report. These shall be provided to the Contracting Officer in accordance with CDRL requirements.

ITEM	SUPPLIES SCHEDULE DATA	QTY	SHIP TO	MARK FOR	TRANS PRI	DATE
0001		1	F2MUAA	F2MUAA		18 Jul 2014
	Noun:	INVESTIGATION, ASSESSMENT, SURVEY AND ANALYSIS				
	ACRN:	9				
0007		1	F2MUAA	F2MUAA		18 Jul 2014
	Noun:	DATA NOT SEPARATELY PRICED (NSP)				
	ACRN:	U				

8. SECTION G - ACCOUNTING AND APPROPRIATION DATA:

This contract/task order **is Wide Area Work Flow (WAWF) eligible**. Submit cost vouchers (cost reimbursable) and invoices (fixed price) electronically through WAWF at <https://wawf.eb.mil> with the pertinent supporting documentation, cost/schedule/status reports, as attachments. Contractors will utilize the specific project number and associated ACRN(s) called out in the task order for the work performed. Send e-mail notification through the WAWF using the feature "SEND ADDITIONAL E-MAIL NOTIFICATIONS", to the pertinent Contracting Officer's Representative (COR), Contracting Officer, Contract Specialist, and Base POC simultaneously with your submittal to the WAWF. AFCEC review of cost vouchers, invoices and supporting documentation will occur in the WAWF. Other required data must be distributed in accordance with the DD Form 1423, Contract Data Requirements List (CDRL) or CDRL table in the pertinent contract/task order.

ACRN	Appropriation/Lmt Subhead/Supplemental Accounting Data	Obligation Amount
AA		$249,859.00
	97 X4930 5CBX 8000025001254080001Y0000S33189 *Funding breakdown:* On CLIN 000101: $249,859.00 *PR/MIPR:* F2MUAA3106B001 $249,859.00 *Descriptive data:* CFO: DLA 13-002 MIPR#: SC44001300688, ISS: 15 MAR 13 PR COMPLETE	

9. The contractor's letter, dated 10 July 2013, confirming negotiations is hereby incorporated by reference.

10. SECTION J - LIST OF ATTACHMENTS & EXHIBITS: See next page.

DOCUMENT	PGS	DATE	TITLE
EXHIBIT A	2	22 MAY 2013	CDRL A
EXHIBIT B	3	22 MAY 2013	CDRL B
ATTACHMENT 1	30	22 MAY 2013	STATEMENT OF WORK
ATTACHMENT 2	1	19 APR 2013	BASE SUPPORT LETTER

SOW Title: RCRA Facility Closure, Hazardous Waste Container Storage Unit Facility, Holloman AFB, NM

CDRL EXHIBIT: A

CDRL : **A001A** **SOW REF :** **4.9**
Title : **Scientific and Technical Reports**

Deliverable: **OSHA Report**
Deliverable Comments:
All submittals shall be uploaded to AFCEC SharePoint using CDUT and posted to the AFCEC/CFSN distribution email address at afcee.exa.deliverables@us.af.mil. In addition, e-copies shall be provided to 722 ESS/PKA CO and CS, and the AFCEC COR. Deliverables shall be provided in both e-copy and hardcopy formats to Base POCs.

Date of First Submission: In accordance with schedule
Frequency : As required

Deliverable Table

	Final
AFCEC/CFSN	1
AFCEC/CDUT	1
722 ESS/PKA	1
Base POCs	3

CDRL : **A001B** **SOW REF :** **6.1, 6.3, 12.4.1**

Title : **Scientific and Technical Reports**

Deliverable: **RCRA Facility Closure Report**

Deliverable Comments:
All submittals shall be uploaded to AFCEC SharePoint using CDUT and posted to the AFCEC/CFSN distribution email address at afcee.exa.deliverables@us.af.mil. In addition, e-copies shall be provided to 722 ESS/PKA CO and CS, and the AFCEC COR. Deliverables shall be provided in both e-copy and hardcopy formats to Base POCs.

Date of First Submission: In accordance with schedule.
Frequency : One report per event plus revisions

Deliverable Table

	Draft	Draft Final	Final	Letter	CD
AFCEC/CFSN	1	1	1	1	1
AFCEC/CDUT	1	1	1	1	0
722 ESS/PKA	0	1	1	1	1
Base POCs	3	3	3	3	3

CDRL : **A003** **SOW REF :** **4.10**
Title : **Report, Production or Delivery Problems (Human Health or Contract Issues)**

Deliverable: **Critical Issues Notification**
Deliverable Comments:
All submittals shall be uploaded to AFCEC SharePoint using CDUT and posted to the AFCEC/CFSN distribution email address at afcee.exa.deliverables@us.af.mil. In addition, e-copies shall be provided to 722 ESS/PKA CO and CS, and the AFCEC COR. Deliverables shall be provided in both e-copy and hardcopy formats to Base POCs.

Date of First Submission: Within 3 working days of notification
Frequency : As required

Deliverable Table

	Letter
AFCEC/CFSN	1
AFCEC/CDUT	1
722 ESS/PKA	1
Base POCs	3

CDRL : **A004** **SOW REF :** **5.1.2**

Title : **Scientific and Technical Reports**

Deliverable: **QPP Part I – Environmental Health and Safety Plan**

Deliverable Comments:
All submittals shall be uploaded to AFCEC SharePoint using CDUT and posted to the AFCEC/CFSN distribution email address at afcee.exa.deliverables@us.af.mil. In addition, e-copies shall be provided to 722 ESS/PKA CO and CS, and the AFCEC COR. Deliverables shall be provided in both e-copy and hardcopy formats to Base POCs.

Date of First Submission: In Accordance With Schedule
Frequency : One report plus revisions

Deliverable Table

	Draft	Final	Letter	CD
AFCEC/CFSN	1	1	1	1
AFCEC/CDUT	1	1	1	0
722 ESS/PKA	0	1	1	1
Base POCs	3	3	3	3

CDRL : **A005** **SOW REF :** **5.1.3**

Title : **Scientific and Technical Reports**

Deliverable: **QPP Part II – Environmental Sampling and Analysis Plan (Field Sampling Plan & Quality Assurance Project Plan)**

Deliverable Comments:
All submittals shall be uploaded to AFCEC SharePoint using CDUT and posted to the AFCEC/CFSN distribution email address at afcee.exa.deliverables@us.af.mil. In addition, e-copies shall be provided to 722 ESS/PKA CO and CS, and the AFCEC COR. Deliverables shall be provided in both e-copy and hardcopy formats to Base POCs.

Date of First Submission: In Accordance With Schedule
Frequency : One report plus revisions

Deliverable Table

	Draft	Draft Final	Final	Letter	CD
AFCEC/CFSN	1	1	1	1	1
AFCEC/CDUT	1	1	1	1	0
722 ESS/PKA	0	1	1	1	1
Base POCs	3	3	3	3	3

CDRL : **A007** **SOW REF :** **5.1.1**

Title : **Scientific and Technical Reports**

Deliverable: **Technical and Management Work Plan**

Deliverable Comments:
All submittals shall be uploaded to AFCEC SharePoint using CDUT and posted to the AFCEC/CFSN distribution email address at afcee.exa.deliverables@us.af.mil. In addition, e-copies shall be provided to 722 ESS/PKA CO and CS, and the AFCEC COR. Deliverables shall be provided in both e-copy and hardcopy formats to Base POCs.

Date of First Submission: In Accordance With Schedule
Frequency : One report plus revisions

Deliverable Table

	Draft	Draft Final	Final	Letter	CD
AFCEC/CFSN	1	1	1	1	1
AFCEC/CDUT	1	1	1	1	0
722 ESS/PKA	0	1	1	1	1
Base POCs	3	3	3	3	3

SOW Title: RCRA Facility Closure, Hazardous Waste Container Storage Unit Facility, Holloman AFB, NM

CDRL EXHIBIT: B

CDRL : **B001** **SOW REF :** **4.2**
Title : **Work Breakdown Structure**

Deliverable: **WBS**
Deliverable Comments:
All submittals shall be uploaded to AFCEC SharePoint using CDUT and posted to the AFCEC/CFSN distribution email address at afcee.exa.deliverables@us.af.mil. In addition, e-copies shall be provided to 722 ESS/PKA CO and CS, and the AFCEC COR. Deliverables shall be provided in both e-copy and hardcopy formats to Base POCs.

Date of First Submission: 30 days after award
Frequency : Once

Deliverable Table

	Final
AFCEC/CFSN	1
AFCEC/CDUT	1
722 ESS/PKA	1
Base POCs	3

CDRL : **B002** **SOW REF :** **4.3.1**
Title : **Project Planning Chart**

Deliverable: **Project Schedule**
Deliverable Comments:
All submittals shall be uploaded to AFCEC SharePoint using CDUT and posted to the AFCEC/CFSN distribution email address at afcee.exa.deliverables@us.af.mil. In addition, e-copies shall be provided to 722 ESS/PKA CO and CS, and the AFCEC COR. Deliverables shall be provided in both e-copy and hardcopy formats to Base POCs.

Date of First Submission: 30 days after award
Frequency : Monthly

Deliverable Table

	Final
AFCEC/CFSN	1
AFCEC/CDUT	1
722 ESS/PKA	1
Base POCs	3

CDRL : **B004** **SOW REF :** **4.4.1**
Title : **Contractor's Progress, Status, and Management Report**

Deliverable: **CPSMR**
Deliverable Comments:
All submittals shall be uploaded to AFCEC SharePoint using CDUT and posted to the AFCEC/CFSN distribution email address at afcee.exa.deliverables@us.af.mil. In addition, e-copies shall be provided to 722 ESS/PKA CO and CS, and the AFCEC COR. Deliverables shall be provided in both e-copy and hardcopy formats to Base POCs.

Date of First Submission: 30 days after award
Frequency : Monthly on or before the 15th of the following month.

Deliverable Table

	Final
AFCEC/CFSN	1
AFCEC/CDUT	1
722 ESS/PKA	1
Base POCs	3

CDRL : B005 SOW REF 4.5
Title : Digital Photography

Deliverable: Digital Photos
Deliverable Comments:
All submittals shall be uploaded to AFCEC SharePoint using CDUT and posted to the AFCEC/CFSN distribution email address at afcee.exa.deliverables@us.af.mil. In addition, e-copies shall be provided to 722 ESS/PKA CO and CS, and the AFCEC COR. Deliverables shall be provided in both e-copy and hardcopy formats to Base POCs.

Date of First Submission: In accordance with schedule
Frequency : As required

Deliverable Table

	Final	Letter	CD
AFCEC/CFSN	1	1	1
AFCEC/CDUT	1	1	0
722 ESS/PKA	1	1	1
Base POCs	3	3	3

CDRL : B008 SOW REF 4.8.1, 4.8.2, 4.9
Title : Presentation Materials

Deliverable: Meeting Presentation Materials
Deliverable Comments:
All submittals shall be uploaded to AFCEC SharePoint using CDUT and posted to the AFCEC/CFSN distribution email address at afcee.exa.deliverables@us.af.mil. In addition, e-copies shall be provided to 722 ESS/PKA CO and CS, and the AFCEC COR. Deliverables shall be provided in both e-copy and hardcopy formats to Base POCs.

Date of First Submission: In accordance with schedule
Frequency : As required

Deliverable Table

	Draft	Final
AFCEC/CFSN	1	1
AFCEC/CDUT	1	1
722 ESS/PKA	0	LT
Base POCs	3	3

CDRL : B009 SOW REF 4.8.1, 4.8.2, 4.9
Title : Meeting Agenda

Deliverable: Meeting Agenda
Deliverable Comments:
All submittals shall be uploaded to AFCEC SharePoint using CDUT and posted to the AFCEC/CFSN distribution email address at afcee.exa.deliverables@us.af.mil. In addition, e-copies shall be provided to 722 ESS/PKA CO and CS, and the AFCEC COR. Deliverables shall be provided in both e-copy and hardcopy formats to Base POCs.

Date of First Submission: In accordance with schedule
Frequency : As required

Deliverable Table

	Draft	Final
AFCEC/CFSN	1	1
AFCEC/CDUT	1	1
722 ESS/PKA	0	LT
Base POCs	3	3

CDRL : B010 SOW REF 4.8.1, 4.8.2, 4.9
Title : Meeting Minutes

Deliverable: Meeting Minutes
Deliverable Comments:
All submittals shall be uploaded to AFCEC SharePoint using CDUT and posted to the AFCEC/CFSN distribution email address at afcee.exa.deliverables@us.af.mil. In addition, e-copies shall be provided to 722 ESS/PKA CO and CS, and the AFCEC COR. Deliverables shall be provided in both e-copy and hardcopy formats to Base POCs.

Date of First Submission: 3 days following meeting
Frequency : As required

Deliverable Table

	Draft	Final
AFCEC/CFSN	1	1
AFCEC/CDUT	1	1
722 ESS/PKA	0	LT
Base POCs	3	3

4PAE08

STATEMENT OF WORK

FOR

RCRA FACILITY CLOSURE

HAZARDOUS WASTE CONTAINER STORAGE UNIT FACILITY

HOLLOMAN AFB, NEW MEXICO

CONTRACT NUMBER: FA8903-08-D-8770

TASK ORDER: 0281

PROJECT: 80001Y0000

22 MAY 2013

STATEMENT OF WORK
For Architect-Engineering (AE) Services Supporting Resource Conservation and Recovery Act Closure of Hazardous Waste Container Storage Unit Facility, Holloman Air Force Base, Alamogordo, New Mexico
PART A – INTRODUCTION

This Statement of Work (SOW) defines requirements for closure of the Hazardous Waste Container Storage Unit (CSU) permitted by the State of New Mexico Environment Department (NMED) under the New Mexico Hazardous Waste Act (HWA) and Resource Conservation and Recovery Act (RCRA), Subtitle C. The CSU Facility at Holloman Air Force Base (AFB) operates under Permit Number NM6572124422-2 dated 24 February 2004 to accept, manage and store on-base generated hazardous waste before transfer to a permitted treatment or disposal facility. The Contractor shall perform RCRA closure of the CSU Facility in accordance with performance standards established in the approved Closure Plan (Attachment K, Hazardous Waste Facility Permit NM6572124422-2), consistent with applicable federal, state, local, Air Force, and Defense Logistics Agency (DLA) laws, regulations and requirements.

The Contractor shall furnish the personnel, services, equipment, materials, facilities, and other requirements necessary for, or incidental to, the performance of work set forth herein. Primary technical services shall be performed by individuals who are credentialed members of architectural, planning, science, and engineering professions. Disciplines include, but are not limited to, architects, landscape architects, interior designers, engineering disciplines typically associated with facility design and construction, environmental engineers and scientists, cost estimators, specification writers, Computer Aided Design and Drafting (CAAD) technicians, publication writers/editors, technical writers, graphic artists, Geographic Information System (GIS) analysts, planners, urban designers, economists, financial analysts, and housing market analysts. Generally, a credentialed professional (a) is licensed (e.g., registered professional engineer) to practice in the state where a facility is located and (b) commands the necessary expertise, in terms of knowledge and experience, to undertake the specific task.

1.0 SCOPE

Holloman AFB is located on approximately 59,827 acres of land about seven miles west of the City of Alamogordo in Otero County in south central New Mexico. Base activities necessitated the use of a variety of products to maintain and repair aircraft and aerospace ground equipment, as well as base structures and roads thus generating wastes classified as hazardous waste under RCRA due to exhibiting characteristics of ignitability, corrosivity, reactivity or toxicity, or conformance to the definition of listed waste under 40 CFR Part 261 Subpart D.

The CSU Facility is located on the east side of the base, approximately 1,400 feet inside the eastern base boundary on roughly 400,000 square feet of land designated for use by the Defense Reutilization and Office (DRMO) (Holloman AFB tenant). The CSU Facility consists of an indoor covered building (Building 118), a staging area, and an outdoor covered area. The permit allows storage of hazardous waste in as many as 788 55-gallon drums or equivalent (43, 340 gallons) including Toxic Substances Control Act (TSCA) regulated materials, wastes, and equipment

containing polychlorinated biphenyls (PCBs). Holloman AFB and DLA have determined that the CSU Facility has reached the end of its intended operational life. Presently, the Facility no longer accepts hazardous waste, and all stored hazardous waste containers and hazardous materials including PCB containing equipment, materials and wastes have been removed from all areas of the CSU Facility.

The Contractor shall close the CSU Facility in accordance with NMED requirements identified in the Closure Plan for the Holloman AFB CSU Facility. Performance standards for RCRA facility closure include:

- Protection of human health and the environment.
- Removal of hazardous waste and hazardous waste residues.
- Decontamination of CSU structures, equipment and related items.
- Minimize or eliminate the need for future maintenance or monitoring.

Work requirements shall include development and approval of planning documents, dismantling and decontamination of storage equipment, decontamination and rinsing of indoor, outdoor and staging areas, sampling and analysis of affected media and waste liquids and material generated from closure activities, PCB wipe sampling, investigation derived waste (IDW) handling and disposal, and certification of clean closure by a Professional Engineer certified by the State of New Mexico. Environmental remediation activities leading to CSU Facility closure shall be closely coordinated with appropriate Holloman AFB-environmental, DLA Disposition Service-Holloman AFB, DLA Installation Support-Battle Creek-Michigan, NMED, and Air Force Civil Engineer Center (AFCEC) personnel.

2.0 TITLE I, TITLE II, AND OTHER AE SERVICES REQUIREMENTS

2.1 Title I Services

Not applicable to this TO.

2.2 Title II Services

Not applicable to this TO.

2.3 Other AE Services

The Contractor shall support Holloman AFB and its tenant DLA Disposition Services in the execution of RCRA Facility Closure of the DLA operated hazardous waste CSU Facility in accordance with the requirements of the Closure Plan (Attachment K, Holloman AFB Hazardous Waste Facility Permit NM6572124422-2).

PART B – ADMINISTRATIVE AND MANAGERIAL REQUIREMENTS

The Contractor shall provide management, planning, performance measurement, and cost status reporting pertinent to the performance of the requirements identified in this TO.

3.0 APPLICABLE DOCUMENTS

The Contractor shall comply with all applicable federal, state, and local environmental statutes, instructions, manuals, handbooks, regulations, guidance, policy letters, and rules including all changes and amendments as well as Presidential Executive Orders in effect on the date of issuance of this TO. In addition, the Contractor shall refer to the AFCEC Technical Services Quality Assurance Program, Guidance for Contract Deliverables (GCD), current version. This GCD is a reference document to be used in the generation of contract deliverables.

4.0 TASK ORDER MANAGEMENT, PLANNING, AND REPORTING SERVICES

The Contractor shall plan project activities, including the development, implementation, and maintenance of project schedules, events, status of resources, reports on the activities, and progress toward accomplishing project objectives. The Contractor shall document the results of the project efforts of this TO.

The Contractor shall send all deliverables and/or submittals, weekly status progress reports, Final Inspection Requests, and Contractor's posted website address to the Contracting Officer (CO), Contract Specialist (CS), Contracting Officer's Representative (COR), Base Point of Contact (POC), and GEITA support team representative in addition to the AFCEC/CFSN distribution email address (afcee.exa.deliverables@us.af.mil). The Contractor shall upload all deliverables/submittals to SharePoint using Contractor Data Upload Tool (CDUT). An instructional memorandum on how to use CDUT may be requested through the COR. Additionally, all Contractor deliverables/submittals shall be posted on the Contractor's website. This is a mandatory requirement.

4.1 Project Website

Not applicable to this TO.

4.2 WBS Requirements

The Contractor shall prepare and submit for approval a Work Breakdown Structure (WBS) as posted in the 4PAE08 Guidance and Resource List or as specified in this TO. The WBS shall be used to report the cost and schedule status for this project. All tasks required under this TO shall be included in the WBS. (CDRL B001)

4.3 Schedule and Planning Requirements

The Contractor shall provide schedules for tracking work progress as specified in this TO.

4.3.1 Project Planning Chart (PPC)

The Contractor shall prepare and submit a PPC for approval. The PPC shall detail the project schedule and status through the use of Gantt charts which shall depict percent-complete for this task. Schedule activities shall be reported according to the approved WBS. (CDRL B002)

4.3.2 Integrated Master Schedule

Not applicable to this TO.

4.4 Cost and Status Reporting

The Contractor shall provide progress and cost reports as specified in this TO.

4.4.1 Contractor's Progress, Status, and Management Report

The Contractor shall prepare and submit CPSMRs. The CPSMRs shall be used to review and evaluate the overall progress of the project along with any existing or potential problem areas. The CPSMRs shall include a summary of the events that occurred during the reporting period, discussion of performance, identification of problems, proposed solutions, corrective actions taken, and outstanding issues. (CDRL B004)

4.4.2 Performance and Cost Report

Not applicable to this TO.

4.4.3 Funds and Man-Hours Expenditure Report

Not applicable to this TO.

4.5 Photo Documentation

The Contractor shall prepare digital photo documentation as required to support this TO. Photography of any kind must be coordinated through the installation POC.

4.6 Task Order Scoping

Not applicable to this TO.

4.7 Environmental Resources Program Information Management System (ERPIMS) and Air Force Restoration Information Management System (AFRIMS) Data Management

Not applicable to this TO.

4.8 Meeting and Conference Services

4.8.1 Meetings/Teleconference Support

The Contractor shall attend and/or support meetings and teleconferences as required by the Contracting Officer's Representative (COR) with the customer and/or AFCEC representatives. The purpose of the meetings include, but are not limited to, contract discussions, progress reviews,

project scoping, planning, design reviews, planning/programming charrette activities, project definition charrette activities, design charrette activities, construction reviews, project status, and the general exchange of information concerning current and future activities. When specified in the TO, the Contractor shall participate in and/or facilitate on-site meetings. (CDRLs B008, B009, B010)

4.8.2 Public Meetings and Hearing

The Contractor shall present technical information and provide logistical support (e.g., facilities, audiovisual, handouts, reports, recordings, verbatim transcripts, translations, slides, synopsis, etc.) for events and/or meetings in support of the government's position. (CDRLs B008, B009, B010)

4.8.3 Conference Support

Not applicable to this TO.

4.9 Regulatory/Professional Interface

The Contractor shall assist with oral/written interaction with interested parties related to the project. Forums may include administrative proceedings, judicial proceedings, formal meetings, or informal meetings. Requirements include, but are not limited to, presentation materials, agendas, minutes, publications, news releases, public notices, and the maintenance of mailing lists.

The Contractor shall assist in project technical review, analysis, and discussions to integrate comments from interested parties on programs and related data and studies. Develop options for responses and prepare reports to communicate government priorities to regulatory agencies and other interested parties.

The Contractor shall assist with the review and interpretation of new statutory and regulatory requirements and make recommendations for government facility planning and policy integration as it applies to the assigned project. (CDRLs A001A, B008, B009, B010)

4.10 Notification Requirements

The Contractor is required to notify the CO and COR of critical issues that may affect the contract performance, human health, and/or the environment. The types of issues that require notification include, but are not limited to, health risks, spills, unexpected utility crossings, unusual weather conditions, unacceptable materials, changes in critical personnel, and unexploded ordinance (UXO). On critical issues, verbal notification should be made immediately followed by written notification as soon as practical. (CDRL A003)

4.11 Work Site Coordination

Not applicable to this TO.

4.12 Spatial Data (Map) Requirements

Not applicable to this TO.

5.0 TASK ORDER PROJECT PLAN DEVELOPMENT SERVICES

Development of project planning documents is required under this TO. Plans must comply with the specifications, procedures, and methodologies (such as approved Federal Facilities Agreements [FFAs]) in the site/project specific plans. Project plans may include any of the following as appropriate to this TO. The COR shall approve (in writing) any proposed modification to, or deviation from, any activity described in these documents, following approval by the CO.

5.1 Quality Program Plan (QPP)

The QPP shall include the Work Plan (WP), the Health and Safety Plan (HSP) (as required by 29 Code of Federal Regulations (CFR) 1910.120), and the Environmental Sampling and Analysis Plan (SAP) as specified below. The project SAP shall include a Quality Assurance Project Plan (QAPP), which is based on the Uniform Federal Policy QAPP (UFP-QAPP), a Field Sampling Plan (FSP), and the Construction Quality Plan (CQP). Minimum QA/QC requirements identified by the current version of the Department of Defense (DoD) Quality Systems Manual (QSM) shall be incorporated in the UFP-QAPP. The current version of the QSM and UFP-QAPP can be found at the following website: http://www.navylabs.navy.mil

5.1.1 Work Plans (WPs)

The Contractor shall prepare a work plan (WP) to comply with Department of Defense, Air Force, United States Environmental Protection Agency (USEPA) (epa.gov/quality), state, and local regulations regarding the proposed work effort. The WP shall adhere to project data quality objectives (DQOs) and performance objectives established in the RCRA permit and other applicable NMED regulations. (CDRLs A007)

5.1.2 Health and Safety Plan (HSP)

The Contractor shall prepare a HSP to comply with Air Force, OSHA, United States Environmental Protection Agency (USEPA), state, and local health and safety regulations regarding the proposed work effort. Utilize to the fullest extent possible any existing related HSP, tailored specifically to the current effort. Use USEPA guidelines for designating the appropriate levels of protection needed at the study site as applicable. Maintain written certification that the approved HSP has been reviewed with all personnel that work at the project site prior to their mobilization. (CDRL A004)

5.1.3 Sampling and Analysis Plan (SAP)

The Contractor shall prepare a SAP. The SAP shall consist of both an FSP and a QAPP. If an installation-wide SAP has already been prepared, this TO may require the preparation of project/site specific addenda. SAPs in the restoration program shall be prepared using the UFP-QAPP, AFCEC Restoration Quality Assurance Examples and Guidance, and project DQOs as specified by the restoration team. (CDRL A005)

5.1.4 Construction Quality Plan (CQP)

Not applicable to this TO.

5.2 Design Work Plan

Not applicable to this TO.

6.0 MANAGEMENT OF CHEMISTRY SERVICES

The Contractor shall be responsible for the quality of all required chemistry services performed. The Contractor shall ensure that all chemistry-related tasks are conducted in accordance with the project-specific SAP. The project specific SAP shall be developed following the UFP Guidance (UFP-QAPP). Minimum QA/QC requirements identified by the current version of the Department of Defense (DoD) Quality Systems Manual (QSM) shall be incorporated in the UFP-QAPP. The current version of the QSM and UFP-QAPP can be found at the following website: http://www.navylabs.navy.mil/.

6.1 Quality Assurance

The Contractor shall develop project specific DQOs consistent with the project's Remedial Action Objectives (RAOs) and designed to ensure data of adequate quality are collected to support project decisions. DQOs shall be developed in consensus with the restoration project team and in accordance with UFP-QAPP (UFP-QAPP is a set of consensus documents prepared by the Intergovernmental Data Quality Task Force (IDQTF) to provide instructions for preparing Quality Assurance Project Plans for any environmental data collection operation) and USEPA QA/G4, Guidance for the Data Quality Objective Process (most recent version) and documented in the project SAP. Minimum QA/QC requirements identified by the current version of the Department of Defense (DoD) Quality Systems Manual shall be incorporated in the UFP-QAPP. The current version of the QSM can be found at the following website: http://www.navylabs.navy.mil/.
All laboratory services shall be conducted in accordance with the project QAPP. Requests for variations to the established QAPP shall be submitted in writing to the restoration team and the AFCEC COR. Approved variances shall be included in the updated SAP. Samples shall not be submitted for analysis until the SAP is approved by the restoration team and AFCEC.
The Contractor shall ensure that all requirements specified in the project SAP are met. If not met, the Contractor may be required to re-accomplish sampling at the Contractor's expense based on the Contracting Officer's determination. The Contractor shall conduct audits, administer a proficiency testing program, verify and validate data, and perform corrective actions in accordance with the project SAP and the 4P A-E Guidance and Resource List. (CDRL A001B)

6.2 Laboratory Selection

The Contractor shall select a laboratory that complies with the requirements of the current version of the DoD Quality Systems Manual (QSM). The current version of the QSM can be found at the following website: http://www.navylabs.navy.mil/. The laboratory must also have analytical capabilities sufficient for the methods specified in the SAP and adequate throughput capacity to handle the project's analytical workload during all field activities. The Contractor shall ensure that the selected laboratory meets all state and federal requirements including state and federal certification/accreditation programs where appropriate.

6.3 Analytical Data Management

The Contractor shall ensure that all hard copy and electronic data deliverables supplied by the laboratory are complete and adequate to support the quality and usability of the data. Raw data packages shall be submitted to AFCEC upon request. Data packages shall include all information required to re-create the analysis, including correspondence with the laboratory regarding Quality Assurance and Quality Control (QA/QC) exceedances and documentation of corrective actions. (CDRL A001B)

PART C – PLANNING SERVICES

7.0 ENVIRONMENTAL PLANNING AND PROGRAMMING

Not applicable to this TO.

8.0 INFRASTRUCTURE AND INSTALLATION PLANNING AND PROGRAMMING

Not applicable to this TO.

9.0 MILITARY FAMILY HOUSING PLANNING

Not applicable to this TO.

PART D – ENVIRONMENTAL SERVICES

For environmental services, all on-site workers (contractor and subcontractor) performing hazardous operations, including working with hazardous materials, must have completed the OSHA 1910.120 Hazardous Waste Operations and Emergency Response (HAZWOPER) training and/or other applicable training as well as annual refresher courses. The Contractor shall maintain training records and have the site-specific Health and Safety Plan (HSP) on-site available for workers and/or regulatory review.

10.0 TITLE I SERVICES FOR ENVIRONMENTAL PROJECTS

Not applicable to this TO.

11.0 TITLE II SERVICES FOR ENVIRONMENTAL PROJECTS

Not applicable to this TO.

12.0 OTHER ENVIRONMENTAL A-E SERVICES

The Contractor shall provide all labor, materials, and services necessary to achieve RCRA Facility Closure of the Holloman AFB Hazardous Waste CSU Facility.

12.1 Air Quality

Not applicable to this TO.

12.2 Community Involvement

Not applicable to this TO.

12.3 Environmental Management

Not applicable to this TO.

12.4 Environmental Restoration

12.4.1 Preliminary Assessment/Site Inspection (PA/SI) or RCRA Facility Assessment (RFA)

The Contractor shall conduct a site visit and review records as part of the planning process leading to the development of planning documents. The planning documents shall be submitted in draft, draft final and final versions and coordinated through all stake holders prior to submittal to NMED for approval. The CSU Facility shall be decontaminated and restored consistent with NMED requirements identified in the Closure Plan located at http://www.nmenv.state.nm.us/HWB/hafb/final_permit_info/Attachment_K-Closure Plan.pdf. Facility closure requirements shall be coordinated with NMED through Holloman AFB and DLA points of contact listed in Section 16 of the SOW. The field work shall be performed in accordance with DQOs and performance standards identified in the Closure Plan and approved planning documents. Sampling and analysis of affected media shall cover all potential contaminants of concern including PCB wipe sampling and IDW characterization. Waste generated as a result of decontamination activities and soil sampling shall be handled, stored and disposed of in accordance with applicable regulations. The Contractor shall submit daily field reports by email during field mobilization. Upon completion of fieldwork, the Contractor shall prepare a certified RCRA Facility Closure Report in draft, draft final and final versions and coordinate report approval by the Air Force, DLA, and NMED within the required time frame. (CDRL A001B)

12.4.2 Remedial Investigation (RI) or RCRA Facility Investigation

Not applicable to this TO.

12.4.3 Feasibility Study (FS) or Corrective Measures Study (CMS)

Not applicable to this TO.

12.4.3.1 Alternatives Development

Not applicable to this TO.

12.4.3.2 Alternatives Analysis

Not applicable to this TO.

12.4.4 Informal Technical Information Reports (ITIRs)

Not applicable to this TO.

12.4.5 Proposed Plans (PPs), Records of Decisions, Decision Documents (DDs), and No Further Response Action Plans (NFRAPs)

Not applicable to this TO.

12.4.6 Engineering Evaluation/Cost Analysis (EE/CA)

Not applicable to this TO.

12.4.7 Remedial Process Optimization (RPO)

Not applicable to this TO.

12.4.8 Treatability Studies, Pilots Tests, Bench Scale Tests, IRAs

Not applicable to this TO.

12.4.9 Management Action Plans (MAPs)

Not applicable to this TO.

12.4.10 Peer Review

Not applicable to this TO.

12.4.11 Warranty of Installed Environmental Restoration Equipment and Systems

Not applicable to this TO.

12.5 Hazardous Material and Hazardous Waste Management

Not applicable to this TO.

12.6 Low Level Radionuclides

Not applicable to this TO.

12.7 Monitoring and Operations

Not applicable to this TO.

12.7.1 Deployed Environmental Surveillance

Not applicable to this TO.

12.7.2 Long-Term Monitoring (LTM) and Remedial-Action Operations (RAO)

Not applicable to this TO.

12.7.3 Monitoring Well Installation, Upgrades, Treatment, Testing, Repairs, and Abandonment

Not applicable to this TO.

12.8 Compliance Assurance and Pollution Prevention (CAPP)

Not applicable to this TO.

12.9 Record Keeping and Reporting

The Contractor shall prepare, compile, and maintain an administrative record containing pertinent information regarding project decisions.

12.10 Risk Assessments

Not applicable to this TO.

12.11 Storage Tank Management

Not applicable to this TO.

12.11.1 Petroleum, Oils, and Lubricants and Other Storage Tank Management

Not applicable to this TO.

12.12 Technology (Demonstration) Evaluation

Not applicable to this TO.

12.13 UXO

Not applicable to this TO.

12.14 Water Quality

Not applicable to this TO.

PART E – TRADITIONAL SERVICES (INCL. MILCON, MFH, AND SRM)

13.0 TITLE I TRADITIONAL SERVICES

Not applicable to this TO.

14.0 TITLE II TRADITIONAL SERVICES

Not applicable to this TO.

15.0 OTHER TRADITIONAL A-E SERVICES

Not applicable to this TO.

16.0 GOVERNMENT POINTS OF CONTACT

HOLLOMAN AIR FORCE BASE POCs	**HQ AFCEC/CFSN**
Ronald Scherer Engineering and Environmental Services DLA Installation Support at Battle Creek, MI 269 961-5911; DSN 661-5911 Ron.Scherer@dla.mil John Hamann Hazardous Waste Manager USAF ACC 49 CES/CEAN Holloman AFB, NM 575 572-6655 John.Hamann@holloman.af.mil Mark Phillips DLA Disposition Services Environmentalist Holloman AFB 575 572-7860 Mark.Phillips@dla.mil	Kent Rohlof, Project Manager 2261 Hughes Ave. Ste 155 Lackland AFB, TX 78236-9853 210 395-8662 Email: kent.rohlof@us.af.mil

17.0 ABBREVIATIONS, ACRONYMS, AND TERMS

Refer to the 4PAE08 Guidance and Resource List for the abbreviations, acronyms, and terms.

APPENDIX A

PERMIT ATTACHMENT K
CLOSURE PLAN

Overview of the Closure Plan

This Closure Plan for the Holloman Air Force Base (**HAFB**) Container Storage Unit (**CSU**) is designed to meet the following performance standards:

- To protect human health and the environment;
- To remove all hazardous waste and hazardous waste residues from the CSU at the time of closure and to decontaminate or remove any remaining containers, liners, bases, and soil containing or contaminated with hazardous waste or hazardous waste residues; and
- To minimize or eliminate the need for future maintenance or monitoring.

This plan identifies the steps that HAFB shall take to close the subject hazardous waste management unit at the end of its intended operation life and achieve clean closure. Holloman Air Force Base DRMO Environmental Coordinator shall maintain a copy of the submitted Closure Plan and all revisions to the plan. Revisions shall be made whenever any modifications are made to the existing equipment, structures, instruments, or procedures related to the management of the CSU. The procedures for meeting these goals are outlined in this section.

Applicability

The DRMO shall provide management and storage capacity for containerized hazardous waste generated on-site (i.e., at HAFB). Treatment of wastes shall not be performed at the CSU, and wastes generated off-site shall not be accepted for management and storage. The CSU consists of a staging area, outdoor storage area, and indoor storage building. The staging area and outdoor storage area consist of diked concrete pads that are outdoors. These portions of the CSU are intended only for waste-handling and accumulation-type activities. Also, because the CSU contains only containers (e.g., steel drums) that hold hazardous waste, ground water monitoring requirements shall not be applicable. However, if HAFB fails to achieve clean closure or cannot demonstrate equivalency clean closure, the CSU shall be closed in place as a landfill, and detective ground water monitoring shall be conducted as per 20.4.1.500 NMAC, incorporating 40 CFR §264.98. This shall be done using the procedures submitted with the post-closure care plan. This Closure Plan identifies the steps necessary to close the CSU at any point during its active life.

Closure Performance Standard

APPENDIX A

This Closure Plan is designed to ensure that the CSU shall not require further maintenance and shall eliminate or minimize the threat to human health and the environment by preventing the escape of hazardous waste, hazardous constituents, leachate, contaminated rainfall, or waste decomposition products. This standard shall be achieved through removal of wastes and waste residues from the CSU. Rinsate from any decontaminated secondary containment, along with samples of surrounding soils shall be tested to ensure that decontamination has been completely effective and that hazardous wastes and hazardous constituents have not migrated from the CSU. Equipment used to perform the closure activity shall be decontaminated. On completion of the decontamination and demonstration that the CSU has been effectively decontaminated, the closure shall be certified by a professional engineer registered in the state of New Mexico.

Partial and Final Closure

There shall be no partial closure of the CSU. Complete closure of all CSU storage buildings, including any additions made through appropriate permit shall occur concurrently. The anticipated date for closure of the CSU is 2011.

Maximum Waste Inventory

The maximum inventory of waste stored at this CSU (i.e., in the staging area, outdoor storage area, and indoor storage area) shall not exceed 47,960 gallons. Most wastes at this CSU shall be managed in containers of 55 gallons or smaller volume. Exceptions shall include transformers containing polychlorinated biphenyls (**PCBs**), containers of solid waste, and salvage drums. PCB items shall not be in storage at the expected closure date.

Description of Decontamination and Removal Procedures

All wastes at the CSU shall be removed from their respective management and storage locations and transferred to transport vehicles for reclamation or treatment and disposal at an approved off-site recycling facility or permitted treatment, storage, and disposal facility. The procedures described in Permit attachments D and G to ensure safe handling, shall prevent mixing of incompatible wastes, and prevent accidental ignition and spills shall be followed in the closure operation. The maximum waste volume from the transfer operation shall not exceed 47,960 gallons.

Decontamination of Soil, Equipment, and Structures

APPENDIX A

Prior to the initiation of closure activities, a notice of intent to close the Unit shall be sent to NMED. At the time formal notification to proceed with closure is submitted, no additional wastes shall be accepted at the CSU. Any waste inventory in the CSU at this time shall be sent off-site for treatment and disposal in accordance with all applicable regulatory requirements.

All CSU structures, equipment, and related items shall be decontaminated by trained personnel wearing appropriate personal protective equipment as required by 40 CFR 1910.120, Appendix B. Representatives from the following organizations shall determine the level of protection required collectively:

- Defense Re-utilization and Marketing Office;
- Defense Re-utilization and Marketing Service/Battle Creek;
- Holloman AFB Civil Engineering Squadron/Environmental Flight; and
- Holloman AFB Bio-environmental Engineering Office

All visible signs of contamination shall be removed using water and detergent. All waste storage area floors, containment trenches, and walls shall be cleaned using high-pressure steam cleaning equipment. All washings (rinsates) shall be collected, stored, and analyzed. If the analysis indicates that the wash is hazardous, it shall be placed in appropriate containers, appropriately labeled, and disposed of as hazardous waste. If the analysis indicates there is no evidence of contamination, the water shall be discharged into the sewer system. Other areas in which the hazardous wastes were handled and the associated containment facilities shall be decontaminated in a similar manner.

Decontamination and Closure Criteria for Rinsate and Soil

A composite sample, as defined in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA Publication SW-846*, shall be collected and analyzed from the collective samples of each decontamination phase. The analysis shall include procedures designed to detect possible contamination that could have resulted from those hazardous chemicals that have been included on the chemical inventory lists of the CSU over its operation lifetime. The specific analytical method shall be indicated in the initial notice of intended closure when it is submitted to the NMED for approval.

APPENDIX A

The rinsate from decontamination of equipment and structures shall be managed as hazardous waste if analytical results indicate that it is hazardous. Inorganic constituents in soil shall be compared to background levels. Surrounding soils shall be sampled to ensure that chemicals handled at the CSU have not migrated from the area. The proposed acceptable decontamination and closure criteria for rinsate and soil shall be based on practical quantitation limit concentrations specified under 20.4.1.500 NMAC, incorporating 40 CFR §264, Appendix IX.

Soil Sampling at the Container Storage Area

Soil samples shall be taken to verify that hazardous constituents have not migrated from the CSU during its active life. Soil samples shall be taken from all sides of the containment area, approximately one foot from the curbing. Figure K-1 shows the location where closure soil samples shall be taken during closure of the CSU. Two equally spaced sets of soil samples shall be taken from each side of the indoor storage facility, one set of soil samples shall be taken from each side of the staging area, and three equally spaced sets of samples shall be taken along each side of the outdoor storage area. Each set of soil samples shall consist of a spoon-collected surface-level sample and a soil core to a depth of 3 ft. Each soil log shall be composited at 1-ft intervals for analysis of the decontamination criteria. If the decontamination criteria cannot be met, the surrounding soils shall be excavated to the indicated depth and replaced with clean fill material. If excavation is required in an area, a second coring shall be taken at the width of the excavation zone. It is considered extremely unlikely that contamination would be found at depths below 3 ft. However, in the unlikely event that such contamination is found, the soils in the affected area shall be sampled and excavated at 1-ft intervals. Each one-foot increment shall be analyzed for constituents of concern. If necessary, additional depth samples shall be taken until a level is established in which no contamination occurred. All contaminated soil shall be removed and disposed of in accordance with the applicable regulatory requirements. A site *Health and Safety Plan* shall be submitted for the closure activities at the time of the closure notice. This plan shall follow the requirements contained in 29 CFR 1910.120, *Hazardous Waste Operations and Emergency Response*.

APPENDIX A

INSERT PAGE 5 OF 10

APPENDIX A

Equipment Decontamination

All CSU equipment shall be moved into the storage building for decontamination. Pallets that were used for container placement shall be dismantled, containerized, and disposed of as hazardous waste if any visible signs of contamination are present. Pallets that do no exhibit visible signs of contamination shall be retained for future use at Holloman AFB. Storage racks from the outdoor storage area shall be dismantled, moved inside the storage building, and initially decontaminated by a high-pressure rinse consisting of hot water or steam and anionic surfactant. This rinsate shall be collected and disposed of as hazardous waste if necessary. On completion of the initial wash, a second rinse shall be applied. The second rinse shall be collected and sampled for the decontamination criteria. Forklifts and tools used during the active life of the CSU shall be moved into the storage building and decontaminated in a similar fashion.

After completion of the initial two-rinse decontamination sequence, a subsequent rinse of hot water or steam followed by cold tap water shall be applied. These rinsates shall be collected and sampled for the decontamination criteria. No further decontamination efforts shall be undertaken until analytical results are received that indicate such actions are warranted. If the decontamination criteria are not being met, these steps shall be repeated. When the criteria are met, these items shall be transferred to the DRMO zone for re-utilization.

During the closure activities, workers shall wash down equipment and instruments, remove protective clothing, and undergo decontamination in this area on a daily basis. Entrance to or exit from the CSU during the closure activities shall occur through this zone. Upon completion of CSU decontamination efforts, all equipment shall be moved to this zone for final cleaning. The final cleaning shall be performed by steam cleaning followed by a tap water rinse.

After equipment decontamination, the outdoor portions of the CSU shall be demolished if necessary. Rubble shall be collected for disposal as non-hazardous solid waste.

Outdoor Storage Area Decontamination

After decontamination of the storage racks and operating equipment, the staging area and covered outdoor storage area shall be decontaminated. The curbs, pad surfaces, and containment basins of these areas shall be steam cleaned with water containing surfactant. If necessary, a vacuum nozzle attachment shall be fitted to the suction line to remove all freestanding liquids in the containment

APPENDIX A

areas. The entire area shall subsequently be rinsed with tap water that shall be collected and sampled as previously described.

In addition to the collection of rinsate samples, standard wipe samples for PCBs shall be taken in the staging area. Wipe samples for PCB contamination shall not be proposed for the outdoor storage pad because PCBs or PCB-contaminated items shall not be placed in that portion of the CSU. The sampling methodology proposed is the 7-point hexagonal grid technique delineated in *Verification of PCB Spill Cleanup by Sampling and Analysis, EPA 560/5-85-016*. The containment sump shall be sampled by a single wipe taken along each wall and the sump bottom.

If the decontamination criteria are met, no further closure action shall be taken in these areas. If the criteria are not met, the affected area shall be scuff sanded along the surfaces. All residues from the sanding shall be collected and disposed of as hazardous waste. After completion of this step, the area shall be rinsed with fresh tap water. The rinsate shall be collected and sampled for the decontamination criteria. If the violated criteria involved PCBs, wipe samples shall be taken in the same fashion as in the preceding step. This procedure shall be repeated until the criteria are met in the rinsate and wipe samples.

Indoor Storage Area Decontamination

The indoor storage area shall be decontaminated in a manner similar to that used for the outdoor portions of the CSU. The initial step in this decontamination cycle shall be swipe sampling of the cells used to sort PCB items and their associated sumps. After collection of the swipe samples, these cells shall be decontaminated by steam cleaning with a water surfactant mixture followed by a water rinse. The initial wash solution shall be collected for disposal as a Toxic Substances Control Act (**TSCA**) and RCRA regulated constituents. The second rinsate shall be sampled to verify that the decontamination criteria are met. If the decontamination criteria have been met in both the rinsate and swipe samples, further sampling for PCBs shall not be performed. If these criteria cannot be met, the surfaces of these cells and associated sumps shall be scarified by sanding, the residues shall be collected for TSCA/RCRA-regulated disposal, and the rinse step shall be repeated until decontamination has been achieved. After each cycle, both the swipe and rinsate sampling shall be repeated. The remaining portions of the building shall be decontaminated in a similar fashion.

Decontamination shall be performed step-wise for each cell and its associated sump by steam cleaning and rinsing as described above. If the criteria cannot be met, the second rinsate shall be disposed of, as hazardous waste and secondary decontamination by scarification and rinsing shall be performed in the affected cells or sumps. Rinsates that do not exceed the decontamination criteria shall be released to the sewer system.

APPENDIX A

Any grates, aisle spaces, or forklift ramps that are near a cell shall be decontaminated as a portion of that cell. CSU walls, to a height of 10 ft, shall also be considered a portion of the corresponding cell.

Groundwater Monitoring, Leachate Collection, and Run-on and Run-off Control

Because the CSU shall be clean closed and no hazardous waste or hazardous constituents shall remain on-site, groundwater monitoring, leachate collection, and run-on/run-off controls shall not be necessary. However, if HAFB cannot achieve clean closure of the CSU, groundwater detection monitoring shall be conducted, as required by 20.4.1.500 NMAC, incorporating 40 CFR §264.98.

Closure Plan Amendments

HAFB shall submit a written notification or request for a permit modification to authorize a change in operating plans, facility design, or the approved Closure Plan in accordance with the applicable procedures in 20.4.1 NMAC. The notification shall be submitted to NMED at least 60 days in advance of the proposed change and no later than 60 days after an unexpected event has occurred. The written notification or request shall include a copy of the amended Closure Plan for review and approval by NMED.

Closure Notification Requirements

HAFB shall notify NMED at least 45 days prior to the date that closure of the CSU shall begin.

Closure Schedule

The anticipated date of closure is 2011. This date is based on the expected service life of the CSU design. Closure of Holloman AFB and its tenant DRMO is not anticipated by this date as the Department of Defense components at Holloman AFB are an integral part of the defense system of the United States. Table K-1 presents a schedule for accomplishment of the closure action. The closure activities shall be completed within 180 days of receipt of the final volume of hazardous waste. If Holloman AFB is unable to complete closure activities in accordance with the approved closure plan and within 180 days, as stipulated under the regulations, an extension shall be requested from the NMED in accordance with 40 CFR §264.113(b).

Certification of Closure

After closure activities are completed, an independent professional engineer registered in the State of New Mexico shall certify the closure. This engineer shall be provided access to the Closure Plan, the site during the closure activities, and all analytical results. Certification of closure of the CSU shall be provided to NMED by registered mail or hand delivered within 60 days of completion. The

APPENDIX A

closure certification for the CSU shall document that no hazardous wastes or hazardous constituents remain on the site, based upon the laboratory analytical results of soil samples taken from the Unit.

POST CLOSURE PLAN

A post-Closure Plan shall not be needed because the permit application only addresses a CSU. All wastes shall be removed, and the storage areas shall be decontaminated upon closure. However, if HAFB cannot clean close the CSU or cannot demonstrate equivalency closure, the Facility shall be subject to post-closure permitting requirements.

TABLE K-1: Schedule for Closure of the KAFB Container Storage Unit

Step	Action	Day Completed
1	Closure notice	-15
2	Receipt of final waste volume	0
3	Conduct final inventory, inspect, and repackage for shipment	30
4	Remove all waste for disposal or reclamation	60
5	Initial outdoor drum rack decontamination and verification sampling	60
6	Initial equipment decontamination and verification sampling	65
7	Receipt of analytical results (Step 7)	85
8	Secondary decontamination of equipment and storage racks[a]	90
9	Initial decontamination of outdoor storage areas/verification sampling	90
10	PCB sampling of storage building	90
11	Initial PCB decontamination of storage building/verification sampling	100
12	Receipt of analytical results (Step 9)	110
13	Receipt of analytical results (Step 10 and 11)	105
14	Secondary decontamination of outdoor areas[a]	115
15	Secondary PCB decontamination in storage building[a]	120
16	Initial decontamination of storage building/verification sampling	130
17	Begin soil sampling	135
18	Complete soil sampling	150
19	Receipt of analytical results (Step 16)	150
20	Secondary decontamination of storage building[a]	155
21	Receipt of soil sample results	165
22	Soil excavation[a]	170
23	Demolition/equipment decontamination	175
24	Shipment of closure residuals	180
25	Certification	240

Notes:
[a]If required

APPENDIX A

PCB = Polychlorinated biphenyl

APPENDIX A

Table Ci-1
Major Waste Categories and Parameters of Concern

Process Generating Waste	Waste Generated	Basis for Hazard Classification	Parameters for Analyses and EPA Waste Codes[1]	LDR (WW or NWW)	Current Analytical Test Method[2]
Paint-Related Operations Locations: 49th Civil Engineer Squadron 49th Transportation Squadron 49th Services Squadron German Air Force Hazmart 49th Maintenance Squadron 846th Test Squadron 46th Test Group DynCorp 49th Materiel Maintenance Squadron Newtec 8th Fighter Squadron 9th Fighter Squadron	Waste paint and thinner (C, I, T, listed)	Historical test data, MSDS, Knowledge of Process (KOP)	Cadmium (D006), lead (D008), chromium (D007), selenium (D010), solvents (VOCs and SVOCs), ignitability (D001), corrosivity (D002)	NWW	SW8260, SW8270, SW6010 or 7000 Series, SW-846 1010/1020, SW9040
	Respirator and booth filter elements (T)	Historical test data	Cadmium (D006), chromium (D007), silver (D011)	NWW	SW6010 or 7000 Series
	Spent alodine from painting (C,T)	Historical test data	Chromium (D007), corrosivity (D002)	NWW	SW6010 or 7000 Series, SW9040
	Rags and debris contaminated with paint wastes and solvents (I, T, listed)	Historical test data, KOP	Cadmium (D006), chromium (D007), lead (D008), solvents (VOCs and SVOCs), ignitability (D001)	NWW	SW8260, SW8270, SW7000 series, SW8240, SW-846 1010/1020 or 1030

[1] RCRA hazardous constituents and/or properties.
[2] These analyses are suggested given the properties of the waste; however, other analytical methods may be substituted or included as deemed appropriate.
[3] Medical wastes are discarded commercial products and are known to be regulated based on their initial composition. No further analysis is required.

C = corrosive
I = ignitable
T = toxic
R = reactive
Listed = listed waste

APPENDIX A

Table Ci-1
Major Waste Categories and Parameters of Concern (Cont.)

Process Generating Waste	Waste Generated	Basis for Hazard Classification	Parameters for Analyses and EPA Waste Codes[1]	LDR (WW or NWW)	Current Analytical Test Method[2]
Aircraft, Vehicle, and Equipment Maintenance Operations Locations: Gas Station 49th Civil Engineer Squadron 49th Transportation Squadron 49th Services Squadron German Air Force DynCorp 49th Maintenance Squadron Newtec 9th Fighter Squadron 8th Fighter Squadron 49th Materiel Maintenance Squadron Newtec 846th Test Squadron	Fuel filters and absorbent (I, T)	KOP, Historical test data	Cadmium (D006), benzene (D018), ignitability (D001)	NWW	SW8260, SW8270, SW6010 or 7000 Series, SW-846: 1010/1020
	Parts cleaning sludge (I,T)	Historical test data	Cadmium (D006), chromium (D007), lead (D008), ignitability (D001)	NWW	SW8260, SW8270, SW6010 or 7000 Series, SW-846 1010/1020
	Spent solvent from parts cleaning and equipment maintenance (I,T, listed)	Historical test data	Lead (D008), chromium (D007), solvents (VOCs and SVOCs), ignitability (D001)	NWW	SW8260, SW8270, SW6010 or 7000 Series, SW-846 1010/1020
	Dirty rags with solvents, oil, and grease (I, T, listed)	Historical test data, KOP, MSDS	Cadmium (D006), lead (D008), chromium (D007), benzene (D018), solvents (VOCs and SVOCs), ignitability (D001)	NWW	SW8260, SW8270, SW6010 or 7000 Series, SW-846 1010/1020
Photographic Equipment Cleaning Operations Locations: Newtec 846th Test Squadron Newtec	Rags with solvent (I, T, listed)	Historical test data, KOP	Cadmium (D006), solvents (VOCs and SVOCs), ignitability (D001)	NWW	SW8260, SW8270, SW6010 or 7000 series, SW-846 1010/1020

[1] RCRA hazardous constituents and/or properties.
[2] These analyses are suggested given the properties of the waste; however, other analytical methods may be substituted or included as deemed appropriate.
[3] Medical wastes are discarded commercial products and are known to be regulated based on their initial composition. No further analysis is required.

C = corrosive
I = ignitable
T = toxic
R = reactive
Listed = listed waste

APPENDIX A

Table Ci-1
Major Waste Categories and Parameters of Concern (Cont.)

Process Generating Waste	Waste Generated	Basis for Hazard Classification	Parameters for Analyses and EPA Waste Codes[1]	LDR (WW or NWW)	Current Analytical Test Method[2]
Miscellaneous Organic Liquids Locations: Hazmart	Expired or off-specification material (C, I, T, listed)	MSDS, Historical test data	Ignitability (D001), corrosivity (D002), metals, solvents (VOCs and SVOCs)	NWW	SW8260, SW8270, SW6010 or 7000 Series, SW9040, SW-846 1010/1020
Metal Cutting Operations Locations: DynCorp 846th Test Squadron	Rags and debris with oil and metals (C, I, T, listed)	Historical test data, KOP	Cadmium (D006), lead (D008), chromium (D007), selenium (D010), solvents, ignitability (D001), corrosivity (D002)	NWW	SW8260, SW8270, SW6010 or 7000 Series, SW-846 1010/1020, SW9040
Medical Operation Locations: 49th Medical Support Squadron 49th Aeromedical Dental Squadron	Expired or off-specification epinephrine or other medical waste (R, Acutely T)	MSDS	Acute toxicity, sodium cyanide, phosphorous (reactivity)	NWW	NA[3]
Weapons Maintenance Operation Locations: 49th Security Forces Squadron 49th Maintenance Squadron DynCorp German Air Force	Rags and debris with solvent and lead (I, T, Listed)	Historical test data	Lead (D008), ignitability (D001), solvents	NWW	SW8260, SW8270, SW6010 or 7000 Series, SW-846 1010/1020

[1] RCRA hazardous constituents and/or properties.
[2] These analyses are suggested given the properties of the waste; however, other analytical methods may be substituted or included as deemed appropriate.
[3] Medical wastes are discarded commercial products and are known to be regulated based on their initial composition. No further analysis is required.

C = corrosive
I = ignitable
T = toxic
R = reactive
Listed = listed waste

APPENDIX A

Ta .i-1

Major Waste Categories and Parameters of Concern (Cont.)

Process Generating Waste	Waste Generated	Basis for Hazard Classification	Parameters for Analyses and EPA Waste Codes[1]	LDR (WW or NWW)	Current Analytical Test Method[2]
Facility Maintenance Operations	Spent fluorescent bulbs - crushed (T)	Historical test data	Mercury (D009), cadmium (D006), lead (D008)	NWW	SW6010 or 7000 Series
Locations: 90-Day Facility-49th Civil Engineer Squadron Hazmart	Bulb crusher filter element (T)	Historical test data	Mercury (D009), cadmium (D006), lead (D008)	NWW	SW6010 or 7000 Series
	Spent batteries such as Ni-Cad used in emergency lighting systems (C, T)	MSDS	Cadmium (D006), lead (D008), corrosivity (D002)	NWW	NA
Potential New Wastes Locations: Received from off-site generators	Various wastes, similar to those described above, generated from surrounding federal facilities.	Generator provided analytical data and/or process knowledge	See appropriate sections of Table Ci-1	See appropriate sections of Table Ci-1	See appropriate sections of Table Ci-1

[1] RCRA hazardous constituents and/or properties.
[2] These analyses are suggested given the properties of the waste; however, other analytical methods may be substituted or included as deemed appropriate.
[3] Medical wastes are discarded commercial products and are known to be regulated based on their initial composition. No further analysis is required.

C = corrosive
I = ignitable
T = toxic
R = reactive
Listed = listed waste

APPENDIX A

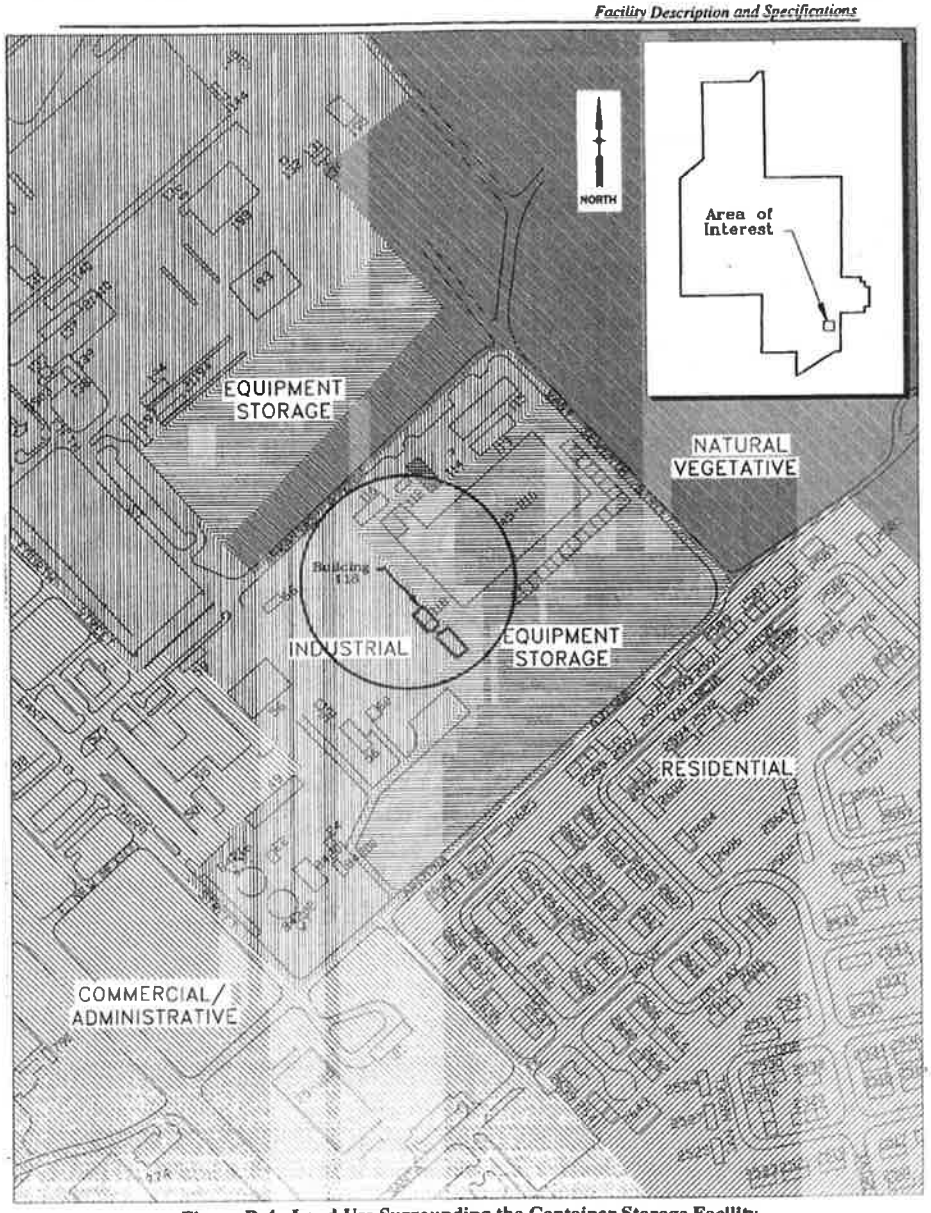
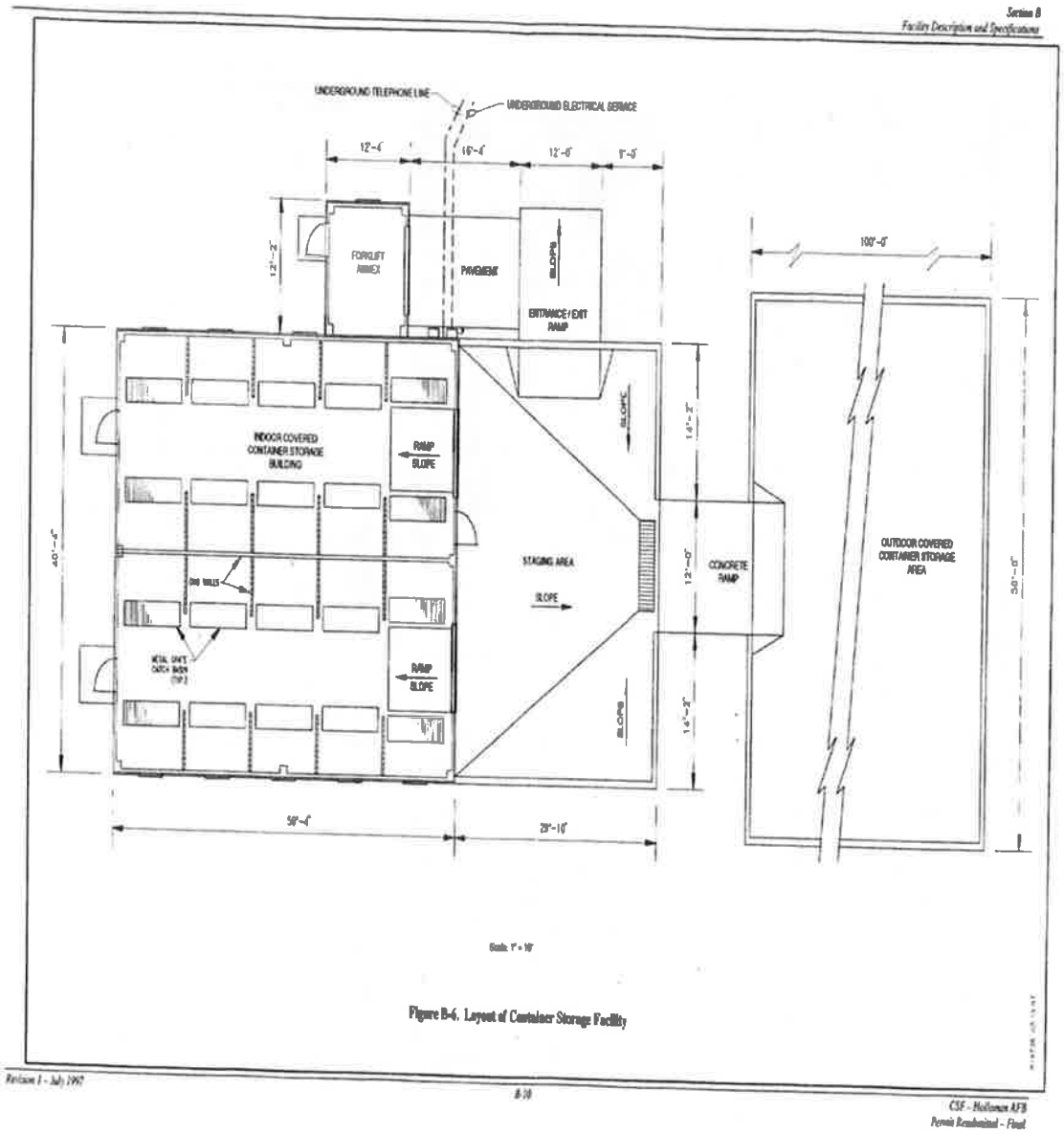


Figure B-4. Land Use Surrounding the Container Storage Facility

APPENDIX A


Section B
Facility Description and Specifications
UNDERGROUND TELEPHONE LINE
UNDERGROUND ELECTRICAL SERVICE
12'-6"
16'-6"
12'-0"
9'-0"
12'-2"
FORKLIFT ANNEX
PAVEMENT
SLOPE
ENTRANCE / EXIT RAMP
100'-0"
INDOOR COVERED CONTAINER STORAGE BUILDING
RAMP SLOPE
SLOPE
14'-3"
40'-6"
STAGING AREA
SLOPE
12'-0"
CONCRETE RAMP
OUTDOOR COVERED CONTAINER STORAGE AREA
56'-0"
RAMP SLOPE
SLOPE
14'-3"
50'-6"
29'-10"
Figure B-6. Layout of Container Storage Facility
Revision 1 - July 1997
B-10
CSF - Holloman AFB
Permit Resubmittal - Final

APPENDIX A

CLOSURE PLANOGRAPH
BUILDING 118, INSIDE STORAGE

CORROSIVE	CORROSIVE								
CO	CO								
BO	BO	FLAM	FLAM	FLAM	FLAM	CORR.ACID	CORR.ACID	CORR.BASE	CORR.BASE
AO	AO	AO	AO	AO	AO	AO	AO	AO	AO
O1	O2	O3	O4	O5	O6	O7	O8	O9	10

FLAM	FLAM	FLAM	FLAM	WATERREA	WATERREAC	PCB	OXID
AO	AO	AO	AO	AO	AO	AO	AO
18	17	16	15	14	13	12	11
FLAM	FLAM	FLAM	FLAM	FLAM	FLAM	CORR.ACID	CORR.ACID
CO	CO	CO	CO	CO	CO	CO	CO
BO	BO	BO	BO	BO	BO	BO	BO
AO	AO	AO	AO	AO	AO	AO	AO
19	20	21	22	23	24	25	26

FLAM	FLAM	TOXIC	TOXIC	OXID	OXID	CORR.BASE	CORR.BASE
CO	CO	CO	CO	CO	CO	CO	CO
BO	BO	BO	BO	BO	BO	BO	BO
AO	AO	AO	AO	AO	AO	AO	AO
34	33	32	31	30	29	28	27

DEFENSE LOGISTICS AGENCY
DISPOSITION SERVICES
74 WASHINGTON AVENUE NORTH
BATTLE CREEK, MICHIGAN 49037-3092

APR 19 2013

MEMORANDUM FOR CONTRACTING OFFICER, AFCEC/CFSN, JBSA LACKLAND, TX

SUBJECT: Defense Logistics Agency (DLA) Disposition Services Holloman Conforming Storage Unit (CSU) Closure

1. In conjunction with AFCEC projects at Holloman AFB, DLA and Holloman AFB will supply the following support:

a. Provide a staging area at Holloman AFB. The security of equipment and supplies shall be the contractor's responsibility.

b. Provide assistance to the contractor in obtaining existing engineering plans, drawings, etc. to facilitate work.

c. Coordinate access to the required facilities within the appropriate area. Contractor will provide site employee names, dates of birth, and driver's license numbers for all persons requiring access.

d. The contractor will obtain a blank digging permit. Contractor shall contact all of the offices listed on the permit for utility locations.

e. Restoration of damaged property or equipment is the responsibility of the contractor to restore to previous conditions.

If you have any questions, or require additional information, you may contact John Hamann, Holloman AFB at (575) 572-6644 or by email John.Hamann@holloman.af.mil or Ronald Scherer, DLA Installation Support at Battle Creek at (269) 961-5911 or by email Ron.Scherer@dla.mil.

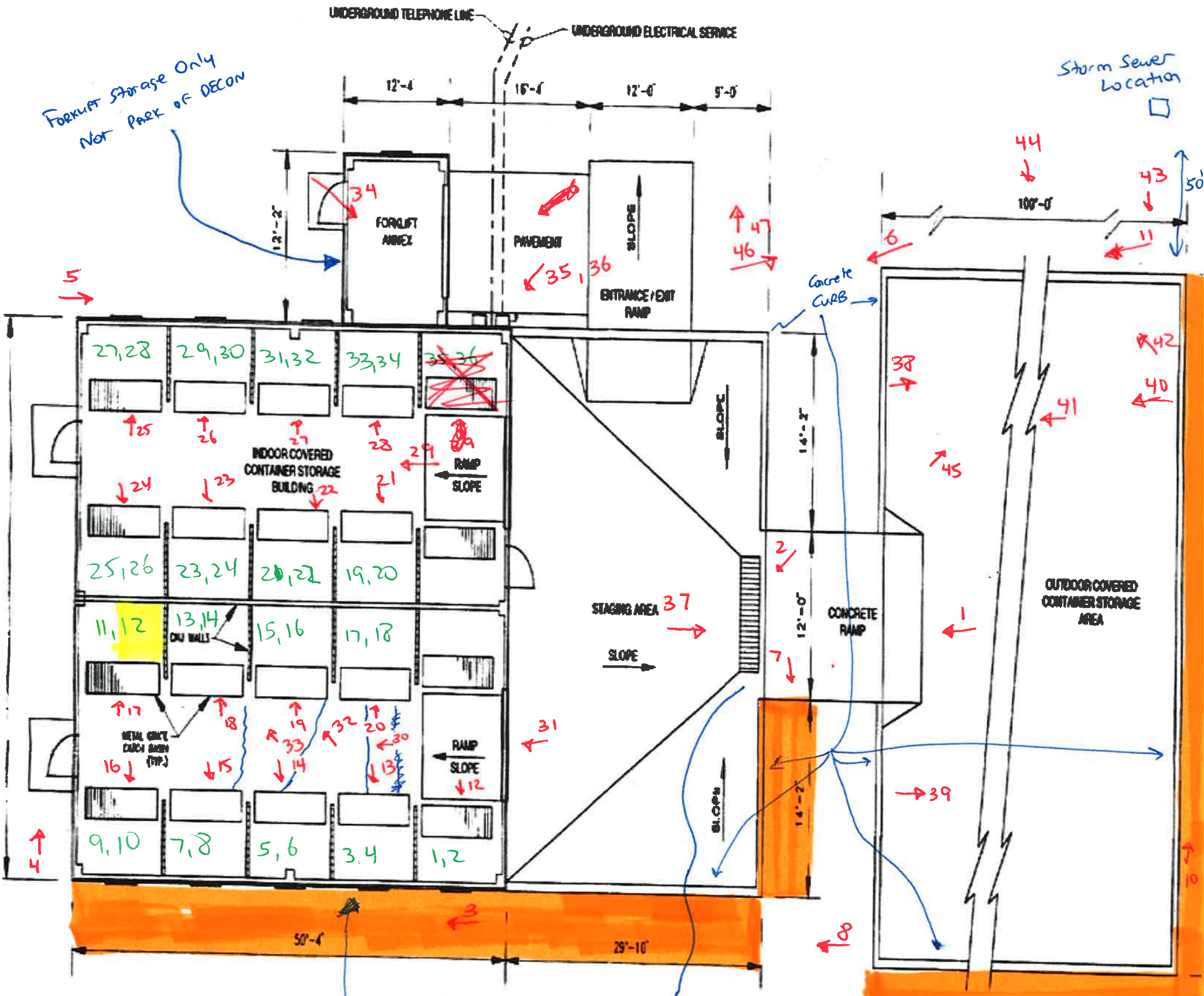
DEAN P. NEWSOME
Site Director
DLA Installation Support
at Battle Creek

ATTACHMENT B: Site Inspection Photograph Log

Photo Log

Photo Number	Description (note: locations and direction of photos appear on the Site Map in red)
1	Indoor CSU Facility (view from the south, looking north)
2	Close-up of the drain on south side of CSU Facility
3	West side of Indoor CSU Facility (view from the south)
4	North side of Indoor CSU Facility (view from the west)
5	East side of Indoor CSU Facility (view from the north)
6	East side of Indoor CSU Facility (view from the south)
7	South side of Indoor CSU Facility (view from the east)
8	West side of Indoor CSU Facility (view from the south at NW corner of the Outdoor CSU Facility)
9	West side of Indoor CSU Facility (view from the south)
10	South side of Outdoor CSU Facility (view from the west)
11	East side of Outdoor CSU Facility (view from the south, southeast)
12	Bays 1,2
13	Bays 3,4
14	Bays 5,6
15	Bays 7,8
16	Bays 9/10
17	Bays 11/12 (Bay 12 contained PCB wastes)
18	Bays 13/14
19	Bays 15/16
20	Bays 17/18
21	Bays 19/20
22	Bays 21/22
23	Bays 23/24
24	Bays 25/26
25	Bays 27/28
26	Bays 29/30
27	Bays 31/32
28	Bays 33/34
29	Eastern half of Indoor CSU Facility
30	Cracks in floor of Indoor CSU Facility
31	Uneven slabs and patched gaps in floor of Indoor CSU Facility
32	Close-up of cracks
33	Close-up of cracks
34	Interior of Forklift Annex (not part of the decontamination effort)
35	Water and electric source area
36	Close-up of water/electric sources)
37	Outdoor CSU Facility (view from the north)

38	Eastern half of Outdoor CSU Facility (view from the north)
39	Western half of Outdoor CSU Facility (view from the north)
40	Closer view of storage racks
41	Eastern half of Outdoor CSU Facility (view from the south)
42	Eastern half of Outdoor CSU Facility (view from the south, southwest)
43	Close-up of materials along southeast end of Outdoor CSU Facility
44	Close-up of materials along north end of Outdoor CSU Facility
45	Close-up of outdoor racks
46	Storm sewer drain located adjacent to SE corner of Outdoor CSU Facility
47	Staging area for racks/pallets east of Outdoor CSU Facility



Drain is estimated to be 8' DEEP 6' ~~WIDE~~ LONG 2' WIDE ≈ (720 gallons)

Scale: 1" = 10

BAY ID's

PHOTO's

Cracks In Flooring

Soil Cover - Remainder Is Ashalt on Concrete

Figure B-6. Layout of Container Storage Facility

BAY CONTAINING PCB Waste

281
DANGER
NO SMOKING
NO OPEN FLAMES

ENTRADA
PERSONAS
AUTORIZACI

DANGER
DANGER
UNAUTHORIZED PERSONNEL KEEP OUT
SE PROHIBE ENTRADA DE PERSONAS SIN AUTORIZACION

HO102

USED

CAUTION
CORROSIVE
BASE
STORAGE
AREA
C
B
1
2
5300 LBS
MAXIMUM
WEIGHT

03
04
3
4
PROPERTY
OF BUSINESS DEV

05
06
5
6

SPILL
CONTROL
PALLET

SPILL
CONTROL
PALLET
9
SPILL
CONTROL
PALLET
10

11
12

WATER
REACTIVE
STORAGE
AREA
W
13
14

DANGER
FLAMMABLE STORAGE
NO SMOKING OR OPEN FLAMES ALLOWED
15
16

17
18
DANGER
FLAMMABLE
STORAGE
NO SMOKING OR
OPEN FLAMES ALLOWED
17
18

DANGER
FLAMMABLE
STORAGE
NO SMOKING OR
OPEN FLAMES ALLOWED
19
20
B
A
C

STORAGE
NO SMOKING OR
OPEN FLAMES ALLOWED
21
B
22

FLAMMABLE
STORAGE
NO SMOKING OR
OPEN FLAMES ALLOWED
C
23
24
23
B
24
A

CORROSIVE
ACID
STORAGE
AREA
25
B
A

CORROSIVE
BASE
STORAGE
AREA
27
B
28
A

29
B
30
A

CAUTION
POISON
TOXIC
CHEMICAL
STORAGE
AREA
CAUTION
OXIDIZER
STORAGE
AREA
C
B
A
31
32

DANGER
FLAMMABLE STORAGE
NO SMOKING OR OPEN FLAMES ALLOWED
C
33
B
34
A

7
15

AIRSEAL
STOUT
STOUT

PELIGRO
SE PROHIBE ENTRADA DE
PERSONAS SIN AUTORIZACION
DEPOSITOS
DE ALMACENAMIENTO
DESHECHOS
NO FUMAR
NO USA NINGUNA
CLASE DE FUEGO

H0101
H0102

H0101

H0102

USED
OIL
USED
OIL
#2
294-A-048

DRMOPROP
FASTPAY
SAFETY
EMPTY

DRMOPROP
USED
OIL

FAIRBANKS

DRAFT FINAL

FIELD SAMPLING PLAN

FOR

RCRA FACILITY CLOSURE
HAZARDOUS WASTE CONTAINER STORAGE UNIT FACILITY
(SWMU #75)
HOLLOMAN AFB, NEW MEXICO

Prepared For

Air Force Civil Engineer Center (AFCEC)
and
Holloman Air Force Base

Prepared By

112 East Pecan Street, Suite #400
San Antonio, Texas 78205

Contract Number: FA8903-08-D-8770
Task Order: 0281
Project: 80001Y0000

December 2013

DRAFT FINAL

FIELD SAMPLING PLAN

FOR

RCRA FACILITY CLOSURE
HAZARDOUS WASTE CONTAINER STORAGE UNIT FACILITY
(SWMU #75)
HOLLOMAN AFB, NEW MEXICO

Prepared For

Air Force Civil Engineer Center (AFCEC)
and
Holloman Air Force Base

Prepared By

AECOM
112 East Pecan Street, Suite #400
San Antonio, Texas 78205

Contract Number: FA8903-08-D-8770
Task Order: 0281
Project: 80001Y0000

December 2013

TABLE OF CONTENTS

Section **Page No.**

1 INTRODUCTION 1-1
1.1 SITE DESCRIPTION AND HISTORY 1-1
1.2 SOURCES OF POTENTIAL CONTAMINANTS 1-1

2 ENVIRONMENTAL SAMPLING SCOPE AND OBJECTIVES 2-1

3 FIELD ACTIVITIES 3-1
3.1 RINSATE SAMPLING AND DISPOSAL 3-1
3.2 SOIL SAMPLING 3-1
3.2.1 Concrete Coring 3-2
3.2.2 Soil Sample Handling 3-2
3.3 PCB WIPE SAMPLING 3-2
3.4 FIELD QUALITY CONTROL SAMPLES 3-3

4 SAMPLE CUSTODY, HANDLING, AND SHIPPING 4-1
4.1 SAMPLE IDENTIFICATION 4-1
4.2 SAMPLE CUSTODY PROCEDURES 4-1
4.2.1 Chain-of-Custody Record 4-1
4.2.2 Transfer of Custody 4-1
4.3 SAMPLE HANDLING 4-2
4.4 SAMPLE PACKAGING AND SHIPPING 4-2

5 INVESTIGATION DERIVED WASTE 5-1

6 REFERENCES 6-1

LIST OF FIGURES

Figure 1-1: Holloman Air Force Base Map
Figure 1-2: Site Location and Vicinity Map
Figure 1-3: CSU Map
Figure 3-1: Sampling Location Map

LIST OF TABLES

Table 3-1: Sampling QC Requirements
Table 3-2: Rinsate Sample Storage Requirements
Table 3-3: Solid Storage Requirements

LIST OF ATTACHMENTS

ATTACHMENT A: Major Waste Categories and Parameters of Concern
ATTACHMENT B: Standard Operating Procedures

ACRONYMS AND ABBREVIATIONS

AECOM	AECOM Technical Services, Inc.
AFB	Air Force Base
CoC	chain-of-custody
COLIWASA	composite liquid waste sampler
CSU	container storage unit
DLA	Defense Logistics Agency
FSP	Field Sampling Plan
ICP-MS	Inductively coupled mass spectrometry
IDW	investigation derived waste
MS/MSD	matrix spike/matrix spike duplicate
MCL	maximum contamination level
NMED	New Mexico Environment Department
NMWQC	New Mexico Water Quality Control Commission
PCB	polychlorinated biphenyl
QAPP	Quality Assurance Project Plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
SOP	Standard Operating Procedure
TCLP	toxicity characteristic leaching procedure
TSCA	Toxic Substances Control Act
USEPA	United States Environmental Protection Agency

1 INTRODUCTION

This field sampling plan (FSP) provides the scope, objectives, field activities and Standard Operating Procedures (SOPs) that will be implemented during the Resource Conservation and Recovery Act (RCRA) Facility Closure of a hazardous waste container storage unit (CSU) (SWMU #75) located at Holloman Air Force Base (AFB), New Mexico (See Figure 1-1 and Figure 1-2). The CSU Facility consists of an indoor covered building (Building 118), a staging area, and an outdoor covered area (See Figure 1-3).

The work is being performed by AECOM Technical Services, Inc. (AECOM) for the Air Force Civil Engineer Center, Department of the Air Force /772D Enterprise Sourcing Squadron /PKA under 4PAE08 Contract Number FA8903-08-D-8770, Task Order 0281, Project 80001Y0000. This FSP is a supplement to the AECOM Draft Final Work Plan (AECOM, 2013a), which includes project background, purpose and scope, organization, schedule; and other project details.

1.1 SITE DESCRIPTION AND HISTORY

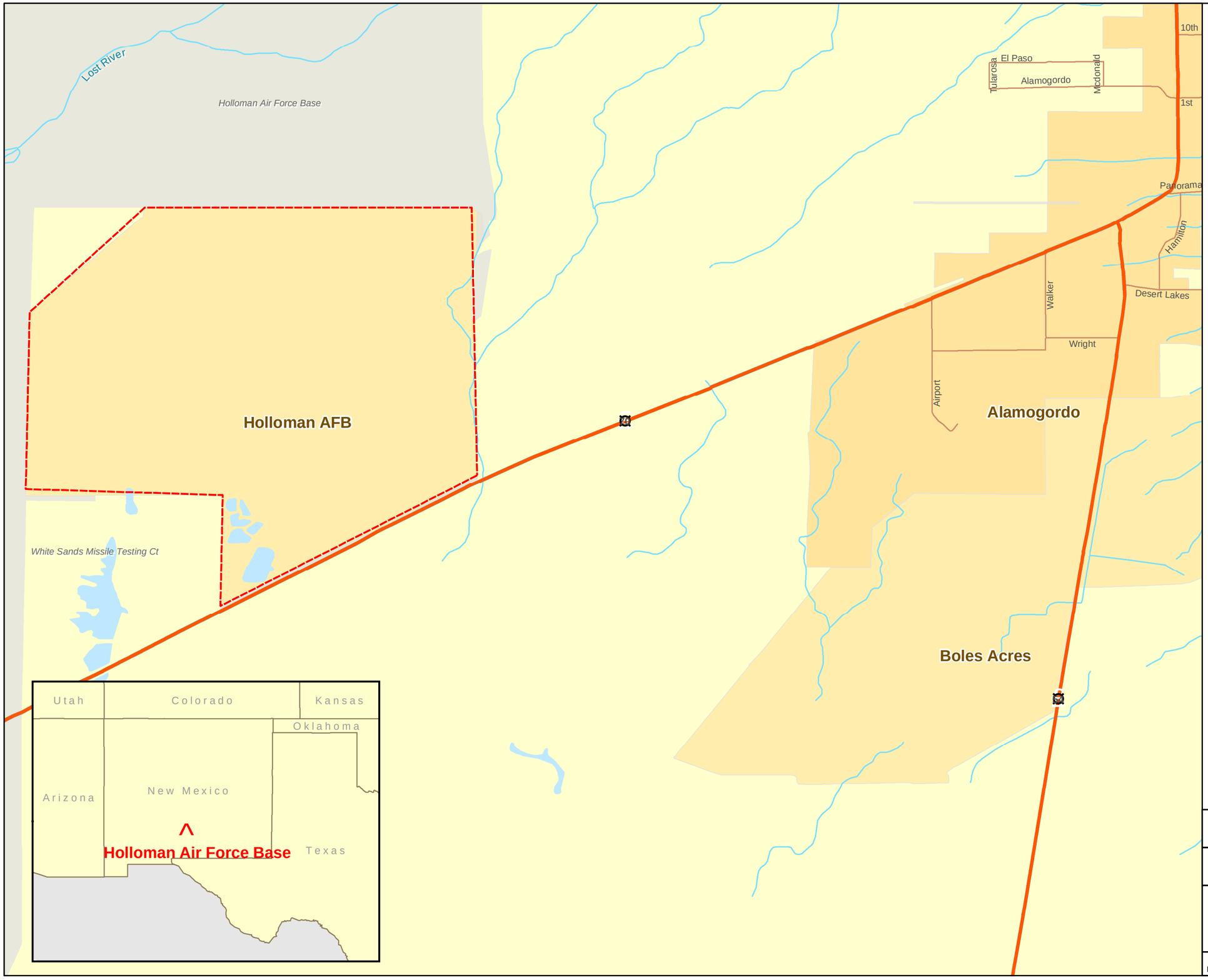
Holloman AFB is located on approximately 59,827 acres of land about seven miles west of the city of Alamogordo, Otero County, in south central New Mexico. Base activities necessitated the use of a variety of products to maintain and repair aircraft and aerospace ground equipment, as well as base structures and roads thus generating wastes classified as hazardous waste under RCRA due to exhibiting characteristics of ignitability, corrosivity, reactivity, toxicity, or conforming to the definition of listed waste under 40 CFR Part 26, Subpart D.

The CSU Facility is located on the east side of the base, approximately 1,400 feet inside the eastern boundary on roughly 400,000 square feet of land designated for use by the Defense Logistics Agency (DLA) Disposition Service (Holloman AFB tenant). As seen in Figure 1-3, the CSU Facility consists of an indoor covered building (Building 118), a staging area, and an outdoor covered area. The was permitted by the New Mexico Environment Department (NMED) to allow for storage of hazardous waste in as many as 788 55-gallon drums or equivalent (43,340 gallons) including Toxic Substances Control Act (TSCA) regulated materials, wastes, and equipment containing polychlorinated biphenyls (PCBs).

Holloman AFB and the DLA have determined that the CSU Facility has reached the end of its intended operational life. Presently, the Facility no longer accepts hazardous waste, and all stored hazardous waste containers and hazardous materials – including PCB-containing equipment, materials, and wastes – have been removed.

1.2 SOURCES OF POTENTIAL CONTAMINANTS

Table Ci-1 within Appendix A of the Statement of Work presents Major Waste Categories and Parameters of Concern (See Attachment A).



Legend

Holloman AFB

Miles

0 0.5 1 2

U.S. AIR FORCE

RCRA Facility Closure

Holloman Air Force Base

AECOM

AECOM Technical Services, Inc.
112 East Pecan, Suite 400
San Antonio, TX 78205
www.aecom.com
TBPE Reg. No. F-3580

Date	September 2013	Project	60304917	Figure	1-1

Legend

- CSULocation
- Sanitary Sewer Junction Point
- HollomanAFB

Feet
0 100 200 400

U.S. AIR FORCE

RCRA Facility Closure

Site Location and Vicinity map

AECOM

AECOM Technical Services, Inc.
112 East Pecan, Suite 400
San Antonio, TX 78205
www.aecom.com
TBPE Reg. No. F-3580

Date	Project	Figure
September 2013	60304917	1-2

Legend

CSU Location

Holloman AFB

Feet

0 25 50 100

U.S. AIR FORCE

RCRA Facility Closure

CSU Map

AECOM

AECOM Technical Services, Inc.
112 East Pecan, Suite 400
San Antonio, TX 78205
www.aecom.com
TBPE Reg. No. F-3580

Date	Project	Figure
September 2013	60304917	1-3

2 ENVIRONMENTAL SAMPLING SCOPE AND OBJECTIVES

The primary objective of this project is to obtain clean closure of the CSU Facility at Holloman AFB, New Mexico. This will be accomplished by defining the nature and extent, if any, of contamination at the CSU Facility.

Contamination of site media could have resulted from the movement or storage of waste within the CSU. The planned characterization of theoretical contamination at the CSU includes:

- The collection of detergent wash water and rinse water (i.e., rinsate);
- Soil sampling around the Facility;
- PCB wipe sampling; and
- Off-site laboratory analysis.

All rinsate will be collected, segregated and moved to polyethylene holding tanks by using portable sump pumps and associated equipment. The water from each holding tank will be sampled and characterized, then properly disposed. A soil assessment of the area surrounding the CSU Facility will be performed using hand auger drilling method. Surface and subsurface soil samples will be collected from up to 19 locations surrounding the CSU Facility. Wipe samples for PCB contamination will be collected from Bay 11 and 12 of the indoor storage facility. The containment sump under the two Bays will also be sampled. Details on the execution of the field sampling effort are described in Section 3, Field Activities.

3 FIELD ACTIVITIES

This section details the execution of field activities including the basis and approach for sampling at the CSU Facility in order to meet the sampling objectives previously discussed in Section 2. Specific sampling discussed in this section includes rinsate sampling, surface and subsurface soil sampling, and PCB wipe sampling. Detailed procedures, techniques, and required equipment are outlined in Attachment B within applicable SOPs for the planned field activities. All sampling activities will adhere to SOP - 1, *Sample Collection, Handling and Custody* (See Attachment B).

3.1 RINSATE SAMPLING AND DISPOSAL

The rinsate from each of the four cleaning phases (initial wash and rinse; second, third, and final rinse) will be segregated and moved to four separate polyethylene tanks (labeled appropriately) using portable sump pumps and associated equipment for sampling, analysis and characterization. Two composite samples will be collected from the rinsate from each of the tanks using a glass thief or composite liquid waste sampler (COLIWASA), for a total of eight composite rinsate samples (See Table 3-1). The glass thief method provides a quick, relatively inexpensive means of collecting liquid wastes, while the COLIWASA permits the representative sampling of wastes having a wide range of viscosity, corrosivity, volatility, and solids content. Both methods are outlined in SOP - 2, *IDW Management and Sampling* (See Attachment B). The samples will be handled as specified in Table 3-2 and Section 4.

Rinsate samples will be analyzed for PCBs, volatiles, semi-volatiles, target analyte list 24 metals, and pesticides against New Mexico Water Quality Control Commission (NMWQC) groundwater standards for contaminants per 20.6.2.3103 New Mexico Administrative Code and United States Environmental Protection Agency's (USEPA's) National Primary Drinking Water Standards maximum contamination level (MCL) criteria. Rinsate not exceeding NMWQC/MCL criteria will be disposed of in a sanitary sewer adjacent to the outdoor storage facility (See Figure 1-2).

If rinsate exceeds NMWQC/MCL standards, it will be analyzed by the toxicity characteristic leaching procedure (TCLP) for volatiles, semi-volatiles, RCRA 8 metals, Flashpoint, reactive cyanide/sulfide, pesticides, herbicides, and pH against TSCA/RCRA criteria. Rinsate not exceeding TSCA/RCRA criteria will be disposed of off-site as non-hazardous waste by a subcontractor managed by AECOM, as outlined in the Work Plan (AECOM, 2013a). Rinsate exceeding TSCA/RCRA criteria will be disposed of off-site as hazardous waste by the subcontractor.

A single sample of the onsite source wash/rinse water (rinsate blank) will be taken and analyzed to serve as a baseline to be referred to during sample analysis.

3.2 SOIL SAMPLING

A soil assessment of the area surrounding the CSU Facility will be performed to verify that hazardous constituents have not migrated from the facility during its active life. Surface and subsurface soil samples will be collected at 19 locations surrounding the CSU Facility, approximately one foot from the curbing (See Figure 4-1). Three equally-spaced sets of soil samples shall be taken along each side of the indoor storage facility, two sets of soil samples shall be taken along the exterior sides the staging area, and three equally-spaced sets of samples shall be taken along each exterior side of the outdoor storage area. Each soil sample collection shall consist of a spoon- or trowel-collected surface-level sample and a soil boring extending to a depth of three feet below ground surface using the hand auger drilling method. Each soil log shall be composited at one-foot intervals; and two duplicates, one matrix spike/matrix spike duplicate (MS/MSD), and one equipment blank shall be collected at each of the 19 borings, for a total of 24 soil samples (See Table 3-1).

Detailed surface and subsurface soil sampling procedures are outlined in SOP - 3, *Collection of Soil Samples* (See Attachment B); and sampling will follow the techniques described in Characterization of Hazardous Waste Sites – a Methods Manual: Volume II (United States Environmental Protection Agency [USEPA], 1984), A Compendium of Superfund Field Operations Methods (USEPA, 1987), and Preparation of Soil Sampling Protocols: Sampling Techniques and Strategies, EPA/600/R-92/128 (USEPA, 1992a).

Soil samples will be shipped to an off-site laboratory and analyzed for NMED Soil Screening Level (NMED, 2006) constituents as outlined in the Quality Assurance Project Plant (QAPP) (AECOM, 2013b), to include the following: PCBs, volatiles, semi-volatiles, pesticides, mercury, and inductively coupled mass spectrometry (ICP-MS) Target Analyte List metals. If the decontamination criteria cannot be met, the surrounding soils shall be excavated to the indicated depth and replaced with clean fill material. If excavation is required in an area, a second coring shall be taken at the width of the excavation zone. Detecting contamination at depths below three feet is extremely unlikely; however, soils in the affected area shall be sampled and excavated at one-foot intervals in the event that such contamination is evident. Each one-foot increment shall be analyzed for constituents of concern. If necessary, additional depth samples shall be taken until a “no contamination” level is established.

3.2.1 Concrete Coring

Coring of concrete and/or asphalt will be required at some soil boring locations and will be achieved using a concrete wet core drill operated by AECOM personnel (See Figure 4-1). The removed concrete cores will be placed back into the removed location and sealed with concrete polymer patching or the available equivalent. For locations where the asphalt was cored, asphalt patch material or the available equivalent will be used to backfill the cores and will be compacted using hand tools.

Excess soils generated during hand augering of borings will be placed back into each respective borehole in the reverse order in which they are generated; therefore, no soil IDW generation is anticipated.

3.2.2 Soil Sample Handling

Soil samples shall be handled in such a way as to minimize the loss of volatiles by using method 5035. Soil samples will be collected by Terra Core® samplers for SW8260. Table 3-3 outlines the required sample containers, preservation, and holding times for solid samples. Only sampling equipment constructed of materials that are compatible with the waste and not susceptible to reactions that might alter or bias the physical or chemical characteristics of organic and inorganic wastes shall be used. Any samples or cuttings suspected to be hazardous because of abnormal color or odor shall be containerized in conformance with TSCA/RCRA, NMED, and local requirements. Sampling personnel will be knowledgeable of and have experience with the sampling techniques and use the safety precautions as given in the safety plans.

General sample handling, documentation, and quality assurance/quality control (QC) requirements are outlined in Section 4, and in SOP - 1, *Sample Collection, Handling and Custody* (See Attachment B).

3.3 PCB WIPE SAMPLING

To evaluate the effectiveness of decontamination procedures, confirmation wipe samples for PCB contamination will be collected from the walls, floor, and sump surrounding Bay 11 and 12 of the indoor storage facility following the four-step decontamination process. Wipe samples will not be collected from the outdoor storage area since PCBs or PCB-contaminated items were not placed in that portion of the CSU Facility. The sampling methodology proposed for the floor and three walls of the Bay is the 7-point hexagonal grid technique delineated in *Verification of PCB Spill Cleanup by Sampling and Analysis*, EPA

560/5-85-026 (USEPA, 1985). In addition to the four 7-point wipe samples, the containment sump shall be sampled by a single wipe taken along each of the four walls and the sump bottom, for a total of five composite PCB wipe samples (See Table 3-1). Detailed procedures for this sampling are outlined SOP - 4, *Collection of PCB Wipe Samples* (See Attachment B). The samples will then be handled as specified in Table 3-3 and Section 4.

The PCB wipe samples will be forwarded to the off-site laboratory for analysis on a "per-wipe value" as described in the QAPP (AECOM, 2013b). If any constituents are detected in the rinsate (Section 3.1) at concentrations greater than the laboratory reporting limits, the affected area shall be scuff sanded along the surfaces. All residues from sanding shall be collected and disposed of as hazardous waste. After completion of this step, the area shall be rinsed with fresh tap water. The rinsate shall be collected and sampled for the decontamination criteria. If the violated criterion involves PCBs, wipe samples shall be taken in the same fashion as in the preceding step. This procedure shall be repeated until criteria are met in the rinsate and wipe samples.

3.4 FIELD QUALITY CONTROL SAMPLES

Field QC samples must be collected at the frequency and per the protocol described in the QAPP (AECOM, 2013b). One equipment blank shall be collected at the beginning of the project. One duplicate for every 10 field samples and one MS/MSD for every 20 field samples shall be collected. In addition, one trip blank per cooler for volatiles (EPA Method SW8260) will be obtained for field QC analysis.

Table 3-1: Sampling QC Requirements

Matrix	Analytical Group	Conc. Level	No. of Samples	No. of Equipment Rinsate Blanks	No. of Field Duplicates	No. of Trip Blanks	No. of MS/MSDs	Total No. of Samples to Lab
PCB Wipes	PCBs by SW8082	Low	5	1[a]	0	0	0	6
Soil	Volatiles by SW8260	Low	19	1	1	5	1/1	29
Soil	Semi-volatiles by SW8270	Low	19	1	1	0	1/1	23
Soil	TAL 24 Metals by SW6000/7000	Low	19	1	1	0	1/1	23
Soil	Pesticides by SW8081	Low	19	1	1	0	1/1	23
Soil	PCBs by SW8082	Low	19	1	1	0	1/1	23
Rinsate (MCLs)	PCBs by SW8082	Low	4	1	1	0	1/1	8
Rinsate (MCLs)	Volatiles by SW8260	Low	4	1	1	2	1/1	10
Rinsate (MCLs)	Semi-volatiles by SW8270	Low	4	1	1	0	1/1	8
Rinsate (MCLs)	TAL 24 Metals by SW6000/7000	Low	4	1	1	0	1/1	8
Rinsate (MCLs)	Pesticides by SW8081	Low	4	1	1	0	1/1	8
Rinsate (TCLP)	Volatiles by SW1311/ SW8260	Low	4	1[b]	0	0	0	4
Rinsate (TCLP)	Semi-volatiles by SW1311/SW8270	Low	4	0	0	0	0	4
Rinsate (TCLP)	RCRA 8 Metals by SW1311/SW6000/7000	Low	4	0	0	0	0	4
Rinsate (TCLP)	Flashpoint by 1010A	Low	4	0	0	0	0	4
Rinsate (TCLP)	Reactive Cyanide by SW846 Chapter 7	Low	4	0	0	0	0	4
Rinsate (TCLP)	Reactive Sulfide by SW846 Chapter 7	Low	4	0	0	0	0	4
Rinsate (TCLP)	Pesticides SW1311/SW8081	Low	4	0	0	0	0	4
Rinsate (TCLP)	Herbicides by SW1311/SW8151	Low	4	0	0	0	0	4
Rinsate (TCLP)	pH by SW9040/9045	Low	4	0	0	0	0	4

Notes and Abbreviations:
[a]An unopened and uncontaminated PCB wipe will be used as the equipment blank.
[b]A single wash water blank will be taken to act as a baseline for wash water. No duplicates are required for IDW.
Rinsate to be analyzed for NMWQC/MCL standards for on-site disposal determination.
Rinsate to be analyzed for TSCA/RCRA standards for off-site disposal determination if on-site disposal is not feasible.

Conc.	concentration	No.	number
IDW	investigation derived waste	PCB	polychlorinated biphenyl
MCL	maximum contaminant level	TAL	target analyte list
MS	matrix spike	TCLP	toxicity characteristic leaching procedure
MSD	matrix spike duplicate		

Table 3-2: Rinsate Sample Storage Requirements

ANALYTE		RINSATE			
Parameter	**EPA Method**	**Minimum Volume**	**Container**	**Preservation**	**Holding Time**
PCBs	SW8082	2000 mL	2x Liter Amber	None	7 E / 40 A (days)
VOCs[1]	SW8260	120 mL	3x 40 mL VOA	HCL	14 days
SVOCs	SW8270	2000 mL	2x Liter Amber	None	7 E / 40 A (days)
TAL 24 Metals[2]	SW6000/7000	250 mL	250 mL Poly	HNO3	180 E / 28 A (days)
Pesticides	SW8081	80 mL	2x Liter Amber	None	7 E / 40 A (days)
VOCs[1]	SW1311/8260	80 mL	2x 40 mL VOA	None	14 E/7 A
SVOCs	SW1311/8270	2000 mL	2x Liter Amber	None	14 E / 40 A (days)
RCRA 8 Metals	SW1311/SW6000 / 7000	250	250 mL Poly	None	14 E / 40 A (days)
Reactivity	SW846 Chapter 7	1000 mL	2x Liter Amber	None	28 days
Pesticides	SW1311/SW8081	2000 mL	2x Liter Amber	None	14 E / 40 A (days)
Herbicides	SW1311/SW8151	2000 mL	2x Liter Amber	None	14 E / 40 A (days)
pH	SW9040/9045	100 mL	250 mL Poly	None	Immediate upon arrival at laboratory

Notes and Abbreviations:
[1]Collect volatile rinsate samples in VOA with no headspace.
[2]Chromium VI has an extraction holding time of 24 hours. Ensure this sample is taken last, and that the laboratory is aware the sample is in route.

To be analyzed for NMWQC/MCL standards for on-site disposal determination.
To be analyzed for TSCA/RCRA standards for off-site disposal determination if on-site disposal is not feasible.

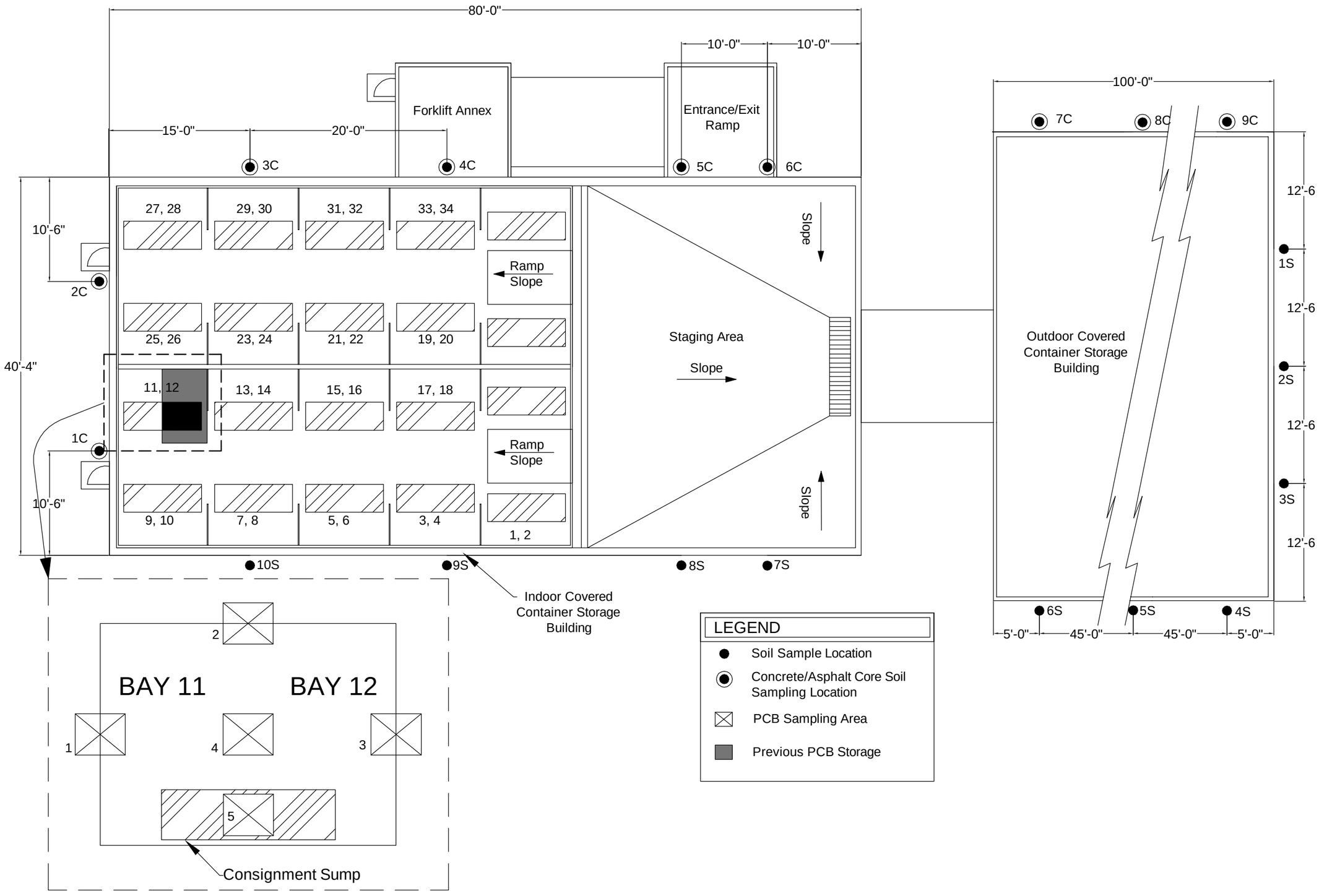
A	analysis	PCB	polychlorinated biphenyl
E	extraction	Poly	polyethylene container
EPA	United States Environmental Protection Agency	RCRA	Resource Conservation and Recovery Act
HCL	hydrochloric acid	SVOC	semi-volatile organic compound
HNO3	nitric acid	TCLP	toxicity characteristic leaching procedure
MCL	maximum contamination level	TSCA	Toxic Substances Control Act
ml	milliliter	VOA	volatile organic analysis
NMWQC	New Mexico Water Quality Control Commission	VOC	volatile organic compound

Table 3-3: Solid Storage Requirements

ANALYTE		SOIL/PCB WIPES		
Parameter	**EPA Method**	**Container**	**Preservation**	**Holding Time**
PCB Wipes	SW8082	4 oz glass jar	Methylene Chloride/Ice	1 E / 1 A (year)
PCB Soils	SW8082	4 oz glass jar[1]	Ice[2]	1 E / 1 A (year)
VOCs	SW8260	40-mL VOA vial	Ice	14 days
SVOCs	SW8270	4 oz glass jar[1]	Ice	14 E / 40A (days)
TAL 24 Metals	SW6000/7000	4 oz glass jar[1]	Ice	6 months[3]
Pesticides	SW8081	4 oz glass jar[1]	Ice	14 E / 40A (days)

Notes and Abbreviations:
[1] Bulk sampling (4 oz. glass jar) technique for soils can be used if there are no hydrocarbons between nC6 and nC12.
[2] Methylene chloride preservation for PCB wipes only.
[3]Chromium VI has an extraction holding time of 24 hours. Ensure this sample is taken last, and that the laboratory is aware the sample is in route.

A	analysis
E	extraction
EPA	United States Environmental Protection Agency
oz	ounce
PCB	polychlorinated biphenyl
SVOC	semi-volatile organic compound
TAL	target analyte list
VOA	volatile organic analysis
VOC	volatile organic compound



AECOM

CSU Sampling Map

PROJECT NO:	60304917
FIGURE	3–1
DRAWN BY:	AECOM, Brittany Meloni
SCALE:	1:10

3-1

4 SAMPLE CUSTODY, HANDLING, AND SHIPPING

The following sections outline the protocol for proper sample custody, handling, and shipping of samples to be delivered for laboratory analysis.

4.1 SAMPLE IDENTIFICATION

A descriptive, project-specific identification (ID) number to each sample will be assigned for data tracking and storage purposes. These ID numbers will be recorded on each sample container, field data sheet, and notebook maintained by field personnel. Sample designations and labeling are presented in SOP - 1, *Sample Collection, Handling and Custody* (See Attachment B).

4.2 SAMPLE CUSTODY PROCEDURES

Samples will be maintained under proper chain-of-custody (CoC) at all times as described in the following subsections. Samples shall be collected, uniquely identified, labeled, handled, stored, and documented in the field at the time of collection in accordance with procedures in the QAPP (AECOM, 2013b). All procedures will be conducted in a manner that maintains sample integrity, assures proper sample custody, and provides for complete CoC records, as outlined. Additionally, these procedures shall begin at the time of sampling and continue through transport, sample receipt, preparation, analysis and storage, data generation and reporting, and sample disposal. Sample custody procedures for this project are based on EPA-recommended procedures described in the National Enforcement Investigations Center Policies and Procedures, EPA/330/9-78-001-R (USEPA, 1991), which emphasizes careful documentation of sample collection and sample transfer.

4.2.1 Chain-of-Custody Record

The CoC forms will be completed in the field according to procedures documented in SOP - 1, *Sample Collection, Handling and Custody* (See Attachment B).

4.2.2 Transfer of Custody

Field personnel initially collecting the sample(s) are responsible for the care and custody of the sample(s) until proper transfer or delivery to laboratory personnel. When transferring the possession of samples, the individuals relinquishing and receiving the samples will sign, date, and note the time on the record. The company from which the sample is relinquished and to which person and/or company it is delivered, and the reason for transfer will be noted.

If the cooler is to be shipped via FedEx or another overnight delivery service, then the name of the shipping company shall be written in as the next recipient on the CoC with a date and time matching those written by the person delivering the cooler to the shipping company/location. This record must document the transfer of samples from the custody of the sampler to all other people/delivery companies until the samples are checked in at the fixed base laboratory. The relinquishing individual will record specific shipping data (air bill number, company, time, and date) on the original and duplicate custody records. It is the AECOM Project Manager's responsibility to verify that all shipping data are consistent and are made part of the permanent project files.

All information on the CoC record and additional sample information will be maintained in a database for later electronic matching with laboratory analytical information for each sample. A copy of the complete and signed original CoC will be a permanent part of the project records and will accompany the samples to the laboratory to document sample custody transfer from the sampler to the laboratory. The laboratory

will eventually return the original CoC in the laboratory data report. If changes or corrections are required, all copies of the CoC will be corrected. Incorrect items will be stricken by a single line with the corrections made. The person(s) making the corrections will initial and date such changes on all copies of the CoC in their possession, and contact all other parties with working copies of the CoC to have the same corrections made.

4.3 SAMPLE HANDLING

Sample containers will be purchased pre-cleaned and treated in accordance with USEPA specifications for glassware cleaning. Sampling containers that are reused must be decontaminated between uses by the EPA-recommended procedures (e.g., EPA 540/R-93/051 [USEPA, 1992b]). Additional sample handling requirements are detailed in Table 3-1 and in SOP - 1, *Sample Collection, Handling and Custody* (See Attachment B).

4.4 SAMPLE PACKAGING AND SHIPPING

All samples to be sent to an off-site laboratory will be packaged carefully in accordance with procedures outlined in SOP - 5, *Packaging and Shipment of Environmental Samples* (See Attachment B).

The shipping containers will be transported as environmental samples to the laboratory as expeditiously as possible, most likely by FedEx or other overnight delivery service. The AECOM Field Team Leader or designee will contact the project manager at each laboratory to give advance notification of all shipments by the telephone on the day of shipment and by advanced scheduling. Samples may be shipped to the laboratories for Saturday delivery if authorization has been received from the laboratory prior to shipment, and provided that “Saturday delivery” stickers have been placed on the coolers. The laboratory shipping address and point of contact are as follows:

Sean Hardin
Gulf Coast Analytical Laboratory
7979 GSRI Avenue
Baton Rouge, Louisiana 70820
Telephone: 225-769-4900
Direct line: 225-214-7047
Fax: 225-767-5717
sean.hardin@gcal.com

Upon laboratory receipt of the coolers, the lab technician will inspect the sample containers in accordance with the QAPP (AECOM, 2013b). The samples will either be removed from the containers for analysis or placed in a refrigerated storage area until they are analyzed. A list of analyses to be performed and a space to record sample condition upon receipt are located on the COC form. The sample custodian will sign the COC form and record the temperature of the samples or cooler on the COC form and on the Sample Condition upon Receipt form.

5 INVESTIGATION DERIVED WASTE

The following types of investigation derived waste (IDW) will be generated during the field investigation:

- Consumable sampling equipment;
- Miscellaneous IDW, anticipated to be comprised primarily of used disposable PPE (e.g., gloves); and,
- Rinsate from facility decontamination.

All equipment used for soil sampling during this investigation will be disposable and will not require decontamination. Disposable sampling equipment and PPE are expected to be lightly soiled and will be collected in plastic trash bags, then disposed of as solid waste. Excess soils generated during hand augering of borings will be placed back into each respective borehole in the reverse order in which they are generated; therefore, no soil IDW generation is anticipated.

The rinsate generated from facility decontamination will be containerized in polyethylene, Department of Transportation-approved containers. Analytical data from the investigation will be evaluated against TCLP hazardous waste limits (as per 40 CFR 261.24) for volatiles, semi-volatiles, herbicides, RCRA 8 metals, pesticides, ignitability, reactivity; and TSCA hazardous waste limits for PCBs (USEPA, 2005) to determine if the rinsate also exhibits the characteristics of a hazardous waste (See QAPP Worksheet 15 [AECOM, 2013b]). Following the characterization of IDW, the decontamination water will be disposed of appropriately, as described in Section 3.1. All IDW handling and disposal procedures will be conducted in accordance with SOP - 2, *IDW Management and Sampling* (See Attachment B).

6 REFERENCES

AECOM Technical Services, Inc. (AECOM), 2013a. *Draft Final Work Plan for RCRA Facility Closure, Hazardous Waste Container Storage Unit Facility, Holloman, AFB, New Mexico*, October.

AECOM, 2013b. *Draft Quality Assurance Project Plan for RCRA Facility Closure, Hazardous Waste Container Storage Unit Facility, Holloman, AFB, New Mexico*, October.

New Mexico Environment Department (NMED), 2006. *New Mexico Environment Department Hazardous Waste Bureau and Ground Water Quality Bureau Voluntary Remediation Program, Technical Background Document for Development of Soil Screening Levels, Revision 4.0*, June.

United States Environmental Protection Agency (USEPA), 1984. *Characterization of Hazardous Waste Sites – A Methods Manual: Volume II. Available Sampling Methods, Second Ed.*, EPA-600/4-84-076, December.

USEPA, 1985. *Verification of PCB Spill Cleanup by Sampling and Analysis*, EPA 560/5-85-026, June.

USEPA, 1987. *A Compendium of Superfund Field Operations Methods: Vol. I*, EPA-540/P-87/001a, August.

USEPA, 1991. *National Enforcement Investigations Center Policies and Procedures*, EPA/330/9-78-001-R, August.

USEPA, 1992a. *Preparation of Soil Sampling Protocols: Sampling Techniques and Strategies*, EPA/600/R-92/128, July.

USEPA, 1992b. *Specifications and Guidance for Contaminant-Free Sample Containers*, EPA-540/R-93/051, December.

USEPA, 2005. *Polychlorinated biphenyl (PCB) Site Revitalization Guidance Under the Toxic Substance Control Act (TSCA)*, November.

ATTACHMENT A: Major Waste Categories and Parameters of Concern

Table Ci-1
Major Waste Categories and Parameters of Concern

Process Generating Waste	Waste Generated	Basis for Hazard Classification	Parameters for Analyses and EPA Waste Codes[1]	LDR (WW or NWW)	Current Analytical Test Method[2]
Paint-Related Operations Locations: 49th Civil Engineer Squadron 49th Transportation Squadron 49th Services Squadron German Air Force Hazmart 49th Maintenance Squadron 846th Test Squadron 46th Test Group DynCorp 49th Materiel Maintenance Squadron Newtec 8th Fighter Squadron 9th Fighter Squadron	Waste paint and thinner (C, I, T, listed)	Historical test data, MSDS, Knowledge of Process (KOP)	Cadmium (D006), lead (D008), chromium (D007), selenium (D010), solvents (VOCs and SVOCs), ignitability (D001), corrosivity (D002)	NWW	SW8260, SW8270, SW6010 or 7000 Series, SW-846 1010/1020, SW9040
	Respirator and booth filter elements (T)	Historical test data	Cadmium (D006), chromium (D007), silver (D011)	NWW	SW6010 or 7000 Series
	Spent alodine from painting (C,T)	Historical test data	Chromium (D007), corrosivity (D002)	NWW	SW6010 or 7000 Series, SW9040
	Rags and debris contaminated with paint wastes and solvents (I, T, listed)	Historical test data, KOP	Cadmium (D006), chromium (D007), lead (D008), solvents (VOCs and SVOCs), ignitability (D001)	NWW	SW8260, SW8270, SW7000 series, SW8240, SW-846 1010/1020 or 1030

[1] RCRA hazardous constituents and/or properties.
[2] These analyses are suggested given the properties of the waste; however, other analytical methods may be substituted or included as deemed appropriate.
[3] Medical wastes are discarded commercial products and are known to be regulated based on their initial composition. No further analysis is required.

C = corrosive
I = ignitable
T = toxic
R = reactive
Listed = listed waste

Table Ci-1
Major Waste Categories and Parameters of Concern (Cont.)

Process Generating Waste	Waste Generated	Basis for Hazard Classification	Parameters for Analyses and EPA Waste Codes[1]	LDR (WW or NWW)	Current Analytical Test Method[2]
Aircraft, Vehicle, and Equipment Maintenance Operations	Fuel filters and absorbent (I, T)	KOP, Historical test data	Cadmium (D006), benzene (D018), ignitability (D001)	NWW	SW8260, SW8270, SW6010 or 7000 Series, SW-846: 1010/1020
Locations: Gas Station	Parts cleaning sludge (I,T)	Historical test data	Cadmium (D006), chromium (D007), lead (D008), ignitability (D001)	NWW	SW8260, SW8270, SW6010 or 7000 Series, SW-846 1010/1020
49th Civil Engineer Squadron 49th Transportation Squadron 49th Services Squadron German Air Force DynCorp	Spent solvent from parts cleaning and equipment maintenance (I,T, listed)	Historical test data	Lead (D008), chromium (D007), solvents (VOCs and SVOCs), ignitability (D001)	NWW	SW8260, SW8270, SW6010 or 7000 Series, SW-846 1010/1020
49th Maintenance Squadron Newtec 9th Fighter Squadron 8th Fighter Squadron 49th Materiel Maintenance Squadron Newtec 846th Test Squadron	Dirty rags with solvents, oil, and grease (I, T, listed)	Historical test data, KOP, MSDS	Cadmium (D006), lead (D008), chromium (D007), benzene (D018), solvents (VOCs and SVOCs), ignitability (D001)	NWW	SW8260, SW8270, SW6010 or 7000 Series, SW-846 1010/1020
Photographic Equipment Cleaning Operations Locations: Newtec 846th Test Squadron Newtec	Rags with solvent (I, T, listed)	Historical test data, KOP	Cadmium (D006), solvents (VOCs and SVOCs), ignitability (D001)	NWW	SW8260, SW8270, SW6010 or 7000 series, SW-846 1010/1020

[1] RCRA hazardous constituents and/or properties.
[2] These analyses are suggested given the properties of the waste; however, other analytical methods may be substituted or included as deemed appropriate.
[3] Medical wastes are discarded commercial products and are known to be regulated based on their initial composition. No further analysis is required.

C = corrosive
I = ignitable
T = toxic
R = reactive
Listed = listed waste

Table Ci-1
Major Waste Categories and Parameters of Concern (Cont.)

Process Generating Waste	Waste Generated	Basis for Hazard Classification	Parameters for Analyses and EPA Waste Codes[1]	LDR (WW or NWW)	Current Analytical Test Method[2]
Miscellaneous Organic Liquids Locations: Hazmart	Expired or off-specification material (C, I, T, listed)	MSDS, Historical test data	Ignitability (D001), corrosivity (D002), metals, solvents (VOCs and SVOCs)	NWW	SW8260, SW8270, SW6010 or 7000 Series, SW9040, SW-846 1010/1020
Metal Cutting Operations Locations: DynCorp 846th Test Squadron	Rags and debris with oil and metals (C, I, T, listed)	Historical test data, KOP	Cadmium (D006), lead (D008), chromium (D007), selenium (D010), solvents, ignitability (D001), corrosivity (D002)	NWW	SW8260, SW8270, SW6010 or 7000 Series, SW-846 1010/1020, SW9040
Medical Operation Locations: 49th Medical Support Squadron 49th Aeromedical Dental Squadron	Expired or off-specification epinephrine or other medical waste (R, Acutely T)	MSDS	Acute toxicity, sodium cyanide, phosphorous (reactivity)	NWW	NA[3]
Weapons Maintenance Operation Locations: 49th Security Forces Squadron 49th Maintenance Squadron DynCorp German Air Force	Rags and debris with solvent and lead (I, T, Listed)	Historical test data	Lead (D008), ignitability (D001), solvents	NWW	SW8260, SW8270, SW6010 or 7000 Series, SW-846 1010/1020

[1] RCRA hazardous constituents and/or properties.
[2] These analyses are suggested given the properties of the waste; however, other analytical methods may be substituted or included as deemed appropriate.
[3] Medical wastes are discarded commercial products and are known to be regulated based on their initial composition. No further analysis is required.

C = corrosive
I = ignitable
T = toxic
R = reactive
Listed = listed waste

Ta .i-1

Major Waste Categories and Parameters of Concern (Cont.)

Process Generating Waste	Waste Generated	Basis for Hazard Classification	Parameters for Analyses and EPA Waste Codes[1]	LDR (WW or NWW)	Current Analytical Test Method[2]
Facility Maintenance Operations	Spent fluorescent bulbs - crushed (T)	Historical test data	Mercury (D009), cadmium (D006), lead (D008)	NWW	SW6010 or 7000 Series
Locations: 90-Day Facility-49th Civil Engineer Squadron Hazmart	Bulb crusher filter element (T)	Historical test data	Mercury (D009), cadmium (D006), lead (D008)	NWW	SW6010 or 7000 Series
	Spent batteries such as Ni-Cad used in emergency lighting systems (C, T)	MSDS	Cadmium (D006), lead (D008), corrosivity (D002)	NWW	NA
Potential New Wastes Locations: Received from off-site generators	Various wastes, similar to those described above, generated from surrounding federal facilities.	Generator provided analytical data and/or process knowledge	See appropriate sections of Table Ci-1	See appropriate sections of Table Ci-1	See appropriate sections of Table Ci-1

[1] RCRA hazardous constituents and/or properties.
[2] These analyses are suggested given the properties of the waste; however, other analytical methods may be substituted or included as deemed appropriate.
[3] Medical wastes are discarded commercial products and are known to be regulated based on their initial composition. No further analysis is required.

C = corrosive
I = ignitable
T = toxic
R = reactive
Listed = listed waste

ATTACHMENT B: Standard Operating Procedures

SOP 1 - Sample Collection, Handling and Custody
SOP 2 - IDW Management and Sampling
SOP 3 - Collection of Soil Samples
SOP 4 - Collection of PCB Wipe Samples
SOP 5 - Packaging and Shipment of Environmental Samples

Standard Operating Procedure

Sample Collection, Handling and Custody

SOP - 1

October 2013

Contents

1.0 Scope and Applicability 1
2.0 Health and Safety Considerations 1
3.0 Responsibility Matrix 1
4.0 Definitions 2
5.0 Equipment , Supplies and Procedures 2
6.0 Exception Provisions 7
7.0 Records 7
8.0 Interferences 8
9.0 References 8
10.0 Tables 9
11.0 Attachments 11

1.0 Scope and Applicability

1.1. Purpose and Applicability

This Standard Operating Procedure (SOP) establishes AECOM Technical Services, Inc. (AECOM) guidelines and procedures for field personnel use to ensure proper sample handling and custody of samples for chemical and physical analysis at the Resource Conservation and Recovery Act facility closure of a Hazardous Waste Container Storage Unit (CSU) Facility located at Holloman Air Force Base (AFB), New Mexico. The procedures and equipment requirements contained in this SOP are subject to modification based upon project-specific requirements and site conditions.

The procedures in this SOP have been modified from multiple guidance documents listed in the reference section to reflect the typical field conditions encountered at the CSU Facility. The procedures are subject to change if unusual or unanticipated field conditions are encountered; however, all deviations must be approved by the AECOM Project Manager before implementation. This information shall in turn be passed on to the Air Force Civil Engineer Center Project Manager prior to the acceptance of the change in the SOP.

This SOP only applies to the identification, labeling, and custody procedures for sample collection. The details within this SOP are only applicable to the general requirements for sample identification, labeling, handling and custody, and should only be used as a guide for developing more job-specific work plans. The details within this SOP should be used in conjunction with the Field Sampling Plan (FSP), which this SOP is an Appendix to, and the Work Plan (AECOM, 2013a), which will generally provide the following information:

- Sample collection objectives;
- Locations and depths of samples to be collected;
- Numbers and volumes of samples to be collected;
- Types of analyses to be conducted for the samples; and
- Specific quality control (QC) procedures and sampling required.

2.0 Health and Safety Considerations

The health and safety considerations for the work associated with this SOP, including both potential physical and chemical hazards, will be addressed in the site-specific Health and Safety Plan (AECOM, 2013b). Adequate health and safety measures must be taken to protect sampling personnel from these potential hazards. This plan must be distributed to all personnel performing sampling, and must be adhered to as field activities are performed.

3.0 Responsibility Matrix

3.1. Project Manager

The Project Manager has the responsibility of overseeing and directing the entire project, and ensuring that all activities are conducted in accordance with the client's direction, this SOP, and any other appropriate procedures.

3.2. Field Team Leader

The Field Team Leader is responsible for ensuring that field activities are completed to meet the project objectives, are conducted in accordance with the project plans and requirements, and all activities are performed according to the respective procedures.

3.3. Field Team

All members of the field team (e.g., samplers, technicians, field geologists, engineers, etc.) are responsible for understanding and implementing this field procedure as well as ensuring all team members perform work in accordance with this procedure. All staff are responsible for reporting deviations from the procedures to the Field Team Leader or AECOM Project Manager.

3.4. Site Contractor Quality Control Systems Manager

The Contractor Quality Control Systems Manager (CQCSM) is responsible for periodic review of field generated documentation associated with this SOP. The CQCSM is also responsible for the implementation of corrective action (e.g., re-training personnel, additional review of work plans and SOPs, issuing non-conformances, etc.) if problems occur.

4.0 Definitions

Sample – Physical evidence collected from a facility or the environment which is representative of conditions at the point and time at which the sample is collected.

5.0 Equipment , Supplies and Procedures

5.1. Supplies and Equipment

The following is a list of the supplies and equipment needed to implement this SOP in the field.

5.1.1. Required Records and Forms

- Sample Collection Log
- Field Log Book
- Samples tags/labels and the appropriate forms/documentation for sample shipment
- Material Safety Data Sheets
- Quality Assurance Project Plan (QAPP)
- Site-Specific Work Plan and/or FSP
- Chain of Custody (CoC) forms

5.1.2. Recommended Materials, Equipment or Supplies

- Indelible black ink pens and markers
- Plastic or metal coolers (typically provided by the laboratory)

- Waterproof sealing tape
- Ice (double bagged)
- Fiberglass packing tape
- Nitrile or Latex gloves
- Plastic Zip-Loc® bags
- Bubble wrap, Styrofoam™ packing material, vermiculite (or other absorbent material)

5.2. Procedures

The following steps must be followed to properly identify, label, and document custody of samples collected in the field.

5.2.1. Sample Identification

A descriptive, project-specific ID number will be assigned to each sample for data tracking and storage purposes. These ID numbers will be recorded on each sample container, field data sheet, and notebook maintained by field personnel. Based upon the sample ID procedures presented in the *Base-wide Generic UFP QAPP* for Holloman AFB, sample designations and labeling are as follows:

5.2.1.1. *Soil Sample Identification*

Soil samples collected will be identified as shown below:

HAFB-CSU-SB1C(0-3)ddmmyy

Where	HAFB	=	Project identifier (Holloman AFB)
	CSU	=	Site identifier
	SB1C	=	Soil Boring Number **(*See Figure 3-1, CSU Soil Sampling Map within the FSP for specific soil boring numbering*)**
	(0-3)	=	Composite soil core depth
	ddmmyy	=	Date of Sampling

5.2.1.2. *Rinsate Sample Identification*

Rinsate samples collected will be identified as shown below:

HAFB-CSU-WW01-ddmmyy

Where	HAFB	=	Project identifier (Holloman AFB)
	CSU	=	Site Identifier
	WW01	=	Rinsate samples, numbered consecutively ***(Each polyethylene tank should be numbered to reference what area was decontaminated or rinsed to capture the rinsate, and what number of wash or rinse it constitutes)***
	ddmmyy	=	Date of Sampling

5.2.1.3. *PCB Wipe Sample Identification*

PCB wipe samples collected will be identified as shown below:

HAFB-CSU-Wipe01-ddmmyy

Where	HAFB	=	Project identifier (Holloman AFB)
	CSU	=	Site Identifier
	Wipe01	=	Wipe samples, numbered consecutively **(*See Figure 3-1, CSU Soil Sampling Map within the FSP for specific wipe area numbering*)**
	ddmmyy	=	Date of Sampling

5.2.1.4. *Sample Duplicates and Field QC Samples*

Duplicates for soil and rinsate sampling will be labeled with a "D" added to the end of the sample ID number.

Example: The duplicate of HAFB-CSU-SB1C(0-1)221013 is HAFB-CSU-SB1C(0-1)221013D

A two- or three-digit QA/QC qualifier will then follow any soil, rinsate, or PCB wipe sample IDs as needed and will be designated on the CoC by the field personnel for each matrix. Equipment blanks and trip blank shall be labeled with a prefix of "EB" or "TB", followed by a sequential number generated by the AECOM CoC system. AECOM shall maintain CoC records for all field and field QC samples. Records concerning the custody and condition of all field and field QC samples shall be maintained in field and laboratory records by AECOM.

5.2.1.5. *Sample Labeling*

Samples shall be identified by a sample label with the following information recorded:

- Sample ID number;
- Date and time of collection;
- Analyses requested;
- Type of preservative used (if any); and,
- Sampler's name or initials

5.2.2. Sample Custody

Samples will be maintained under proper CoC at all times as described in the following sections. A sample is defined as being under a person's custody if any of the following conditions exist:

- It is in their possession;
- It is in their view after being in their possession;
- It was in their possession and they locked it up; or,
- It is in a designated secure area.

Samples shall be collected, uniquely identified, labeled, handled, stored, and documented in the field at the time of collection in accordance with procedures outlined in this SOP and in the QAPP (AECOM, 2013c). These procedures shall begin at the time of sampling and continue through transport, sample receipt, preparation, analysis and storage, data generation and reporting, and sample disposal. Moreover, all

activities will be conducted in a manner that maintains sample integrity, assures proper sample custody, and provides for complete CoC records. Sample custody procedures outlined in this SOP are based on United States Environmental Protection Agency (USEPA)-recommended procedures, which emphasizes careful documentation of sample collection and transfer (USEPA, 1978).

5.2.2.1. *Chain of Custody Record*

Sample custody is maintained by the CoC form, which is completed by the individual(s) designated by the AECOM Project Manager as being responsible for sample shipment completed at the sampling site. After collection and identification, all samples will be maintained under CoC protocols. Additionally, all coolers within a shipment must be accompanied to the laboratory with their own CoC. The following information must be recorded on the CoC:

- **Laboratory** – The laboratory name and address where the samples are being sent.
- **Contact** – The primary contact at the laboratory, along with phone and fax numbers.
- **Client** – The address of the AECOM office (San Antonio) contracting the sample analyses.
- **Shipment Number** – A unique identifier applied to the shipment.
- **Method of Shipment** – FedEx, Courier, etc.
- **Air Bill Number** – The shipper's unique identifier for the shipment.
- **Cooler Number** – A unique identifier for the cooler in which the samples are sent to the laboratory.
- **Project Number** – The AECOM Project and Task Number under which the samples were collected.
- **Project Name** – A description of the AECOM Project Task Number.
- **Project Contact –** The name of the AECOM Project Manager with phone and fax numbers.
- **Sampler's Signature** – The signature of the person responsible for collecting the samples and filling out the CoC form.
- **Page** – The page number of the CoC (e.g., Page 1 of 2).
- **Sample ID** – The unique sample identifier outlined in Section 5.3.
- **Sampling Date** – The date the sample was collected.
- **Sampling Time** – The time the sample was collected.
- **Matrix Type** – The matrix type of the sample.
- **Preservation Temperature** – The specified storage temperature for samples (e.g., 6°C).
- **Preservation Chemical** – The chemical or substance used to preserve the sample (e.g., methylene chloride).
- **Number of Containers** – The number of containers per sample.
- **Analyses Requested** – A list of all analyses to be performed for the samples listed, which includes checking the corresponding boxes.

- **Remarks** – A sample or analysis-specific remark (e.g., MS/MSD requests, short holding time, etc.).
- **Relinquished By-Signature** – The signature of the person relinquishing the shipment of samples.
- **Relinquished By-Printed** – The printed name of the person relinquishing the shipment of samples.
- **Relinquished By-Company** – The company that the person relinquishing the shipment of samples works for.
- **Relinquished By-Date/Time** – The date and time the samples are relinquished.
- **Received By-Signature** – The signature of the person receiving the shipment of samples.
- **Received By-Printed** – The printed name of the person receiving the shipment of samples.
- **Received By-Company** – The company that the person receiving shipment of samples works for.
- **Received By-Date/Time** – The date and time the samples are received.
- **Comments** – Shipment related comments, such as special sample handling instructions, turnaround time, QC sample designation, etc.

Different methods may require different sample containers or preservatives for aqueous analyses. Each will require a separate line on the CoC record, so the field sample ID number may be entered multiple times on different lines for a given rinsate or soil sample.

5.2.2.2. *Transfer of Custody*

Field personnel initially collecting the sample(s) are responsible for the care and custody of the sample(s) until proper transfer or delivery to laboratory personnel. When transferring the possession of samples, the individuals relinquishing and receiving the samples will sign, date, and note the time on the record. The company from which the sample is relinquished and to which person and/or company it is delivered, and the reason for transfer will be noted.

If the cooler is to be shipped via FedEx or another overnight delivery service, then the name of the shipping company should be written in as the next recipient on the CoC with a date and time matching those written by the person delivering the cooler to the shipping company/location. This record must document the transfer of samples from the custody of the sampler to all other people/delivery companies until the samples are checked in at the fixed base laboratory. The relinquishing individual will record specific shipping data (air bill number, company, time, and date) on the original and duplicate custody records. It is the AECOM Project Manager's responsibility to verify that all shipping data are consistent and are made part of the permanent project files.

All information on the CoC record, as well as additional sample information, will be maintained in a database for later electronic matching with laboratory analytical information for each sample. A copy of the complete and signed original CoC will be a permanent part of the project records and will accompany the samples to the laboratory to document sample custody transfer from the sampler to the laboratory. The laboratory will eventually return the original CoC in the laboratory data report. If changes or corrections are required, all copies of the CoC will be corrected. Incorrect items will be stricken by a single line with the corrections made. The person(s) making the corrections will initial and date such changes on all copies of the CoC in their possession, and contact all other parties with working copies of the CoC to have the same corrections made.

5.2.3. Sample Handling

5.2.3.1. *Container Requirements*

Sample containers shall be purchased pre-cleaned and treated in accordance with USEPA-recommended specification for glassware cleaning. Sampling containers that area reused must be decontaminated in accordance with USEPA specifications (USEPA, 1992). Containers should be stored in clean areas to prevent exposure to fuels, solvents, and other contaminants. Amber glass bottles are routinely used where glass containers are specified in the sampling protocol. All glass sample bottles will be wrapped in bubble pack or equivalent packing material and sealed in re-sealable plastic bags. This will minimize the potential for contamination and breakage of the bottles during shipment. However, plastic bottles do not require wrapping and shall be sealed in zip-top, re-sealable plastic bags.

5.2.3.2. *Sample Preservation*

Sample preservation is required to retain sample integrity. The most common preservation techniques include adding chemicals or substances for pH adjustment and temperature control. Field personnel will use USEPA-recommended containers and adhere to USEPA-recommended preservation techniques for the parameters of concern (USEPA, 2001). Minimum sample volumes required for each analysis are also specified and must be observed. Pre-cleaned containers for rinsate samples and PCB wipes, which will contain the appropriate preservatives, will be provided by the project analytical laboratory. Tables 1 and 2 in Section 10.0 summarize the site-specific sample handling requirements for rinsate, soil and PCB wipes.

5.2.3.3. *Holding Times*

Samples should be analyzed as soon as possible after collection. Many samples are not stable for lengthy periods following collection, so daily shipment to laboratories is optimal, if possible. The holding times listed in Table 1 are the maximum amount of time that the samples may be held before analysis from time of collection and still be considered valid. Samples exceeding these holding times are not valid for compliance and will have to be retaken.

6.0 Exception Provisions

Volatile organic analysis vials are to have Teflon®-faced, silicone septum caps to be filled completely with no headspace or air pockets. All other jars are to have Teflon®-lined caps, leaving adequate headspace in containers to allow for thermal expansion of sample material and mixing of the sample.

7.0 Records

Sample custody is maintained by the CoC form. After collection and identification, all samples will be maintained under CoC protocols. Additionally, all coolers within a shipment must be accompanied to the laboratory with their own CoC, which shall document sample custody transfer. The laboratory will eventually return the original CoC in the laboratory data report. A copy of the complete and signed original CoC will then become a permanent part of the project records. All information on the CoC record will be maintained in a database for later electronic matching with laboratory analytical information for each sample. Records generated as a result of this SOP will be controlled and maintained in the project record files.

8.0 Interferences

None.

9.0 References

AECOM Technical Services, Inc. (AECOM), 2013a. *Draft Final Work Plan for RCRA Facility Closure, Hazardous Waste Container Storage Unit Facility, Holloman, AFB, New Mexico*, October.

AECOM, 2013b. *Draft Health and Safety Plan for RCRA Facility Closure, Hazardous Waste Container Storage Unit Facility, Holloman, AFB, New Mexico*, October.

AECOM, 2013c. *Draft Quality Assurance Project Plan for RCRA Facility Closure, Hazardous Waste Container Storage Unit Facility, Holloman, AFB, New Mexico*, October.

United States Environmental Protection Agency (USEPA), 1978. *National Enforcement Investigations Center Policies and Procedures Manual,* May.

USEPA, 1992. *Specifications and Guidance for Contaminant-Free Sample Containers,* December.

USEPA, 2001. *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*, EPA Region 4, Athens, GA, November.

10.0 Tables

Table 1: IDW Rinsate Sample Storage Requirements

ANALYTE		IDW RINSATE			
Parameter	**EPA Method**	**Minimum Volume**	**Container**	**Preservation**	**Holding Time**
VOCs[1]	SW1311/8260B	80mL	2x 40mL VOA	None	14 E/7 A
SVOCs	SW1311/8270C	2000mL	2x Liter Amber	None	14 E / 40 A (days)
Metals	SW1311/SW6010B/ 7470A	250	250mL Poly	None	14 E / 40 A (days
PCBs	8082	2000mL	2x Liter Amber	None	14 E / 40 A (days
Corrosivity	9041A	125mL	125mL Poly	None	Immediate upon arrival at laboratory
Ignitability	SW1010	250mL	250mL Poly	None	None
Reactivity	SW-846 Chapter 7	1000mL	2x Liter Amber	None	28 days
Pesticides	SW1311/SW8081A	2000mL	2x Liter Amber	None	14 E / 40 A (days
Herbicides	SW1311/SW8151A	2000mL	2x Liter Amber	None	14 E / 40 A (days

Notes and Abbreviations:
[1]Collect volatile rinsate samples in VOA with no headspace.

A	analysis
E	extraction
EPA	United States Environmental Protection Agency
IDW	investigation derived waste
PCB	polychlorinated biphenyl
SVOC	semi-volatile organic compound
VOC	volatile organic compound

Table 2: Soil/PCB Sample Storage Requirements

ANALYTE		SOIL/PCB WIPES		
Parameter	**EPA Method**	**Container**	**Preservation**	**Holding Time**
VOCs	8260B	40-mL VOA vial	Ice	14 days
SVOCs	8270D	4 oz glass jar[1]	Ice	14 E / 40A (days)
Metals	6020A/7470/7471	4 oz glass jar[1]	Ice	6 months
PCBs	8082A	4 oz glass jar[1]	Methylene Chloride/ Ice[2]	1 E / 1 A (year)
Pesticides	8081B	4 oz glass jar[1]	Ice	14 E / 40A (days)

Notes and Abbreviations:

[1] Bulk sampling (4 oz. glass jar) technique for soils can be used if there are no hydrocarbons between nC6 and nC12.

[2] Methylene chloride preservation for PCB wipes only.

A	analysis
E	extraction
EPA	United States Environmental Protection Agency
oz	ounce
PCB	polychlorinated biphenyl
SVOC	semi-volatile organic compound
VOA	volatile organic analysis
VOC	volatile organic compound

11.0 Attachments

None.

Standard Operating Procedure

IDW Management and Sapling

SOP - 2

October 2013

Contents

1.0 Scope and Applicability 1

2.0 Health and Safety Considerations 1

3.0 Responsibility Matrix 1

4.0 Definitions 2

5.0 Equipment, Supplies and Procedures 3

6.0 Exception Provisions 6

7.0 Records 7

8.0 Interferences 7

9.0 References 7

10.0 Tables 7

11.0 Attachments 7

1.0 Scope and Applicability

The purpose of this Standard Operating Procedure (SOP) is to establish specific management practices for the sampling, handling and disposal of environmental media generated as a result of investigation actions, or investigation derived waste (IDW), at the Resource Conservation and Recovery Act (RCRA) facility closure of a Hazardous Waste Container Storage Unit (CSU) Facility located at Holloman Air Force Base (AFB), New Mexico. The procedures and equipment requirements contained in this SOP are subject to modification based upon project specific requirements and site conditions.

The procedures have been modified from multiple guidance documents listed in the reference section to reflect the typical field conditions encountered at the CSU Facility and are subject to change if unusual or unanticipated field conditions are encountered. However, all deviations must be approved by either the AECOM Project Manager before implementation. This information shall in turn be passed on to the Air Force Civil Engineer Center Project Manager prior to the acceptance of the change in SOP.

This SOP applies only to the sampling, handling and disposal management of decontamination water (rinsate) generated during facility decontamination at the Holloman AFB CSU Facility; and handling and disposal management of consumable sampling equipment, and other miscellaneous items anticipated to be primarily comprised of used disposable personal protective equipment (PPE). Excess soils generated during hand augering of borings will be placed back into each respective borehole in the reverse order from which they are generated; therefore, no soil IDW generation is anticipated. Moreover, soil sampling equipment is expected to be lightly soiled, thus requiring no decontamination. All disposable IDW is expected to be lightly soiled and will be collected in plastic trash bags for solid waste disposal. When accumulated, the waste materials must be managed appropriately to minimize the exposure to human health and the environment while adhering to applicable regulatory requirements. The details within this SOP should be used in conjunction with the Field Sampling Plan (FSP), which this SOP is an Appendix to, and the Work Plan (AECOM, 2013a).

2.0 Health and Safety Considerations

The health and safety considerations for the work associated with this SOP, including both potential physical and chemical hazards, will be addressed in the site-specific Health and Safety Plan (AECOM, 2013b). Adequate health and safety measures must be taken to protect sampling personnel from these potential hazards. This plan must be distributed to all personnel performing sampling, and must be adhered to as field activities are performed.

3.0 Responsibility Matrix

3.1 Project Manager

The Project Manager has the responsibility of overseeing and directing the entire project, and ensuring that all activities are conducted in accordance with the client's direction, this SOP, and any other appropriate procedures.

3.2 Field Team Leader

The Field Team Leader is responsible for ensuring that field activities are completed to meet the project objectives, are conducted in accordance with the project plans and requirements, and all activities are performed according to the respective procedures.

3.3 Field Team

All members of the field team (e.g., samplers, technicians, field geologists, engineers, etc.) are responsible for understanding and implementing this field procedure as well as ensuring all team members perform work in accordance with this procedure. All staff are responsible for reporting deviations from the procedures to the Field Team Leader or AECOM LHAAP Technical Manager.

3.4 Site Contractor Quality Control Systems Manager

The Site Contractor Quality Control Systems Manager (CQCSM) is responsible for periodic review of field generated documentation associated with this SOP. The CQCSM is also responsible for the implementation of corrective action (i.e., retraining personnel, additional review of work plans and SOPs, variances to the abandonment requirements, issuing non-conformances, etc.) if problems occur.

4.0 Definitions

Composite Liquid Waste Sampler (COLIWASA) - The COLIWASA is a sampling tool used to collect samples from liquid holding containers. It consists of a tube with a tapered end and stopping device inside the tube that can be manipulated at the top of the COLIWASA by a stopper rod handle. The sampler is used by slowly lowering the tube into the holding container and then manipulating the stopping device downward with the attached stopper rod handle to plug the end of the tube, effectively trapping the liquid being sampled inside. The COLIWASA can then be removed from the drum, and by once again manipulating the stopping device upward, the sample inside will flow from the bottom of the tube and can be collected. The COLIWASA is the preferred sampling method when the objective is to obtain a representative cross-section of a potentially layered sample.

Glass Thief - This sampling tool is a tube (or thief) made of glass with a tapered end, and is used to collect samples from liquid holding containers. It is used by lowering the thief into the drum solution and then capping the top of the thief with either the sampler's thumb or a stopper. The thief can then be removed from the drum, and by removing the capping device, the sample will flow from the bottom of the thief for collection.

Investigation Derived Waste - Waste generated as a result of field investigation activities that is approved and overseen by state or federal regulations, and may be specifically designed to determine the nature and extent of contamination during a site remediation or cleanup.

Sludge - The loosely compacted settled suspension potentially found at the bottom of a container holding liquid.

5.0 Equipment, Supplies and Procedures

5.1 Supplies and Equipment

The following is a list of the supplies and equipment needed to implement this SOP in the field.

5.1.1 Required Records and Forms

- Field log book
- United States Department of Transportation (DOT)-approved labels, appropriate forms, and/or documentation for container shipment
- Material Safety Data Sheets
- FSP and Site-Specific Work Plan

5.1.2 Required Materials, Equipment, or Supplies

- Indelible black ink pens and markers
- Appropriate sample containers
- Heavy-duty plastic trash bags
- Personal protective clothing and gear, to include nitrile or latex gloves
- Appropriate equipment and meters for obtaining field measurements
- Glass thief or COLIWASA, and appropriate sampling containers with labels
- Rubber stopper for the glass thief
- Paper towels
- Sheeting (polyethylene)
- Cooler with ice and packing materials
- Decontamination solutions; non-phosphate detergent, rinse water, deionized water
- Decontamination buckets and spray bottle

5.2 Procedures

All personnel must read and understand the approved, site-specific HASP, have had the proper training and certifications required under Occupational Safety and Health Administration regulations, and don the appropriate PPE as dictated by the site-specific HASP while conducting IDW management activities.

5.2.1 General IDW Handling Requirements

IDW should be handled according to the specific waste stream in which it is generated. Moreover, wastes may be classified as non-investigative or investigative waste. Non-investigative waste, such as litter, shall be collected on an as-needed basis to maintain each site in a clean and orderly manner. This waste shall be disposed in a designated collection bin or dumpster (USEPA, 1991).

The IDW at the CSU Facility will be generated as a result of two major activities – 1) drilling soil borings with hand augers and 2) four-phase facility decontamination (initial wash and rinse, second, third, and final rinse).

In instances where soil borings are advanced, soil cuttings shall be placed adjacent to the borehole on plastic or other suitable material capable of precluding contact with the ground surface. Upon completion of the activity, soil cuttings will be placed back into the borehole from which they were generated. The replaced cuttings will be compacted to the extent practical.

In cases where rinsate is generated as a waste from facility decontamination, all decontamination water accumulated from each phase shall be segregated and containerized in separate polyethylene tanks for sampling and analysis using portable sump pumps and associated equipment. The rinsate from each tank shall then be sampled to allow for characterization. After each tank has been filled, the container and lid, if appropriate, will be labeled with a description of the media (i.e., final rinsate), origin of media (i.e., storage and handling equipment decontamination), date the media was placed in the container, site identification, date container was sealed and sampled, and any other pertinent information (i.e., hazardous versus nonhazardous). The containers may be labeled using a paint pen or other indelible marker that will not fade when exposed to weather. A record of the number of containers and their contents will be completed at each generation site and will be included in the field log book before leaving each site.

At the end of each day and/or field activity, all containers will be sealed or covered in such a way to prevent the introduction of rain water or surface run-off. Centralized staging area(s) will be assigned prior to initiation of any site work. Unless directed otherwise, the staging area will be located within the boundaries of the site where field work will take place. All filled containers generated for a given area will be placed in the central location. In the event that conditions indicate the potential for reactive wastes, special handling and storage precautions will be utilized. The integrity of containers moved to the staging area will be monitored routinely, as required (USEPA, 1992).

5.2.2 Rinsate IDW Sampling

5.2.2.1 Specific Requirements for Glass Thief Sampling

Follow steps given below:

1. Slowly insert the thief to just a few inches above the bottom of the tank so that no sludge is collected. Ensure that the liquid remains level in the thief and tank during the descent of the tube so that various phases are accurately proportioned. If the liquid inside the thief is lower than the level outside the thief,

the sampling rate is too fast and will result in biased sample content. Approximately one foot of the thief should extend above the tank opening.

2. Try to avoid placing the thief in sludge. If sludge clogs the tip of the thief, it can be removed with a stainless steel spoon, or equivalent.

3. Cap the top of the thief with a tapered stopper or gloved thumb, ensuring that the liquid does not come in contact with the stopper or thumb.

4. Carefully remove the capped thief from the tank and insert the uncapped end into the sample container, being careful not to spill any liquid outside the container. This may require a step or platform.

5. Release the stopper or thumb and allow the liquid to drain into the sample container. Repeat as necessary until the appropriate sample containers are filled.

6. Remove the tube from the sample container, dispose of properly, and secure the cap tightly on the sample container.

7. Label the sample bottle with the appropriate sample label. Be sure to complete the label carefully and clearly, addressing all the categories or parameters.

5.2.2.2 Specific Requirements for COLIWASA Sampling

Follow steps given below:

1. Choose the plastic or glass ball-type stopper COLIWASA for the liquid waste to be sampled and assemble the sampler.

2. Ensure that the sampler is functioning properly. Adjust the locking mechanism, if necessary, to make sure the stopper provides a tight closure.

3. Put the sampler in the open position by placing the stopper rod handle in the T-position and pushing the rod down until the handle sits against the locking block of the sampler. The open position for the glass ball type is achieved by pulling up on the inner rod, thereby pulling the glass ball away from the tapered end of the outer tube. The sampler MUST be open BEFORE inserting the COLIWASA into the liquid to be sampled. This prevents a gross oversampling of a single layer.

4. Once the COLIWASA is in the open position, slowly lower the sampler into the tank at a rate that permits the levels of liquid inside and outside the sampler tube to equalize. If the liquid in the sampler tube is lower than the level outside the sampler, the sampling rate is too fast and will result in bottom-biased sample content.

5. When the sampler stopper hits the bottom of the waste container, slowly push the sampler tube downward against the stopper to close the sampler. Lock the sampler in the closed position by turning the T-handle until it is upright and one end rests tightly on the locking block. The closed position for the glass ball type is achieved by slowly pushing the glass ball end of the inner rod against the tapered end of the outer tube.

6. Carefully withdraw the sampler from the tank with one hand while wiping the sampler tube with a disposable cloth or rag with the other hand.

7. Carefully discharge the sample into a suitable sample container by slowly opening the sampler. This is done by slowly pulling the lower end of the T-handle away from the locking block and pulling up on the inner rod to release the contents, while the lower end of the sampler is positioned in the sample container. Repeat as necessary.

8. Slow movements during all the above steps ensure the cross-section of the sample is not disturbed.

9. Secure the sample container cap tightly.

10. Label the sample bottle with the appropriate sample label. Be sure to complete the label carefully and clearly, addressing all the categories or parameters.

5.2.2.3 Decontamination

If the glass thief or COLIWASA are to be used multiple times they shall be decontaminated before and after each use and in between sampling each tank. Refer to the decontamination SOP for complete procedures.

5.3 Final Disposition of IDW

5.3.1 Rinsate

Once adequately characterized, rinsate exceeding Toxic Substances Control Act (TSCA)/RCRA criteria will be disposed of as hazardous waste. Rinsate not exceeding TSCA/RCRA criteria will be disposed of in a sanitary sewer adjacent to the outdoor storage facility. DOT-approved labels will be used if transportation outside of Holloman AFB is required or anticipated. (USEPA, 1992)

5.3.2 Soil Cuttings

No soil IDW disposal is required since soil cuttings will be placed back into each respective borehole in the reverse order from which they are generated.

5.3.3 Solid Waste

Solid waste includes nonhazardous IDW such as spent PPE, plastic sheeting, rope, and disposable sampling equipment utilized during field activities. These materials will be placed into heavy-duty plastic trash bags and dumpsters for disposal at a permitted solid waste disposal facility. Waste materials may also be bulked on site, with like waste streams possessing compatible nonhazardous characteristics.

6.0 Exception Provisions

None.

7.0 Records

None.

8.0 Interferences

None.

9.0 References

AECOM Technical Services, Inc. (AECOM), 2013a. *Draft Final Work Plan for RCRA Facility Closure, Hazardous Waste Container Storage Unit Facility, Holloman, AFB, New Mexico*, October.

AECOM, 2013b. *Draft Health and Safety Plan for RCRA Facility Closure, Hazardous Waste Container Storage Unit Facility, Holloman, AFB, New Mexico*, October.

United States Environmental Protection Agency (USEPA), 1991. *Management of Investigative-Derived Wastes during Site Inspections, Office of Research and Development, Publication, EPA/540/G-91/009*, May.

USEPA, 1992. *Management of Contaminated Media, Region IV EPA, Guidance Number TSC-92-02*, December.

10.0 Tables

None.

11.0 Attachments

None.

Standard Operating Procedure

Collection of Soil Samples

SOP - 3

October 2013

Contents

1.0	**Scope and Applicability**	**1**
2.0	**Health and Safety Considerations**	**1**
3.0	**Responsibility Matrix**	**2**
4.0	**Definitions**	**2**
5.0	**Procedures, Equipment and Supplies**	**3**
6.0	**Exception Provisions**	**7**
7.0	**Records**	**7**
8.0	**Interferences**	**7**
9.0	**References**	**8**
10.0	**Tables**	**8**
11.0	**Attachments**	**8**

1.0 Scope and Applicability

1.1. Purpose and Applicability

This Standard Operating Procedure (SOP) establishes the AECOM Technical Services, Inc. (AECOM) guidelines and procedures for field personnel to use in the collection and documentation of surface-to-shallow subsurface (0 to 3 feet depth) soil samples at the Resource Conservation and Recovery Act facility closure of a Hazardous Waste Container Storage Unit (CSU) Facility located at Holloman Air Force Base, New Mexico. The procedures and equipment requirements contained in this SOP are subject to modification based upon project-specific requirements and site conditions.

The procedures in this SOP have been modified from multiple guidance documents listed in the reference section to reflect the typical field conditions encountered at the CSU facility. The procedures are subject to change if unusual or unanticipated field conditions are encountered; however, all deviations must be approved by the AECOM Project Manager before implementation. This information shall in turn be passed on to the Air Force Civil Engineer Center Project Manager prior to the acceptance of the change in SOP. Proper collection procedures are necessary to assure the quality and integrity of all soil samples.

Soil samples are collected to determine the type(s) and level(s) of contamination (if any) and define the contaminated area(s). These samples may be collected as part of an investigative plan, confirmation sampling, and/or as a screen for “hot spots”, which may require more extensive sampling. Based on analytical requirements, surface and shallow subsurface soil is easily collected using Terra Core™ Samplers, stainless steel and/or Teflon-lined trowels, hand augers, or equivalent.

Prior to conducting a soil sampling investigation, a sampling strategy should be developed based on the objectives of the investigation. The details within this SOP should be used in conjunction with the Field Sampling Plan (FSP), which this SOP is an Appendix to, and the Work Plan (AECOM, 2013a), which will generally provide the following information:

- Locations and depths of soil samples to be collected;
- Numbers and volumes of soil samples to be collected;
- Types of analyses to be conducted for the samples; and,
- Specific quality control (QC) procedures and sampling required.

2.0 Health and Safety Considerations

The health and safety considerations for the work associated with this SOP, including both potential physical and chemical hazards, will be addressed in the site-specific Health and Safety Plan (AECOM, 2013b). Adequate health and safety measures must be taken to protect sampling personnel from these potential hazards. This plan must be distributed to all personnel performing sampling, and must be adhered to as field activities are performed.

3.0 Responsibility Matrix

3.1. Project Manager

The Project Manager has the responsibility of overseeing and directing the entire project, and ensuring that all activities are conducted in accordance with the client's direction, this SOP, and any other appropriate procedures.

3.2. Field Team Leader

The Field Team Leader is responsible for ensuring that field activities are conducted and documented in accordance with this SOP and any other appropriate procedures. This will be accomplished through staff training and by maintaining quality assurance/QC.

3.3. Field Team

All members of the field team (e.g., samplers, technicians, field geologists, engineers, etc.) assigned to perform these activities are responsible for understanding, implementing and completing their tasks according to specifications outlined in this SOP and other appropriate procedures. Moreover, individual team members is must also ensure all team members perform work in accordance with this procedure. All staff are responsible for reporting deviations from the procedures to the Field Team Leader.

3.4. Site Contractor Quality Control Systems Manager

The Site Contractor Quality Control Systems Manager (CQCSM) is responsible for periodic review of field generated documentation associated with this SOP. The CQCSM is also responsible for the implementation of corrective action (e.g., re-training personnel, additional review of work plans and SOPs, variances to the abandonment requirements, issuing non-conformances, etc.) if problems occur.

4.0 Definitions

Surface Soil – The soil which exists below the land surface to approximately six inches.

Shallow Subsurface Soil – The soil which exists below surface soil to a depth of approximately three feet.

Terra Core™ Sampler – A disposable volumetric sampling device used for collecting small amounts (five to 10 grams) of soil for volatiles analysis into laboratory supplied containers.

Hand Auger – A hand-operated device used for collecting subsurface soil samples. Several types of hand augers are available: screw-type augers, barrel augers, tube type augers, and hand-held power augers. The basic operation of a hand auger involves turning the auger repeatedly while applying pressure so that it goes down into the soil. Soil samples are collected either from the cuttings (screw-type) or the barrel (barrel or tube-type) of the auger.

Trowel – A small stainless steel shovel, approximately six to eight inches in length, with a slightly curved blade. The trowel has a stem-like handle (for hand operation). Samples are collected with a scooping action.

5.0 Procedures, Equipment and Supplies

5.1. Supplies and Equipment

The following is a list of the supplies and equipment needed to implement this SOP in the field.

5.1.1. Required Records and Forms

- Sample Collection Log (SCL)
- Field log book
- Samples tags/labels and the appropriate forms/documentation for sample shipment
- Project-specific HASP
- Site-specific Work Plan and/or FSP
- Material Safety Data Sheets
- Manufacturer's instructions for the Terra Core™ Sampler

5.1.2. Recommended Materials, Equipment or Supplies

- Indelible black ink pens and markers
- Appropriate sample containers (typically provided by the laboratory)
- Insulated coolers
- Waterproof sealing tape
- Decontamination equipment and supplies, including rinse bottles and deionized water
- Fiberglass packing tape
- Paper towels
- Nitrile or Latex gloves
- Boring logs
- Aluminum foil
- Plastic Zip-Loc® bags
- Personal protective equipment (PPE)
- Stainless steel and/or Teflon®-lined spatulas, pans, trays, or bowls
- Stainless steel and/or Teflon®-lined trowels and/or hand auger
- Linear measuring device (e.g., tape measure)
- Terra Core™ Sampler
- Radio, two-way, hand held or cellular phone

5.2. General Requirements

Surface field-screening samples will be collected using a decontaminated stainless steel or Teflon®-lined trowel or Terra Core™ Sampler for VOA. Shallow subsurface field-screening samples will be collected

using the hand auger sampling technique. The following steps must be followed when preparing for soil sample collection:

1. Verify that all personnel have read and understood the approved site-specific HASP and have the proper training and certifications required under the Occupational Safety and Health Administration.
2. Verify the site location by existing maps and surface features. Delineate the boundaries of the work site with flagging or other means to prohibit access to unauthorized personnel. Samples are to be marked and proper utility clearances obtained prior to sampling event.
3. Ensure that all soil sample locations have been appropriately cleared of all underground utilities and buried objects. Review all forms and diagrams documenting the location of the cleared sampling locations, as well as that of any underground utilities, lines, or other buried objects.
4. Check to see that all the necessary equipment (including PPE) is available at the site, is in good working condition, and has been properly decontaminated. Don the appropriate PPE and clothing as dictated by the project-specific HASP.
5. Place clean plastic sheeting on a flat, level surface near the sampling area, if possible. Place equipment to be used on the plastic. Place decontamination equipment, supplies, and insulated cooler(s) on separate plastic sheeting. Cover all equipment and supplies with clean plastic sheeting when not in use.
6. Document the sampling events, recording the information on the SCL or equivalent form as specified. Document any and all deviations from this procedure in the Field Log Book and include rationale for changes.

5.3. Specific Requirements for Collection of Soil Samples for VOA Using the Terra Core™ Sampler

Soil samples for volatile organic compound analysis (VOA) shall be collected using the Terra Core™ Samplers unless otherwise directed. Collection for VOA is slightly more complex than collection of samples for other routine chemical or physical testing, primarily because of the concern for the potential loss of volatiles during the sample collection procedure. To limit the potential for loss of volatiles, the soil sample needs to be obtained from the sampling equipment as quickly and directly as possible. This generally means that the VOA sample is to be collected and placed into the appropriate sample container first. The VOA sample should also be obtained from a discrete portion of the entire sample interval and not composited or homogenized.

For sample collection activities that do not require the use of the Terra Core™ Sampler, collection procedures are documented in Section 5.4. Sample analysis precedence is also presented in Section 5.5. Following the manufacturer's instructions, samples for VOA should be collected as outlined below:

1. Carefully remove any ground cover (e.g., stones, vegetation, etc.) from sampling location surface and the top one to two centimeters of exposed soil, sediment, or sludge before sample collection. For subsurface samples, collect the freshly-exposed soil prior to compositing as detailed in Section 5.5.
2. Have the 40-mL glass VOA vial containing the appropriate preservative ready to receive a soil sample.
3. Follow sampling pattern as described in the FSP.

4. With the plunger seated in the center of the T-shaped sampler, securely hold the sampler in-hand and push the coring portion of the sampler into the ground. The soil will fill the chamber within the coring portion.
5. Check to ensure that the chamber within the sampler is full. Once the chamber is full, rotate the plunger in the center of the T-shaped sampler and push the plunger to extrude the sample into the laboratory-supplied container.
6. Label each sample container with the appropriate information. Secure the label by covering it with a piece of clear tape.
7. Use a decontaminated, stainless steel or Teflon®-lined trowel, or auger as many times as necessary to obtain the volume needed to fill the specified sample containers.
8. Secure the appropriate cap on each container immediately after filling it.
9. Wipe the sample containers clean with an unused Kimwipe or paper towel. Follow the proper sample handling, packaging, and shipping requirements as detailed in the field procedures sample handling section.
10. Place sample containers in individual zip-top or similar plastic bags and seal the bags.
11. Pack all samples going to the same laboratory in a cooler. Include properly completed Chain of Custody forms and affix custody seals to the three unhinged sides of the cooler lid (see Packaging and Shipment of Environmental Samples SOP).
12. To minimize cross-contaminations, decontaminate sampling equipment after sample collection at each sample location.

If high concentrations of volatiles are suspected or expected, one additional subsample will be collected according to one of two methods:

- For high concentrations expected significantly above reporting limits (RLs), one unpreserved (no chemicals, no water) 40-mL VOA vial will be packed tightly with no headspace using soil from the sampling location and labeled for high concentration analysis.
- For marginally high concentrations (two- to three-fold dilutions expected), one subsample of approximately 1.5 to 2 g may be collected and extruded immediately into a specially prepared, tared VOA vial and labeled for high concentration analysis.

Alternatively, for the high-concentration soil method (solid samples with VOC concentrations greater than 200 µg/kg), one of two methods may be used:

- VOCs are determined by collecting a bulk sample in a vial or other suitable container without the use of the preservative solution (sodium bisulfate). A portion of that sample is removed from the container in the laboratory and is dispersed in a water-miscible solvent (methanol) to dissolve the VOCs. An aliquot of the solution is added to 5-mL of reagent water in a purge tube. Surrogates and internal standards (if applicable) are added to the solution, then purged using Method SW5030B, and analyzed using an appropriate, determinative method.
- VOCs are determined by collecting an approximately 5 g sample in a pre-weighed vial with a septum-sealed screw cap that contains 5-mL of water-miscible organic solvent (methanol). The use of soil preservative ratios of 10 g/10 mL or 25 g/25 mL is also acceptable. At the time of analysis, surrogates are added to the vial, then an aliquot of the solvent is removed from the vial, purged using Method SW5030B, and analyzed by an appropriate, determinative method.

5.4. Specific Requirements for Collection of Soil Samples for Non-volatile Organic or Inorganic Analyses

1. Label each sample container with the appropriate information. Secure the label by covering it with a piece of clear tape.
2. Use a decontaminated stainless steel or Teflon®-lined trowel or auger as many times as necessary to obtain the volume needed to fill the specified sample containers.
3. Empty the contents of each fill of the sampling device directly into a clean, stainless steel or Teflon®-lined tray or bowl, or equivalent (e.g. a large zip-top plastic bag).
4. Homogenize the sample by thoroughly mixing together the total volume of sample using a decontaminated stainless steel or Teflon® spoon, spatula, or trowel.
5. Use the spoon, spatula, or trowel to distribute the uniform mixture into the labeled sample containers.
6. Secure the appropriate cap on each container immediately after filling it.
7. Wipe the sample containers clean with a clean Kimwipe or paper towel. Follow the proper sample handling, packing, and shipping requirements as detailed in the corresponding SOPs.
8. Place sample containers in individual zip-top or similar plastic bags and seal the bags.
9. The sample coordinator will pack all samples going to the same laboratory in a cooler. Include properly-completed chain of custody forms and affix custody seals to the three unhinged sides of the cooler lid.
10. To minimize cross-contamination, decontaminate sampling equipment after sample collection at each sample location.

Surface soil samples are normally collected starting in the area believed to be least-contaminated, then moving to progressively more contaminated locations until the most-contaminated areas are sample last.

5.5. Specific Requirements for Hand Augering

1. Follow the general procedures for collection of subsurface soil samples as outlined in Section 5.2.
2. For sites with volatile organic compound (VOC) impacts: Using gloved hands or spatula/spoon, fill either a clean container or zip-top bag approximately one-half to two-thirds full with soil/sediment and tightly seal the zip-top bag or tightly cap the clean container with a piece of aluminum foil.
3. Properly identify the sample and record it on the boring log.
4. Obtain soil samples for laboratory analyses:
    a. Samples requiring VOC analysis (per the site-specific FSP) will always be collected first.
    b. Other analyses that do not require sample homogenation (per the site and/or investigation-specific work plan) will be collected second. This may include semi-volatile organic compound (SVOC), total petroleum hydrocarbon (TPH), or other analysis as designated in the site and/or investigation-specific work plan.
    c. Samples requiring soil homogenation (per the site-specific FSP) will be collected last. This may include metals analysis as designated in the site and/or investigation-specific work plan.

5.6. Records

All soil screening and sampling data will be recorded in the boring log. For each soil sample collected, the technician will complete a SCL. The SCL prompts the technician to identify and record information such as: site identification (ID), sample location ID, sample number, collection date and time, sample containers, and associated QC sample information. General information regarding the screening and sampling of the soil borings will be entered in the field log book. The field log book will record the general information regarding the soil sampling activities referencing the SCL. Entries will be recorded chronologically and the time of the entry recorded first. All field log book continuation pages will be sequentially numbered and the last page recorded for the day will be signed and dated by the recording technician.

5.7. Restrictions and Limitations

The Terra Core™ sampler is a disposable, single-use device. **The material obtained by the Terra Core™ system in a preserved VOA vial must be frozen or analyzed within 48 hours**. Consequently, the samples must be shipped overnight delivery to the laboratory on the same day that the samples are collected. Failure to ship VOA samples immediately will result in the samples exceeding their 48-hour holding time.

One VOA vial packed tightly with soil shall be collected for percent moisture determination but must *not* be frozen.

6.0 Exception Provisions

Headspace analysis is limited by potential loss of VOCs during method execution.

Since the soil sample sleeves from borings will be collected for other non-VOA methods, the additional percent moisture VOA vial may not be required, as the percent moisture determination can be made using soil from the sleeves.

7.0 Records

None.

8.0 Interferences

None.

9.0 References

AECOM Technical Services, Inc. (AECOM), 2013a. *Draft Final Work Plan for RCRA Facility Closure, Hazardous Waste Container Storage Unit Facility, Holloman, AFB, New Mexico*, October.

AECOM, 2013b. *Draft Health and Safety Plan for RCRA Facility Closure, Hazardous Waste Container Storage Unit Facility, Holloman, AFB, New Mexico*, October.

En Novative Technologies, Inc., Green Bay, Wisconsin, Disposable Terra Core™ Sampler Sampling Procedures. http://www.ennovativetech.com/pages/the-en-core-sampler/en-core-product-information/sampling-procedures.php

10.0 Tables

None.

11.0 Attachments

None.

Standard Operating Procedure

Collection of PCB Wipe Samples

SOP - 4

October 2013

Contents

1.0 Scope and Applicability 1
2.0 Health and Safety Considerations 1
3.0 Responsibility Matrix 1
4.0 Definitions 2
5.0 Procedures, Equipment and Supplies 2
6.0 Exception Provisions 5
7.0 Records 5
8.0 Interferences 5
9.0 References 5
10.0 Tables 5
11.0 Attachments 5

1.0 Scope and Applicability

This Standard Operating Procedure (SOP) establishes the AECOM Technical Services, Inc. (AECOM) guidelines and procedures for field personnel use in the collection and documentation of surface wipe samples for polychlorinated biphenyls (PCBs) at the Resource Conservation and Recovery Act closure of a Hazardous Waste Container Storage Unit (CSU) Facility located at Holloman Air Force Base, New Mexico. The procedures and equipment requirements contained in this SOP are subject to modification based upon project specific requirements and site conditions.

The procedures in this SOP have been modified from multiple guidance documents listed in the reference section to reflect the typical field conditions encountered at the CSU Facility. The procedures are subject to change if unusual or unanticipated field conditions are encountered; however, all deviations must be approved by the AECOM Project Manager before implementation. Proper collection procedures are necessary to assure the quality and integrity of all PCB wipe samples. Documents other than those required by the contract and consulted in the preparation of this SOP are listed under "References." The details within this SOP should be used in conjunction with the Field Sampling Plan (FSP), which this SOP is an Appendix to, and the Work Plan (AECOM, 2013a).

Surface wipe samples are collected to determine the level(s) of contamination of PCBs and define the contaminated area(s). These samples may be collected as part of an investigative plan, confirmation sampling, and/or as a screen for "hot spots," which may require more extensive sampling. Surface wipe samples shall be collected on smooth and impervious surfaces and collected using a wipe from a pre-packaged kit. Surface wipe sampling is inappropriate for surfaces which are porous and would absorb PCBs, such as wood and asphalt. Where a porous sample is encountered a chisel, drill, or saw, etc., may be used to remove a sufficient sample for analysis. Before collection of verification samples, a selected wipe and solvent should be used to generate a field blank. (USEPA, 1985). Prior to conducting the PCB wipe sampling investigation, the sampling strategy outlined in "Procedures, Equipment, and Supplies" should be followed based on the objectives of the investigation. Moreover, the details within this SOP should be used in conjunction with the Site-Specific Work Plan.

2.0 Health and Safety Considerations

The health and safety considerations for the work associated with this SOP, including both potential physical and chemical hazards, will be addressed in the site-specific Health and Safety Plan (AECOM, 2013b). Adequate health and safety measures must be taken to protect sampling personnel from these potential hazards. This plan must be distributed to all personnel performing sampling, and must be adhered to as field activities are performed.

3.0 Responsibility Matrix

3.1 Project Manager

The Project Manager has the responsibility of overseeing and directing the entire project, and ensuring that all activities are conducted in accordance with the client's direction, this SOP, and any other appropriate procedures.

3.2 Field Team Leader

The Field Team Leader, is responsible for ensuring that field activities are conducted and documented in accordance with this SOP and any other appropriate procedures. This will be accomplished through staff training and by maintaining quality assurance/quality control.

3.3 Field Team

All field team members assigned to perform these activities are responsible for completing their tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from the procedures to the Field Team Leader or AECOM Technical Lead.

3.4 Site Contractor Quality Control Systems Manager

The Contractor Quality Control Systems Manager (CQCSM) is responsible for periodic review of field generated documentation associated with this SOP. The CQCSM is also responsible for the implementation of corrective action (i.e., retraining personnel, additional review of Work Plans and SOPs, variances to the abandonment requirements, issuing non-conformances, etc.) if problems occur.

4.0 Definitions

PCB Wipe – A piece of 11-cm. filter paper or gauze pad used to collect field samples for analysis and detection of PCBs.

5.0 Procedures, Equipment and Supplies

5.1 Supplies and Equipment

The following is a list of the supplies and equipment needed to implement this SOP in the field.

5.1.1 Required Records and Forms

- Sample Collection Log (SCL)
- Field log book
- Sample tags/labels and the appropriate forms/documentation for sample shipment
- Site-Specific HASP
- Site-Specific Work Plan and/or FSP

5.1.2 Recommended Materials, Equipment, or Supplies

- Indelible black-ink pens and markers
- Insulated cooler

- Packing tape
- Nitrile gloves
- Plastic zip-top bags
- Personal protective clothing and gear
- Field measurement equipment
- Linear measuring device (e.g., tape measure)
- Appropriate sampling containers
- Laboratory-supplied PCB wipe sampling kit (pre-packaged wipe, 4-oz. jar filled with solvent)
- Stainless steel forceps
- 10-cm. by 10-cm. (100-cm^2) stainless steel template

5.2 General Requirements

The following steps shall be followed when preparing for PCB wipe sample collection:

1. Don the appropriate personal protective clothing as dictated by the Site-Specific HASP.
2. Ensure that all PCB wipe sample locations have been clearly marked on diagrams.
3. Place clean plastic sheeting on a flat, level surface as close to the sampling area as possible. Store sampling equipment on the plastic and place decontamination equipment, supplies, and insulated cooler(s) on separate plastic sheeting. Cover all equipment and supplies with clean plastic sheeting when not in use.
4. Document the sampling events, recording the information on the SCL or equivalent form as specified. Document any and all deviations from this procedure in the field log book and include rationale for changes.

5.3 Specific Requirements for Collection of PCB Wipe Samples Using Pre-packaged Wipes

5.3.1 Creating the Sampling Area Using the 7-Point Hexagonal Grid Technique

1. The 7-point hexagonal grid technique (7-point method) forms a sampling area in the shape of a hexagon, as seen in Figure 1. Each individual sampling area will be marked with a 10-cm. by 10-cm. (100-cm^2) stainless steel template.
2. Locate the middle of the sampling surface by drawing a diagonal line from the top of one corner to the bottom of the opposing corner. Repeat on the other corners. The intersection of the diagonals (which will form an “X”) shall be the center sampling point.

3. Two more sampling points can be found by measuring the distance of the sampling surface from top to bottom. Divide this distance by two, giving another distance, “h”. Measure the distance “h” one inch from the edge of either side of the sampling surface.

4. Locate the final four sampling points by measuring the wall from one side to the other. Divide this distance by three, giving “w”. Measure the distance “w” from one edge of the wall towards the center point and one inch from either the top or the bottom of the sampling surface. Repeat this step on each side of the surface to complete the sampling grid.

5.3.2 Collecting the Sample

1. Identify sumps and surfaces to be sampled.

2. Prepare a 4-oz. glass jar for wipe sample collection and ensure proper labeling by using laboratory-supplied labels and an indelible pen or marker.

3. When collecting a 7-point sample, mark the points by securing a 10-cm. by 10-cm. (100-cm^2) stainless steel template to the surface of the sampling area.

4. With a gloved hand, open and remove the wipe from the pre-packaging and fold in half. Attach the stainless steel forceps to the edge of the fold.

5. Spread the wipe open and place it on the surface to be sampled with the forceps. Ensure that only the wipe is touching the sampling surface. Note that only one side of the wipe should be used.

6. Wipe the entire area within each template of the 7-point sampling grid with firm strokes. Once each of the seven points has been sampled, place the wipe in the labeled, 4-oz. glass jar.

7. When conducting a collective sample, firmly stroke one side of the wipe across each wall of the sump and the sump bottom before placing it in the labeled, 4-oz. glass jar. Do not touch the used side of the wipe after the sample has been collected.

8. Place the glass jar in an insulated cooler until the jar can be refrigerated for storage.

9. The sample coordinator shall pack all samples going to the same laboratory in a cooler, include properly-completed chain-of-custody forms, and affix custody seals to the three unhinged sides of the cooler lid in accordance with procedures outlined in the “Packaging and Shipment of Environmental Samples” SOP.

10. In order to minimize cross-contamination, decontaminate or dispose of all sampling equipment after sample collection at each sampling location.

5.3.3 Restrictions/Limitations

PCB wipes can be stored in the 4-oz. glass jars for up to 14 days at 4˚C.

5.3.4 Records

For each PCB wipe sample collected, the technician/sampling personnel will complete a SCL. This form prompts the identification and recordation information such as: site identification (ID), sample location ID, sample number, collection date and time, sample containers, and associated quality control sample

information. Moreover, the field log book will record the general information regarding the PCB wipe sampling activities and reference the SCL for all the sampling data and information (USEPA, 2001).

6.0 Exception Provisions

None.

7.0 Records

None.

8.0 Interferences

None.

9.0 References

AECOM Technical Services, Inc. (AECOM), 2013a. Draft Final Work Plan for RCRA Facility Closure, Hazardous Waste Container Storage Unit Facility, Holloman, AFB, New Mexico, October.

AECOM, 2013b. Draft Health and Safety Plan for RCRA Facility Closure, Hazardous Waste Container Storage Unit Facility, Holloman, AFB, New Mexico, October.

United States Environmental Protection Agency (USEPA), 1985. *Verification of PCB Spill Cleanup by Sampling and Analysis,* EPA-5601585026, August.

USEPA, 2001. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual, November.

10.0 Tables

None

11.0 Attachments

Figure 1

Figure 1: 7-Point Hexagonal Grid Technique Example

Standard Operating Procedure

Packaging and Shipment of Environmental Samples

SOP - 5

October 2013

Contents

1.0 Scope and Applicability 1
2.0 Health and Safety Considerations 1
3.0 Responsibility Matrix 1
4.0 Definitions 2
5.0 Procedures, Equipment and Supplies 2
6.0 Exception Provisions 4
7.0 Records 5
8.0 Interferences 5
9.0 References 5
10.0 Tables 6
11.0 Attachments 6

1.0 Scope and Applicability

1.1. Purpose and Applicability

This Standard Operating Procedure (SOP) establishes the AECOM Technical Services, Inc. (AECOM) guidelines and procedures for field personnel to use in the packaging and shipping of environmental samples for chemical and physical analysis at the Resource Conservation and Recovery Act facility closure of a Hazardous Waste Container Storage Unit (CSU) Facility located at Holloman Air Force Base, New Mexico. The procedures and equipment requirements contained in this SOP are subject to modification based upon project-specific requirements and site conditions.

The procedures in this SOP have been modified from multiple guidance documents listed in the reference section to reflect the typical field conditions encountered at the CSU facility. The procedures are subject to change if unusual or unanticipated field conditions are encountered; however, all deviations must be approved by the AECOM Project Manager before implementation. This information shall in turn be passed on to the Air Force Civil Engineer Center Project Manager prior to the acceptance of the change in SOP.

This SOP only applies to the packaging and shipping of low concentration environmental samples. This procedure does not apply to those samples considered as hazardous materials, hazardous waste, mixed waste, radioactive waste, or dangerous goods. Those requirements are specified in the United States Department of Transportation (DOT) 49 Code of Federal Regulations (CFR) 171-178 (DOT, 2013), and the most current edition of the International Air Transport Association (IATA) Dangerous Goods Regulations (IATA, 2014). The details within this SOP are only applicable to the general requirements for sample packaging and shipping and should only be used as a guide for developing more job-specific work plans. The details within this SOP should be used in conjunction with the Field Sampling Plan (FSP), which this SOP is an Appendix to, and the Work Plan (AECOM, 2013a).

2.0 Health and Safety Considerations

The health and safety considerations for the work associated with this SOP, including both potential physical and chemical hazards, will be addressed in the site-specific Health and Safety Plan (AECOM, 2013b). Adequate health and safety measures must be taken to protect sampling personnel from these potential hazards. This plan must be distributed to all personnel performing sampling, and must be adhered to as field activities are performed.

3.0 Responsibility Matrix

3.1. Project Manager

The Project Manager has the responsibility of overseeing and directing the entire project, and ensuring that all activities are conducted in accordance with the client's direction, this SOP, and any other appropriate procedures.

3.2. Field Team Leader

The Field Team Leader is responsible for ensuring that field activities are completed to meet the project objectives, are conducted in accordance with the project plans and requirements, and all activities are performed according to the respective procedures.

3.3. Field Team

All members of the field team (e.g., samplers, technicians, field geologists, engineers, etc.) are responsible for understanding and implementing this field procedure as well as ensuring all team members perform work in accordance with this procedure. All staff are responsible for reporting deviations from the procedures to the Field Team Leader or AECOM Technical Lead.

3.4. Site Contractor Quality Control Systems Manager

The Site Contractor Quality Control Systems Manager (CQCSM) is responsible for periodic review of field generated documentation associated with this SOP. The CQCSM is also responsible for the implementation of corrective action (e.g., re-training personnel, additional review of work plans and SOPs, variances to the abandonment requirements, issuing non-conformances, etc.) if problems occur.

4.0 Definitions

Environmental Sample – A low contaminant concentration sample that does not meet DOT or IATA definitions for a regulated shipment.

Hazardous Materials/Dangerous Goods Sample – Medium or high contaminant concentration sample regulated by either DOT or IATA.

Hazardous Waste – Any substance listed in 40 CFR Subpart D (260.30 et seq.) or otherwise characterized as ignitable, corrosive, reactive, or toxic as specified in Subpart C (261.20 et seq.) that would be subject to manifest and packaging requirements specified in 40 CFR 262. Hazardous waste is defined and regulated by the United States Environmental Protection Agency.

Sample – Physical evidence collected from a facility or the environment which is representative of conditions at the point and time at which the sample is collected.

U.S. DOT Regulations – Requirements for shipping hazardous materials by highway domestically found in 49 CFR 171-178.

IATA Regulations – Requirements for shipping dangerous goods by air both domestically and internationally.

5.0 Procedures, Equipment and Supplies

5.1. Supplies and Equipment

The following is a list of the supplies and equipment needed to implement this SOP in the field.

5.1.1. Required Records and Forms

- Sample Collection Log
- Field Log Book

- Samples tags/labels and the appropriate forms/documentation for sample shipment
- Material Safety Data Sheets
- Site-Specific Work Plan and/or FSP
- Quality Assurance Project Plan (QAPP)
- 49 CFR 171-178 for ground shipping or the IATA regulations for air shipping

5.1.2. Recommended Materials, Equipment or Supplies

- Indelible black ink pens and markers
- Plastic or metal coolers (typically provided by the laboratory)
- Waterproof sealing tape
- Ice (double bagged)
- Fiberglass packing tape
- Nitrile or Latex gloves
- Plastic Zip-Loc® bags
- Bubble wrap, Styrofoam™ packing material, vermiculite (or other absorbent material)
- Shipping and Chain of Custody (CoC) forms

5.2. Procedures

The following steps must be followed when packaging and shipping non-regulated environmental samples:

1. Properly label (with indelible ink) sample container with the site, unique sample identifier, matrix type, time and date of collection, analytical method, preservatives, and sampling personnel at the time of sample collection. Clear tape should be placed over the label to minimize moisture damage to the ink.
2. Immediately after sample collection, hermetically seal the container by tightening the cap and placing a piece of tape over and around it. This also means that the custody tape should be placed over the cap so that any attempt to remove the cap will cause the tape to be broken. Do not place custody tape over a volatile organic analysis (VOA) vial septum.
3. Prepare CoC and request for analyses forms as required by the QAPP (AECOM, 2013c).
4. Place all containers in separate, appropriately sized, airtight, seam-sealing polyethylene bags (e.g., Ziploc®). Seal the bag by removing any excess air and wrap with bubble wrap or similar material.
5. Place the bagged container inside an insulating shipping container, such as a common plastic picnic cooler (not Styrofoam™).
6. Surround the bagged container with absorbent material (e.g., vermiculite), if desired.
7. Samples must be packed so they are surrounded and covered by a sufficient volume of ice to maintain a 4 ± 2 degrees Celsius (°C) temperature immediately following collection of the samples in the field and during the entire shipping period. Ice used in the cooler must be contained in two sealed, leak-proof plastic bags to prevent contact of the sample containers with melted ice.

8. Sample labels must be compared to the CoC forms to ensure proper documentation. Sample labels must be attached so they will not come loose from sample containers during shipment or if they become wet (the use of clear tape wrapped around the label will prevent this).
9. Place additional packing material (e.g., bubble wrap, vermiculite, or Styrofoam™) on top of the samples to eliminate the potential for shifting during shipment. Cushioning materials may be used to inhibit breakage of sample containers; however, cushioning material must not interfere with maintaining sample cooling.
10. Record the air bill number or other shipping information on the CoC.
11. Place the original CoC in a re-sealable bag and tape to the inside top of the cooler. A copy of the CoC must be retained for the field file.
12. Place custody seals on the shipping container. Use custody seals on individual bottles if coolers might be opened during transport (e.g., customs, etc.).
13. Seal cooler with strapping tape over the custody seals. Place address label on the cooler. Mark the container "THIS END UP", or apply arrow labels that indicate the proper position to be maintained during shipping.
14. If samples are shipped via commercial overnight delivery service, a copy of the shipping bill must be retained in the appropriate files. All pertinent information must also be recorded in the Field Log Book. If sampling personnel are delivering samples to the laboratory, this should be noted on the CoC. In this case, the cooler need not have custody seals during transport.
15. The laboratory should be contacted to confirm safe arrival of all samples. If sample delivery to the laboratory will occur on weekends or holidays, the laboratory will be notified so that someone will be available to receive them. Any problems occurring after sample shipment should be recorded in the Field Log Book, along with the names of personnel at the laboratory who identified or explained the problem (USEPA, 2011).

6.0 Exception Provisions

1. Blue ice or similar products are not allowed for shipping because they do not maintain the 4°C standard required for sample shipping. Blue ice should only be used while collecting samples in the field.
2. Samples must be packed so they are surrounded and covered by a sufficient volume of ice to maintain a 4 ± 2°C temperature immediately following collection of the samples in the field and during the entire shipping period. Ice used in the cooler must be contained in sealed, leak-proof, plastic bags to prevent contact of the sample containers with melted ice.
3. When shipping packages containing samples preserved with corrosives such as hydrochloric acid (HCl), nitric acid (HNO_3), sulfuric acid (H_2SO_4), and sodium hydroxide (NaOH), the samples will not meet DOT's definition of Class 8 – Corrosives because of the preservative, as long as the following limitations are met:
    a. HCl in water solution at a concentration of 0.04% or less by weight (pH > 1.96).
    b. HNO_3 in water solution at a concentration of 0.15% or less by weight (pH > 1.62).
    c. H_2SO_4 in water solution at a concentration of 0.35% or less by weight (pH > 1.15).
    d. NaOH in water solution at a concentration of 0.08% or less by weight (pH < 12.30).

4. After it has been established that the samples do not meet DOT's definition of Class 8 – Corrosive because of the preservative, it must still be determined if the contaminant of concern causes the sample to meet any of DOT's hazard class definitions. If it does, appropriate identification, classification, packaging, marking, labeling, and documentation must be performed accordingly.
5. When shipping bottles that contain only preservatives, the trained shipper will attempt to meet the small quantity/excepted quantity or limited quantity requirements detailed in the DOT or IATA regulations in order to reduce preparation time, materials costs, handling hazards, and shipping costs. Complete instructions are found in the appropriate sections of the applicable regulations.
6. Per 49 CFR 172, Subpart H, an employee who performs hazardous materials (or dangerous goods) shipping is required to complete General Awareness and Function-Specific Training covering his or her particular shipping responsibilities. Training shall be updated at least every three years (domestic shipping) or every two years (international shipping).

7.0 Records

All sample packaging and shipment data will be recorded in the Field Log Book for the samples shipped. The Field Log Book entries will be recorded chronologically and the time of the entry recorded first. All Field Log Book continuation pages will be sequentially numbered and the last page recorded of the day will be signed and dated by the recording technician.

Records generated as a result of this SOP will be controlled and maintained in the project record files.

8.0 Interferences

None.

9.0 References

AECOM Technical Services, Inc. (AECOM), 2013a. *Draft Final Work Plan for RCRA Facility Closure, Hazardous Waste Container Storage Unit Facility, Holloman, AFB, New Mexico*, October.

AECOM, 2013b. *Draft Health and Safety Plan for RCRA Facility Closure, Hazardous Waste Container Storage Unit Facility, Holloman, AFB, New Mexico*, October.

AECOM, 2013c. *Draft Quality Assurance Project Plan for RCRA Facility Closure, Hazardous Waste Container Storage Unit Facility, Holloman, AFB, New Mexico*, October.

International Air Transport Association (IATA), 2014, *Dangerous Goods Regulations*.

United States Department of Transportation (DOT), 2013. *Title 49 CFR, Parts 171-180, Pipeline and Hazardous Materials Safety Administration*, September.

USEPA, 2011. *Packing, Marking, Labeling and Shipping of Environmental and Waste Samples*, EPA Region 4, Athens, GA, April.

10.0 Tables

None.

11.0 Attachments

None.

DRAFT FINAL
HEALTH AND SAFETY PLAN
FOR
RCRA FACILITY CLOSURE
HAZARDOUS WASTE CONTAINER STORAGE UNIT FACILITY (SWMU #75)
HOLLOMAN AFB, NEW MEXICO

Prepared For

Air Force Civil Engineer Center (AFCEC)
and
Holloman Air Force Base

Prepared By

112 East Pecan Street, Suite #400
San Antonio, Texas 78205

Contract Number: FA8903-08-D-8770
Task Order: 0281
Project: 80001Y0000

December 2013

DRAFT FINAL

Health and Safety Plan

FOR

RCRA FACILITY CLOSURE
HAZARDOUS WASTE CONTAINER STORAGE UNIT FACILITY
(SWMU #75)
HOLLOMAN AFB, NEW MEXICO

Prepared For

Air Force Civil Engineer Center (AFCEC)
and
Holloman Air Force Base

Prepared By

AECOM
112 East Pecan Street, Suite #400
San Antonio, Texas 78205

Contract Number: FA8903-08-D-8770
Task Order: 0281
Project: 80001Y0000

Health and Safety Plan Expiration Date: December 2014

HEALTH AND SAFETY PLAN APPROVAL

This Health and Safety Plan (HASP) was prepared for employees performing a specific, limited scope of work. It was prepared based on the best available information regarding the physical and chemical hazards known or suspected to be present on the project site. While it is not possible to discover, evaluate, and protect in advance against all possible hazards, which may be encountered during the completion of this project, adherence to the requirements of the HASP will significantly reduce the potential for occupational injury.

By signing below, I acknowledge that I have reviewed and hereby approve the HASP for the Resource Conservation and Recovery Act Facility Closure of the Hazardous Waste Container Storage Unit located at Holloman Air Force Base, New Mexico. This HASP has been written for the exclusive use of AECOM Technical Services, Inc., its employees, and subcontractors. The plan is written for specified site conditions, dates, and personnel, and must be amended if these conditions change.

Approved by:

Daniel Schillings, REM
District Safety Manager
(210) 253-7567

December 30, 2013
Date

Concurrence by:

Josh Miller
Project Manager
(210) 253-7517

December 30, 2013
Date

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS V

1.0 INTRODUCTION 1-1
1.1 General 1-1
1.2 Policy Statement 1-1
1.3 References 1-1

2.0 SITE INFORMATION AND SCOPE OF WORK 2-1
2.1 Site description and history 2-1
2.2 Scope Of Work 2-1

3.0 PROJECT HEALTH AND SAFETY ORGANIZATION 3-1
3.1 Work Order Project Manager: Josh Miller 3-1
3.2 Safety Professional: Daniel Schillings 3-1
3.3 Site Supervisor: Raymond castillo 3-1
3.3.1 Responsibilities 3-1
3.3.2 Authority 3-1
3.3.3 Qualifications 3-1
3.4 Site Safety and health Officer: raymond castillo 3-2
3.4.1 Responsibilities 3-2
3.4.2 Authority 3-2
3.4.3 Qualifications 3-2
3.5 Employees 3-2
3.5.1 Employee Responsibilities 3-2
3.5.2 Employee Authority 3-3
3.6 Subcontractors 3-3
3.7 Visitors 3-3

4.0 SAFETY PROGRAMS 4-1
4.1 HAZWOPER Qualifications 4-1
4.2 Site-Specific Safety Training 4-1
4.3 Hazard Communication 4-2
4.3.1 Container Labeling 4-2
4.3.2 Material Safety Data Sheets 4-2
4.3.3 Employee Information and Training 4-2
4.4 Confined Space Entry 4-2
4.5 Hazardous, Solid, Or Municipal Waste 4-3
4.6 General Safety Rules 4-3
4.6.1 Housekeeping 4-3
4.6.2 Smoking, Eating, or Drinking 4-3
4.6.3 Personal Hygiene 4-3
4.6.4 Buddy System 4-3
4.6.5 Heat and Cold Stress 4-4
4.7 Use of Utility Knives or Other Open-Bladed Cutting Tools 4-10

TABLE OF CONTENTS (continued)

4.8 Equipment Safety Cards 4-10
4.9 Stop Work Authority 4-10
4.10 Client Specific Safety Requirements 4-10
4.11 Environmental Compliance and Management 4-10
4.11.1 Air Emissions 4-10
4.11.2 Hazardous Waste Management 4-10
4.11.3 Storm Water Pollution Prevention 4-11

5.0 HAZARD ASSESSMENT 5-1
5.1 Hazard Analysis 5-1
5.1.1 Unanticipated Work Activities/Conditions 5-1
5.2 Environmental Contaminant Exposure Hazards 5-1
5.2.1 Volatile and Semi-Volatile Organic Compounds 5-1
5.2.2 Metals 5-1
5.2.3 Lead 5-2
5.2.4 Mercury 5-3
5.2.5 Cadmium 5-4
5.2.6 Chromium 5-5
5.2.7 Sodium Cyanide 5-6
5.2.8 Polychlorinated Biphenyls 5-6
5.2.9 Pesticides 5-7
5.3 Assessment of Exposure Hazards 5-7
5.4 Physical Hazards 5-7
5.5 UV Hazards 5-8

6.0 ACTIVITY SPECIFIC REQUIREMENTS 6-1
6.1 Supplemental Safety Procedures 6-1
6.1.1 Slips, Trips, Falls, and Protruding Objects 6-1
6.1.2 Hazardous Noise Environments 6-1
6.1.3 Manual Lifting 6-2
6.1.4 Ladder Safety 6-2
6.1.5 Flame, Heat, or Spark Producing Operations (Hot Work) 6-2
6.1.6 Fire Prevention and Protection 6-2
6.1.7 Small Quantity Flammable Liquids 6-4
6.1.8 Powered Hand Tools 6-4
6.1.9 Soil Sampling 6-4
6.1.10 Lockout/Tagout of Hazardous Energy Sources 6-4
6.1.11 Electrical Power 6-5
6.1.12 Heavy Equipment Safety 6-5
6.1.13 Traffic Safety 6-6
6.1.14 Elevated Work Platforms and Aerial Lifts 6-6
6.1.15 Working at Heights 6-6
6.1.16 Subsurface Utilities 6-6
6.1.17 Overhead Utilities 6-6
6.1.18 Confined Space Entry 6-7
6.1.19 Dust and Odor Control 6-8

TABLE OF CONTENTS (continued)

6.1.20 Spill Prevention 6-8
6.2 Exposure Monitoring Procedures 6-8
6.2.1 Real-Time Exposure Measurement 6-8
6.2.2 Biological Hazard Injury and Illness Prevention 6-10
6.2.3 Snakes 6-11
6.2.4 Rodents 6-11
6.2.5 Ticks 6-12
6.2.6 Chiggers 6-13
6.2.7 Scorpions 6-13
6.2.8 Venomous Arthropods 6-13
7.0 PERSONAL PROTECTIVE EQUIPMENT 7-1
7.1 Respiratory Protection 7-1
7.2 PPE Doffing and Donning Information 7-2
7.3 Decontamination 7-2
7.3.1 General Requirements 7-2
7.3.2 Decontamination Equipment 7-2
7.3.3 Personal/Equipment Decontamination 7-3
8.0 SITE CONTROL 8-1
8.1 General 8-1
8.2 Controlled Work Areas 8-1
8.2.1 EZ 8-1
8.2.2 CRZ 8-1
8.2.3 SZ 8-2
8.3 Site Access Documentation 8-2
8.3.1 Visitor Access 8-2
8.4 Site Security 8-2
9.0 EMERGENCY RESPONSE PLANNING 9-1
9.1 Emergency Action Plan 9-1
9.1.1 Emergency Coordinator 9-1
9.1.2 Site-Specific Emergency Procedures 9-1
9.1.3 Spill Containment Procedure 9-3
9.1.4 Safety Accident/Incident Reporting 9-3
9.1.5 Environmental Spill/Release Reporting 9-3
10.0 PERSONNEL ACKNOWLEDGEMENT 10-1

TABLE OF CONTENTS (continued)

ATTACHMENTS

Attachment A: Activity Hazard Analyses

Attachment B: Safety Data Sheets

Attachment C: Equipment Safety Cards

Attachment D: Site-Specific Spill Reporting Card

Attachment E: Equipment Inspection Checklist

FIGURES

Figure 2-1: CSU Map 2-3

Figure 9-1: Non-Emergency Hospital Driving Directions 9-6

Figure 9-2: Emergency Driving Map 9-7

TABLES

Table 4-1: Temperature Adjustment Factors 4-5

Table 4-2: Work Rest Schedule 4-6

Table 4-3: Identification and Treatment of Heat-Related Illness 4-7

Table 4-4: Cold Weather Break Calculation 4-9

Table 6-1: Monitoring Parameters and Equipment 6-8

Table 6-2: Monitoring Procedures and Action Levels 6-9

Table 6-3: Hazardous Plant Identification Guide 6-10

Table 7-1: Personal Protective Equipment 7-1

Table 7-2: Respiratory Protection 7-1

Table 9-1: Emergency Planning 9-2

Table 9-2: CERCLA Reportable Quantities 9-4

Table 9-3: Emergency Contacts 9-5

ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
°F	degrees Fahrenheit
ACGIH	American Conference of Governmental Industrial Hygienists
AECOM	AECOM Technical Services, Inc.
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AHA	Activity Hazard Analysis
ANSI	American National Standards Institute
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CIH	Certified Industrial Hygienist
CFR	Code of Federal Regulations
CSU	container storage unit
DLA	Defense Logistics Agency
EAP	Emergency Action Plan
EZ	Exclusion Zone
GFCI	ground fault circuit interrupter
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HEPA	high efficiency particulate air
IDLH	immediately dangerous to life or health
IDW	investigative-derived waste
LEL	lower exposure limit
mg/m^3	milligrams per cubic meter
mm	millimeter
NIOSH	National Institute for Occupational Safety and Health
NMED	New Mexico Environment Department
OSHA	Occupational Safety and Health Administration
OTC	over-the-counter
PCB	polychlorinated biphenyl
PEL	permissible exposure limit
PID	photoionization detector
PM	Project Manager
PPE	personal protective equipment

ppm	parts per million
RCRA	Resource Conservation and Recovery Act
REL	recommended exposure limit
SDS	Safety Data Sheet
SH&E	Safety, Health, and Environmental
SOP	Standard Operating Procedure
SOW	Statement of Work
SP	Safety Professional
SPF	solar protection factor
SZ	Support Zone
TLV	threshold limit value
TSCA	Toxic Substances Control Act
U.S.	United States
USCG	U.S. Coast Guard
USEPA	U.S. Environmental Protection Agency
UV	ultraviolet
VOC	volatile organic compound
WHMIS	Workplace Hazardous Materials Information System

1.0 INTRODUCTION

This Health and Safety Plan (HASP) (including Attachments A through E) provides a general description of the levels of personal protection and safe operating guidelines expected of each employee or subcontractor associated with the environmental services being conducted within the hazardous waste container storage unit (CSU) (SWMU #75) project site at Holloman Air Force Base (AFB), located west of Alamogordo, New Mexico. This HASP also identifies chemical and physical hazards known to be associated with the AECOM Technical Services, Inc. (AECOM)-managed activities addressed in this document.

HASP Supplements will be generated as necessary to address any additional activities or changes in site conditions, which may occur during field operations.

1.1 GENERAL

The provisions of this HASP are mandatory for all AECOM and subcontractor personnel engaged in fieldwork associated with the environmental services being conducted at the subject site. A copy of this HASP, any applicable HASP Supplements and the United States (U.S.) Operations Safety, Health, and Environmental (SH&E) Manual shall be maintained on-site and available for review at all times. Record keeping will be maintained in accordance with this HASP and the applicable Standard Operating Procedures (SOPs). In the event of a conflict between this HASP, the SOPs and federal, state, and local regulations, workers shall follow the most stringent/protective requirements.

1.2 POLICY STATEMENT

It is the policy of AECOM to provide a safe and healthy work environment for all of its employees. AECOM considers no phase of operations or administration is of greater importance than injury and illness prevention. Safety takes precedence over expediency or shortcuts. At AECOM, we believe every accident and every injury is avoidable. We will take every reasonable step to reduce the possibility of injury, illness, or accident. This is detailed in AECOM's Safety, Health, and Environmental Policy Statement.

The practices and procedures presented in this HASP and any supplemental documents associated with this HASP are binding to all AECOM employees while engaged in the subject work. Operational changes to this HASP and supplements that could affect the health or safety of personnel, the community, or the environment will not be made without prior approval of the AECOM Project Manager (PM) and the assigned AECOM Safety Professional.

1.3 REFERENCES

This HASP conforms to the regulatory requirements and guidelines established in the following documents:

- Title 29, Part 1910 of the Code of Federal Regulations (CFR) (29 CFR 1910), *Occupational Safety and Health Standards* (with special attention to Section 120, *Hazardous Waste Operations and Emergency Response*)
- 29 CFR 1926, *Safety and Health Regulations for Construction*
- National Institute for Occupational Safety and Health (NIOSH)/Occupational Safety and Health Administration (OSHA)/U.S. Coast Guard (USCG)/U.S. Environmental Protection Agency (USEPA), *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, Publication No. 85-115, 1985
- American National Standards Institute (ANSI), *American National Standard for Occupational Health and Safety Management Systems* (ANSI Z10), 2005
- ANSI Z41 Protective Footwear
- ANSI Z89.1 Industrial Head Protection
- ANSI Z88.2 Respiratory Protection

- ANSI Z87.1 Eye and Face Protection
- ANSI Z358.1 Emergency Eyewash and Shower Equipment
- 29 CFR 1904 Recording and Reporting Occupational Injuries and Illnesses
- 29 CFR 1910 Occupational Safety and Health Standards
- American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs®) and Biological Exposure Indices, 2004
- AECOM Corporate Health and Safety Plan (this document will be on-site and available to site personnel during the project)
- Department of Defense 6055.9-Standard, Ammunition and Explosive Safety Standard
- AECOM, 2013. Draft Work Plan for RCRA Facility Closure, Hazardous Waste Container Storage unit Facility, Holloman, AFB, New Mexico, September.

The requirements in this HASP also conform to AECOM's Corporate SH&E Program requirements as specified in the U.S. SH&E Manual, a copy of which will be maintained on-site at all times.

2.0 SITE INFORMATION AND SCOPE OF WORK

AECOM will conduct environmental services at Holloman AFB in Alamogordo, New Mexico. Work will be performed in accordance with the applicable Statement of Work (SOW) and the associated Work Plan developed for the site. Deviations from the listed SOW will require review by a Safety Professional to ensure adequate protection of personnel and other property.

The following is a summary of relevant data concerning Holloman AFB, and the work procedures to be performed. The Work Plan prepared by AECOM (2013) as a companion document to this HASP provides significantly greater details concerning both site history and planned work operations.

2.1 SITE DESCRIPTION AND HISTORY

Holloman AFB is located on approximately 59,827 acres of land about seven miles west of the city of Alamogordo, Otero County, in south central New Mexico. Base activities necessitated the use of a variety of products to maintain and repair aircraft and aerospace ground equipment, as well as base structures and roads thus generating wastes classified as hazardous waste under Resource Conservation and Recovery Act (RCRA) due to exhibiting characteristics of ignitability, corrosivity, reactivity, toxicity, or conforming to the definition of listed waste under 40 CFR Part 26, Subpart D.

The CSU Facility (See Figure 2-1) is located on the east side of the base, approximately 1,400 feet inside the eastern boundary on roughly 400,000 square feet of land designated for use by the Defense Logistics Agency (DLA) Disposition Service, a Holloman AFB tenant. The CSU Facility consists of an indoor covered building (Building 118), a staging area, and an outdoor covered area. The permit allows storage of hazardous waste in as many as 788 55-gallon drums or equivalent (43,340 gallons) including Toxic Substances Control Act (TSCA) regulated materials, wastes, and equipment containing polychlorinated biphenyls (PCBs).

Holloman AFB and the DLA have determined that the CSU Facility has reached the end of its intended operational life. Presently, the Facility no longer accepts hazardous waste, and all stored hazardous waste containers and hazardous materials – including PCB-containing equipment, materials, and wastes – have been removed.

2.2 SCOPE OF WORK

AECOM shall close the CSU Facility in accordance with New Mexico Environment Department (NMED) requirements identified in the Closure Plan for the Holloman AFB CSU Facility. Work requirements shall include development and approval of planning documents, dismantling and decontamination of storage equipment, decontamination and rinsing of indoor, outdoor and staging areas, sampling and analysis of affected media and waste liquids and material generated from closure activities, PCB wipe sampling, investigation derived waste (IDW) handling and disposal, and certification of clean closure by a Professional Engineer certified by the State of New Mexico. Environmental remediation activities leading to CSU Facility closure shall be closely coordinated with appropriate Holloman AFB-environmental, DLA Disposition Service-Holloman AFB, DLA Installation Support-Battle Creek-Michigan, NMED, and Air Force Civil Engineer Center (AFCEC) personnel.

The list of work tasks that follow are inherently hazardous activities that have been analyzed to identify controls that will protect the safety and health of all personnel working at and entering the project site. Field activities that require hazard analysis include:

- Mobilization & Site Preparation
- Inspection
- Facility Equipment Dismantling
- Decontamination of the Facility and Equipment
- Wastewater Sampling

- Soil Sampling
- Electrical hazards
- Hand and Power Tool Usage
- Motor Vehicle Operation
- Machinery and Mechanized Equipment
- Manual Lifting
- Concrete Coring

Legend

- CSULocation
- Sanitary Sewer Junction Point
- HollomanAFB

Feet

0 100 200 400

U.S. AIR FORCE

RCRA Facility Closure

Site Location and Vicinity map

AECOM

AECOM Technical Services, Inc.
112 East Pecan, Suite 400
San Antonio, TX 78205
www.aecom.com
TBPE Reg. No. F-3580

Date	Project	Figure
September 2013	60304917	2-1

3.0 PROJECT HEALTH AND SAFETY ORGANIZATION

3.1 WORK ORDER PROJECT MANAGER: JOSH MILLER

The PM has overall management authority and responsibility for all site operations, including safety. The specific safety responsibilities for the PM are listed in Section 4.5.2 of S3NA-209-PR Project Hazard Assessment and Planning[1]. The PM, with support from the Client Service Manager, will provide the Site Supervisor with work plans, staff, and budgetary resources, which are appropriate to meet the safety needs of the project operations.

3.2 SAFETY PROFESSIONAL: DANIEL SCHILLINGS

The Safety Professional (SP) is the member of the AECOM SH&E Department assigned to oversee health and safety requirements for the project and provide any needed technical support. The SP will be the first point-of-contact for all of the project's health and safety matters. Duties include the following:

- Approving this HASP and any required changes
- Approving the designated Site Safety and Health Officer (SSHO)
- Reviewing all personal exposure monitoring results
- Investigating any reported unsafe acts or conditions

3.3 SITE SUPERVISOR: RAYMOND CASTILLO

The Site Supervisor has the overall responsibility and authority to direct work operations at the job site according to the provided work plans. The PM may act as the Site Supervisor while on-site, or delegate the duty to another.

3.3.1 Responsibilities

The Site Supervisor is responsible to:

- Discuss deviations from the work plan with the SSHO and PM
- Discuss safety issues with the PM, SSHO, and field personnel
- Assist the SSHO with the development and implementation of corrective actions for site safety deficiencies
- Assist the SSHO with the implementation of this HASP and ensuring compliance
- Assist the SSHO with inspections of the site for compliance with this HASP and applicable SOPs

3.3.2 Authority

The Site Supervisor has authority to:

- Verify that all operations are in compliance with the requirements of this HASP, and halt any activity that poses a potential hazard to personnel, property, or the environment
- Temporarily suspend individuals from field activities for infractions against the HASP pending consideration by the SSHO, the Safety Professional, and the PM

3.3.3 Qualifications

In addition to being Hazardous Waste Operations and Emergency Response (HAZWOPER)-qualified (see Section 4.1), the Site Supervisor is required to have completed the 8-hour HAZWOPER Supervisor Training Course in accordance with 29 CFR 1910.120 (e)(4).

[1] Additional responsibilities as cited in the BNSF Programmatic SH&E Management Plan.

3.4 SITE SAFETY AND HEALTH OFFICER: RAYMOND CASTILLO

3.4.1 Responsibilities

The SSHO is responsible to:

- Update the site-specific HASP to reflect changes in site conditions or the scope of work. HASP updates must be reviewed and approved by the Safety Professional
- Be aware of changes in AECOM Safety Policy
- Monitor the lost time incidence rate for this project and work toward improving it
- Inspect the site for compliance with this HASP and the SOPs using the appropriate audit inspection checklist provided by an AECOM Safety Professional
- Work with the PM to develop and implement corrective action plans to correct deficiencies discovered during site inspections; Deficiencies will be discussed with project management to determine appropriate corrective action(s)
- Contact the Safety Professional for technical advice regarding safety issues
- Provide a means for employees to communicate safety issues to management in a discreet manner (i.e., suggestion box, etc.)
- Determine emergency evacuation routes, establish and post local emergency telephone numbers, and arranging emergency transportation
- Ensure that all site personnel and visitors have received the proper training and medical clearance prior to entering the site
- Establish any necessary controlled work areas (as designated in this HASP or other safety documentation)
- Present tailgate safety meetings and maintain attendance logs and records
- Discuss potential health and safety hazards with the Safety Professional, and the PM
- Select an alternate SSHO by name and inform him/her of their duties, in the event that the SSHO must leave or is absent from the site

3.4.2 Authority

The SSHO has authority to:

- Verify that all operations are in compliance with the requirements of this HASP
- Issue a “Stop Work Order” under the conditions set forth in Section 4.9 of this HASP
- Temporarily suspend individuals from field activities for infractions against the HASP pending consideration by the Safety Professional and the PM

3.4.3 Qualifications

In addition to being HAZWOPER-qualified (see Section 4.1), the SSHO is required to have completed the 8-hour HAZWOPER Supervisor Training Course in accordance with 29 CFR 1910.120 (e)(4).

3.5 EMPLOYEES

3.5.1 Employee Responsibilities

Responsibilities of employees associated with this project include, but are not limited to:

- Understanding and abiding by the policies and procedures specified in the HASP and other applicable safety policies, and clarifying those areas where understanding is incomplete
- Providing feedback to health and safety management relating to omissions and modifications in the HASP or other safety policies

- Notifying the SSHO, in writing, of unsafe conditions and acts

3.5.2 Employee Authority

The health and safety authority of each employee assigned to the site includes the following:

- The right to refuse to work and/or stop work authority when the employee feels that the work is unsafe (including subcontractors or team contractors), or where specified safety precautions are not adequate or fully understood
- The right to refuse to work on any site or operation where the safety procedures specified in this HASP or other safety policies are not being followed
- The right to contact the SSHO or the Safety Professional at any time to discuss potential concerns

3.6 SUBCONTRACTORS

The requirements for subcontractor selection and subcontractor safety responsibilities are outlined in S3NA-213-PR, Subcontractors. Each AECOM subcontractor is responsible for assigning specific work tasks to their employees. Each subcontractor's management will provide qualified employees and allocate sufficient time, materials, and equipment to safely complete assigned tasks. In particular, each subcontractor is responsible for equipping its personnel with any required personal protective equipment (PPE).

AECOM considers each subcontractor to be an expert in all aspects of the work operations for which they are tasked to provide, and each subcontractor is responsible for compliance with the regulatory requirements that pertain to those services. Each subcontractor is expected to perform its operations in accordance with its own unique safety policies and procedures, in order to ensure that hazards associated with the performance of the work activities are properly controlled. Copies of any required safety documentation for a subcontractor's work activities will be provided to AECOM for review prior to the start of onsite activities, if required.

Hazards not listed in this HASP but known to any subcontractor, or known to be associated with a subcontractor's services, must be identified and addressed to the AECOM PM or the Site Supervisor prior to beginning work operations. The Site Supervisor or authorized representative has the authority to halt any subcontractor operations, and to remove any subcontractor or subcontractor employee from the site for failure to comply with established health and safety procedures or for operating in an unsafe manner.

3.7 VISITORS

Authorized visitors (e.g., client representatives, regulators, AECOM management staff, etc.) requiring entry to any work location on the site at the request of AECOM will be briefed by the SSHO or PM on the hazards present at that location. Visitors will be escorted at all times at the work location and will be responsible for compliance with their employer's health and safety policies. In addition, this HASP specifies the minimum acceptable qualifications, training and PPE that are required for entry to any controlled work area. Visitors must comply with these requirements at all times.

Unauthorized visitors, and visitors not meeting the specified qualifications, will not be permitted within established controlled work areas.

4.0 SAFETY PROGRAMS

4.1 HAZWOPER QUALIFICATIONS

Personnel performing work at the job site must be qualified as HAZWOPER workers (unless otherwise noted in specific activity hazard analysis [AHA] or by the SSHO), and must meet the medical monitoring and training requirements specified in the following safety procedures:

- S3NA-003-PR SH&E Training
- S3NA-210-PR Project Safety Meetings
- S3NA-507-PR Hazard Materials Communication /Workplace Hazardous Materials Information System(WHMIS)
- S3NA-509-PR Hazardous Waste Operations and Emergency Response

Personnel must have successfully completed training meeting the provisions established in 29 CFR 1910.120 (e)(2) and (e)(3) (40-hour initial training). As appropriate, personnel must also have completed annual refresher training in accordance with 29 CFR 1910.120 (e)(8); each person's most recent training course must have been completed within the previous 365 days. Personnel must also have completed a physical exam in accordance with the requirements of 29 CFR 1910.120 (f), where the medical evaluation includes a judgment of the employee's ability to use respiratory protective equipment and to participate in hazardous waste site activities. These requirements are further discussed in S3NA-509-PR Hazardous Waste Operations and Emergency Response.

If site monitoring procedures indicate that a possible exposure has occurred above the OSHA permissible exposure limit (PEL), employees may be required to receive supplemental medical testing to document symptoms specific to the particular materials present.

4.2 SITE-SPECIFIC SAFETY TRAINING

All personnel performing field activities at the site will be trained in accordance with S3NA-003-PR, SH&E Training. For this project, training will include the requirements specified in the following:

1. S3NA-210-PR, Project Safety Meetings
2. S3NA-507-PR, Hazardous Materials Communication - WHMIS
3. S3NA-509-PR, Hazardous Waste HAZWOPER Activities
4. S3NA-519-PR, Respiratory Protection Program

In addition to the general health and safety training programs, personnel will be:

- Instructed on the contents of applicable portions of this HASP and any supplemental health and safety information developed for the tasks to be performed
- Workers will be instructed on the proper ultraviolet (UV) radiation protection measures per SH&E S3NA-517-PR Radiation, Non-Ionizing
- Informed about the potential routes of exposure, protective clothing, precautionary measures, and symptoms or signs of chemical exposure and heat stress
- Made aware of task-specific physical hazards and other hazards that may be encountered during site work
- Made aware of fire prevention measures, fire extinguishing methods, and evacuation procedures

The site-specific training will be performed prior to the worker performing the subject task or handling the impacted materials and on an as-needed basis thereafter. Training will be conducted by the SSHO (or his/her designee) and will be documented on the form attached to SH&E SOP S3NA-210-PR Project Safety Meetings.

4.3 HAZARD COMMUNICATION

Section 5.2 provides information concerning the materials that may be encountered as environmental contaminants during the work activities. In addition, any organization wishing to bring any hazardous material onto any AECOM-controlled work site must first provide a copy of the item's Safety Data Sheet (SDS) to the SSHO for approval and filing (the SSHO will maintain copies of all SDSs on-site). SDSs may not be available for locally-obtained products, in which case some alternate form of product hazard documentation will be acceptable. In accordance with the requirements of S3NA-507-PR Hazard Materials Communication / WHMIS, all personnel shall be briefed on the hazards of any chemical product they use, and shall be aware of and have access to all SDSs.

4.3.1 Container Labeling

AECOM personnel will ensure that all drums and containers are labeled according to contents. These drums and containers will include those from manufacturers and those produced on-site by operations. All incoming and outgoing labels shall be checked for identity, hazard warning, and name and address of responsible party. Labeling on any containers not intended for single-day, individual use shall contain additional information indicating potential health and safety hazards (flammability, reactivity, etc.).

4.3.2 Material Safety Data Sheets

Attachment B provides copies of SDSs for those items planned to be brought on-site at the time this HASP is prepared. This information will be updated as required during site operations.

4.3.3 Employee Information and Training

Training employees on chemical hazards is accomplished through an ongoing corporate training program. Additionally, chemical hazards are communicated to employees through daily safety meetings held at AECOM field projects and by an initial site orientation program.

At a minimum, AECOM and subcontractor employees will be instructed about the following:

- Chemicals and their hazards in the work area
- How to prevent exposure to these hazardous chemicals
- What the company has done to prevent workers' exposure to these chemicals
- Procedures to follow if they are exposed to these chemicals
- How to read and interpret labels and SDSs for hazardous substances found on AECOM sites
- Emergency spill procedures
- Proper storage and labeling

Before a new chemical is introduced on-site, each AECOM and related subcontractor employee will be given information in the same manner as during the initial site orientation program. The SSHO will be responsible for seeing that the SDS for the new chemical is available for review by on-site personnel. The information pertinent to the chemical hazards will be communicated to project personnel.

Morning safety meetings will be held and the hazardous materials used on-site will be discussed. Attendance is mandatory for all on-site employees.

4.4 CONFINED SPACE ENTRY

The SSHO/Site Supervisor shall identify all potential confined spaces in accordance with SH&E SOP S3NA-301-PR, Confined Spaces. In addition, the SSHO/Site Supervisor will inform all employees of the location of

confined spaces. Confined space entry procedures and training requirements are listed in SH&E 301. Currently confined space entry is not anticipated to be encountered during this project.

4.5 HAZARDOUS, SOLID, OR MUNICIPAL WASTE

If hazardous, solid, and/or municipal wastes are generated during any phase of the project, the waste shall be accumulated, labeled, and disposed of in accordance with applicable Federal, State, and/or local regulations.

4.6 GENERAL SAFETY RULES

All site personnel shall adhere to S3NA-001-PR Safe Work Standards and Rules, during site operations. In addition, the housekeeping, sanitation, and personal hygiene requirements in S3NA-307-PR Housekeeping, Worksite will be observed. Specific excerpts from S3NA-307 are listed below.

4.6.1 Housekeeping

During site activities, work areas will be continuously policed for identification of excess trash and unnecessary debris. Excess debris and trash will be collected and stored in an appropriate container (e.g., plastic trash bags, garbage can, roll-off bin) prior to disposal. At no time will debris or trash be intermingled with waste PPE or contaminated materials.

4.6.2 Smoking, Eating, or Drinking

Smoking, eating and drinking will not be permitted inside any controlled work area at any time. Field workers will first wash hands and face immediately after leaving controlled work areas (and always prior to eating or drinking). Consumption of alcoholic beverages is prohibited at any AECOM site.

4.6.3 Personal Hygiene

The following personal hygiene requirements will be observed:

Water Supply: A water supply meeting the following requirements will be utilized:

> *Potable Water* - An adequate supply of potable water will be available for field personnel consumption. Potable water can be provided in the form of water bottles, canteens, water coolers, or drinking fountains. Where drinking fountains are not available, individual-use cups will be provided as well as adequate disposal containers. Potable water containers will be properly identified in order to distinguish them from non-potable water sources.
>
> *Non-Potable Water* - Non-potable water may be used for hand washing and cleaning activities. Non-potable water will not be used for drinking purposes. All containers of non-potable water will be marked with a label stating:

Non-Potable Water
Not Intended for Drinking Water Consumption

Toilet Facilities: A minimum of one toilet will be provided for every 20 personnel on-site, with separate toilets maintained for each sex except where there are less than five total personnel on-site. For mobile crews where work activities and locations permit transportation to nearby toilet facilities on-site facilities are not required.

Washing Facilities: Employees will be provided washing facilities (e.g., buckets with water and Alconox) at each work location. The use of water and hand soap (or similar substance) will be required by all employees following exit from the Exclusion Zone (EZ), prior to breaks, and at the end of daily work activities.

4.6.4 Buddy System

All field personnel will use the buddy system when working within any controlled work area. Personnel belonging to another organization on-site can serve as "buddies" for AECOM personnel. Under no circumstances will any employee be present alone in a controlled work area. For areas not in controlled work areas, the procedures outlined in S3NA-314-PR Working Alone & Remote Travel will be followed at all times.

4.6.5 Heat and Cold Stress

Heat and cold stress may vary based upon work activities, PPE/clothing selection, geographical locations, and weather conditions. To reduce the potential of developing heat/cold stress, be aware of the signs and symptoms of heat/cold stress and watch fellow employees for signs of heat/cold stress. For additional requirements, refer to SH&E SOP S3NA-511-PR, Heat Stress and SH&E SOP S3NA-505-PR, Cold Stress Prevention.

Severe weather can occur with little warning. The employee must be aware of the potentials for lightning, flash flooding and high wind events. AECOM Work Instruction S3NA 203-WI1, Emergency Response to Specific Hazards provides additional guidance.

Be Prepared, Know What is Coming your Way

- Listen to the radio for severe weather alerts
- Check the Storm Prediction Center's web page for alerts and warnings http://www.spc.noaa.gov/products/wwa/
- Pay attention to the weather in your area, up wind of your location, and in the watershed upstream from your location
- When in the field, be aware of the route you must take to get to shelter
- When working in low areas, be aware of the potential for flash flooding and the route to higher ground

4.6.5.1 Heat Stress

Types of Heat Stress

Heat related problems include **heat rash, fainting, heat cramps, heat exhaustion and heat stroke**. **Heat rash** can occur when sweat isn't allowed to evaporate; leaving the skin wet most of the time and making it subject to irritation. **Fainting** may occur when blood pools to lower parts of the body and as a result, does not return to the heart to be pumped to the brain. Heat related fainting often occurs during activities that require standing erect and immobile in the heat for long periods of time. **Heat cramps** are painful spasms of the muscles due to excessive salt loss associated with profuse sweating.

Heat exhaustion typically results from the loss of large amounts of fluid and excessive loss of salt from profuse sweating. The skin will be clammy and moist and the affected individual may exhibit giddiness, nausea and headache.

Heat stroke occurs when the body's temperature regulatory system has failed. The skin is hot, dry, red and spotted. The affected person may be mentally confused and delirious. Convulsions could occur. **EARLY RECOGNITION AND TREATMENT OF HEAT STROKE ARE THE ONLY MEANS OF PREVENTING BRAIN DAMAGE OR DEATH.** A person exhibiting signs of heat stroke should be removed from the work area to a shaded area. The person should be soaked with water to promote evaporation. Fan the person's body to increase cooling.

Increased body temperature and physical discomfort also promote irritability and a decreased attention to the performance of hazardous tasks.

Early Symptoms of Heat-Related Health Problems:

decline in task performance	excessive fatigue	coordination reduced
vigilance	decline in alertness	muscle cramps
unsteady walk	dizziness	

Susceptibility to Heat Stress Increases due to:

lack of physical fitness	obesity	lack of acclimatization
drug or alcohol use	increased age	sunburn
dehydration	infection	

People unaccustomed to heat are particularly susceptible to heat fatigue. First timers in PPE need to gradually adjust to the heat.

The Effect of PPE

Sweating normally cools the body as moisture is removed from the skin by evaporation. However, the wearing of certain PPE, particularly chemical protective coveralls (e.g., Tyvek), reduces the body's ability to evaporate sweat and thereby regulate heat buildup. The body's efforts to maintain an acceptable temperature can therefore become significantly impaired by the wearing of PPE.

Measures to Avoid Heat Stress:

The following guidelines should be adhered to when working in hot environments:

- Establish work-rest cycles (short and frequent are more beneficial than long and seldom)
- Identify a shaded, cool rest area
- Rotate personnel, alternative job functions
- Water intake should exceed sweat produced. Most workers exposed to hot conditions drink an insufficient amount of fluids than needed because of a lack of thirst. **DO NOT DEPEND ON THIRST TO SIGNAL WHEN AND HOW MUCH TO DRINK**. Consume enough liquid to force urination every two hours. In humid climates ice water or ice should be consumed to help maintain normal body temperature since evaporation does not provide an efficient mechanism for heat removal
- Eat light meals before and during work shifts. Avoid highly salted foods
- Drink sports drinks such as Gatorade® diluted 1:1 with water
- Save most strenuous tasks for non-peak heat hours such as the early morning or at night
- Avoid alcohol during prolonged periods of heat. Alcohol will cause additional dehydration

The implementation and enforcement of the above mentioned measures will be the joint responsibility of the PM and SSHO. Potable water and fruit juices should be made available each day for the field team.

Table 4-1: Temperature Adjustment Factors

Time of Day	
Before daily temperature peak[2]	+2°F
10 am – 2 pm (peak sunshine)	+2°F
Sunshine	
No clouds	+1°F
Partly Cloudy (3/8 – 5/8 cloud cover)	-3°F
Mostly Cloudy (5/8 – 7/8 cloud cover)	-5°F
Cloudy (>7/8 cloud cover)	-7°F
Indoor or nighttime work	-7°F
Wind (*ignore if indoors or wearing CPC*)	
Gusts greater than 5 miles per hour at least once per minute	-1°F
Gusts greater than 10 miles per hour at least once per minute	-2°F
Sustained greater than 5 miles per hour	-3°F
Sustained greater than 10 miles per hour	-5°F

[2] This adjustment accounts for temperature rise during the day. If the temperature has

Humidity (*ignore if wearing CPC*)	
Relative Humidity greater than 90%	+5°F
Relative humidity greater than 80%	+2°F
Relative Humidity less than 50%	-4°F
Chemical Protective Clothing (CPC)	
Modified Level D PPE (coveralls, no respirator)	+5°F
Level C PPE (coveralls w/o hood, full-face respirator)	+8°F
Level C PPE (coveralls with hood, full-face respirator)	+10°F
Level B PPE with airline system	+9°F
Level B PPE with self contained breathing apparatus	+9°F and right one column[3]
Level A PPE	+14°F and right one column[2]
Other	Specified in the HASP
Miscellaneous	
Unacclimated work force	+5°F
Partially acclimated work force	+2°F
Working in shade	-3°F
Breaks taken in air conditioned space	-3°F

Table 4-2: Work Rest Schedule

Work-Rest Regimen	Adjusted Temperature (°F)			
	Light Work	Moderate Work	Heavy Work	Very Heavy Work
No specified requirements	< 80	< 75	< 70	< 65
15 minute break every 90 minutes of work	80 – 90	75 - 85	70 - 80	65 – 75
15 minute break every 60 minutes of work	>90 – 100	> 85 - 95	>80 - 85	>75 - 80
15 minute break every 45 minutes of work	>100 – 110	>95 - 100	>85 - 90	>80 - 85
15 minute break every 30 minutes of work	>110 - 115	>100 - 105	>90 - 95	>85 - 90
15 minute break every 15 minutes of work	>115 - 120	>105 - 110	>95 -100	>90 - 95
Stop Work	**>120**	**>110**	**>100**	**>95**

Note: Time spent performing decontamination or donning/doffing CPC should not be included in calculating work or break time lengths.

[3] Locate the proper column based on work rate, then move one column to the right (next higher work rate) before locating the corresponding adjusted temperature.

Heat Stress Monitoring Techniques

Site personnel should regularly monitor their heart rate as an indicator of heat strain by the following method:

Radial pulse rates may be checked by using fore-and middle fingers and applying light pressure top the pulse in the wrist for one minute at the beginning of each rest cycle. If the pulse rate exceeds 110 beats/minute, the next work cycle will be shortened by one-third and the rest period will be kept the same. If, after the next rest period, the pulse rate still exceeds 110 beats/minute, the work cycle will be shortened again by one-third.

4.6.5.2 Responding to Heat-Related Illness

The guidance below will be used in identifying and treating heat-related illness.

Table 4-3: Identification and Treatment of Heat-Related Illness

Type of Heat-Related Illness	Description	First Aid
Mild Heat Strain	The mildest form of heat-related illness. Victims exhibit irritability, lethargy, and significant sweating. The victim may complain of headache or nausea. This is the initial stage of overheating, and prompt action at this point may prevent more severe heat-related illness from occurring.	• Provide the victim with a work break during which he/she may relax, remove any excess protective clothing, and drink cool fluids. • If an air-conditioned spot is available, this is an ideal break location. • Once the victim shows improvement, he/she may resume working; however, the work pace should be moderated to prevent recurrence of the symptoms.
Heat Exhaustion	Usually begins with muscular weakness and cramping, dizziness, staggering gait, and nausea. The victim will have pale, clammy moist skin and may perspire profusely. The pulse is weak and fast and the victim may faint unless they lie down. The bowels may move involuntarily.	• Immediately remove the victim from the work area to a shady or cool area with good air circulation (*avoid drafts or sudden chilling*). • Remove all protective outerwear. • Call a physician. • Treat the victim for shock. (*Make the victim lie down, raise his or her feet 6–12 inches, and keep him/her cool by loosening all clothing*). • If the victim is conscious, it may be helpful to give him/ her sips of water. • Transport victim to a medical facility as soon as possible.

Type of Heat-Related Illness	Description	First Aid
Heat Stroke	The most serious of heat illness, heat stroke represents the collapse of the body's cooling mechanisms. As a result, body temperature may rise to 104 degrees Fahrenheit (^{o}F) or higher. As the victim progresses toward heat stroke, symptoms such as headache, dizziness, nausea can be noted, and the skin is observed to be dry, red, and hot. Sudden collapse and loss of consciousness follows quickly and death is imminent if exposure continues. Heat stroke can occur suddenly.	• Immediately evacuate the victim to a cool/shady area. • Remove all protective outerwear and as much personal clothing as decency permits. • Lay the victim on his/her back w/the feet slightly elevated. • Apply cold wet towels or ice bags to the head, armpits, and thighs. • Sponge off the bare skin with cool water. • The main objective is to cool without chilling the victim. • Give no stimulants or hot drinks. • Since heat stroke is a severe medical condition requiring professional medical attention, emergency medical help should be summoned immediately to provide onsite treatment of the victim and proper transport to a medical facility.

4.6.5.3 Cold Stress

Type of Cold Stress

Cold injury is classified as either localized, as in frostbite, frostnip or chilblain; or generalized, as in hypothermia. The main factors contributing to cold injury are exposure to humidity and high winds, contact with wetness and inadequate clothing.

The likelihood of developing frostbite occurs when the face or extremities are exposed to a cold wind in addition to cold temperatures. The freezing point of the skin is about 30°F. When fluids around the cells of the body tissue freeze, skin turns white. This freezing is due to exposure to extremely low temperatures. As wind velocity increases, heat loss is greater and frostbite will occur more rapidly.

Symptoms of Cold Stress

The first symptom of frostbite is usually an uncomfortable sensation of coldness, followed by numbness. There might be a tingling, stinging or aching feeling in the affected area. The most vulnerable parts of the body are the nose, cheeks, ears, fingers and toes.

Symptoms of hypothermia, a condition of abnormally low body temperature, include uncontrollable shivering and sensations of cold. The heartbeat slows and can become irregular, the pulse weakens and the blood pressure changes. Pain in the extremities and severe shivering can be the first warning of dangerous exposure to cold.

Maximum severe shivering develops when the body temperature has fallen to 95°F. Productive physical and mental work is limited when severe shivering occurs. Shivering is a serious sign of danger. Immediately remove any person who is shivering from the cold.

Methods to Prevent Cold Stress

When the ambient temperature, or a wind chill equivalent, falls to below 40°F (ACGIH recommendation), site personnel who must remain outdoors should wear insulated coveralls, insulated boot liners, hard hat helmet liners and insulated hand protection. Wool mittens are more efficient insulators than gloves. Keeping the head

covered is very important, since 40% of body heat can be lost when the head is exposed. If it is not necessary to wear a hard hat, a wool knit cap provides the best head protection. A facemask may also be worn.

Persons should dress in several layers rather than one single heavy outer garment. The outer piece of clothing should ideally be wind and waterproof. Clothing made of thin cotton fabric or synthetic fabrics such as polypropylene is ideal since it helps to evaporate sweat. Polypropylene is best at wicking away moisture while still retaining its insulating properties. Loosely fitting clothing also aids in sweat evaporation. Denim is not a good protective fabric. It is loosely woven which allows moisture to penetrate. Socks with a high wool content are best. If two pairs of socks are worn, the inner sock should be smaller and made of cotton, polypropylene or similar types of synthetic material that wick away moisture. If clothing becomes wet, it should be taken off immediately and a dry set of clothing put on.

If wind conditions become severe, it might become necessary to shield the work area temporarily. The SSHO and the PM will determine if this type of action is necessary. Heated break trailers or a designated area that is heated should be available if work is performed continuously in the cold at temperatures, or equivalent wind chill temperatures, of 20°F.

Dehydration occurs in the cold environment and can increase the susceptibility of the worker to cold injury due to significant change in blood flow to the extremities. Drink plenty of fluids, but limit the intake of caffeine.

The table below will be used for calculating cold weather breaks due to due to temperature and wind speed.

Table 4-4: Cold Weather Break Calculation

Sunny Sky Air Temperature		**No Noticeable Wind**		**Wind 8 km/h (5 mph)**		**Wind 16 km/h (10 mph)**		**Wind 24 km/h (15 mph)**		**Wind 32 km/h (20 mph)**	
^{o}C below zero*	^{o}F below zero*	Max. work period	Number of breaks /4 hours	Max. work period	Number of breaks /4 hours	Max. work period	Number of breaks /4 hours	Max. work period	Number of breaks /4 hours	Max. work period	Number of breaks /4 hours
26 to 28	15 to 19	normal breaks	1	normal breaks	1	75 minutes	2	55 minutes	3	40 minutes	4
29 to 31	20 to 24	normal breaks	1	75 minutes	2	55 minutes	3	40 minutes	4	30 minutes	5
32 to 34	25 to 29	75 minutes	2	55 minutes	3	40 minutes	4	30 minutes	5	Non-emergency work should stop	
35 to 37	30 to 34	55 minutes	3	40 minutes	4	30 minutes	5	Non-emergency work should stop			
38 to 39	35 to 39	40 minutes	4	30 minutes	5	Non-emergency work should stop					
40 to 42	40 to 44	30 minutes	5	Non-emergency work should stop							
43 and below	45 and below	Non-emergency work should stop									

4.6.5.4 UV Radiation Protection

To protect against exposure to UV radiation, workers will observe the following requirements:

1. All workers will wear sunglass-type safety glasses at all times when working outdoors during daylight hours.
2. Workers will utilize a commercial sunblock with a minimum solar protection factor (SPF) of 15 or higher.
3. Wide-brim hard hats are recommended as they provide additional UV protection.

4.7 USE OF UTILITY KNIVES OR OTHER OPEN-BLADED CUTTING TOOLS

All utility knives with manually retracting blades (including "pocket knives" and other "collapsible, open-blade cutting tools") are no longer permitted on any AECOM jobsite, unless specifically authorized on a task-specific basis in this HASP and associated AHA. The only acceptable type of utility knife will be those with automatically retracting blades. Other "cutters" must be equipped with a completely enclosed and guarded blade. Additional recommendations regarding the use of cutting tools can be found in S3NA-305-PR Hand and Power Tools.

4.8 EQUIPMENT SAFETY CARDS

Equipment safety cards have been produced by the SH&E Department for review prior to operating portable mechanized equipment (e.g., chainsaws, chop saws, power washers, etc.). Equipment safety cards should be used as a point of reference prior to using the specified piece of equipment. The cards will be used in conjunction with the manufacturers operating instructions. Personnel must be adequately trained in the tools usage prior to operation, thus using the card as a reminder or AHA for additional safe operation. The cards are not a substitute for training, which at a minimum, must consist of having an observed skill set indicating good working knowledge and equipment operation time. The applicable Equipment Safety Cards are included in Attachment C of this HASP.

4.9 STOP WORK AUTHORITY

All employees have the right and duty to stop work when conditions are unsafe and to assist in correcting these conditions as outlined in S3NA-002-PR Stop Work Authority for Unsafe Work. Whenever the SSHO determines that workplace conditions present an uncontrolled risk of injury or illness to employees, immediate resolution with the appropriate supervisor shall be sought. Should the supervisor be unable or unwilling to correct the unsafe conditions, the SSHO is authorized and required to stop work, which shall be immediately binding on all affected AECOM employees and subcontractors.

Upon issuing the stop work order, the SSHO shall implement corrective actions so that operations may be safely resumed. Resumption of safe operations is the primary objective; however, operations shall not resume until the Safety Professional has concurred that workplace conditions meet acceptable safety standards.

4.10 CLIENT SPECIFIC SAFETY REQUIREMENTS

All planned subsurface activities must comply with the Holloman AFB guidelines for underground utility clearance prior to any AECOM or subcontractor-performed subsurface activities.

4.11 ENVIRONMENTAL COMPLIANCE AND MANAGEMENT

This project and the individual tasks will comply with all federal, state, provincial, and local environmental requirements as well as S3NA-204-PR, Environmental Compliance.

4.11.1 Air Emissions

Air quality is not expected to be an issue as a result of the proposed work at Holloman AFB.

4.11.2 Hazardous Waste Management

All hazardous waste management, characterization, storage, transport, and disposal will be completed in accordance with the NMED which has adopted the federal hazardous waste regulations (20.4.1 NMAC). IDW in the form of decontamination rinsate will be stored onsite until it can be characterized from the analytical data. No potential hazardous waste will be transported offsite without proper characterization data and evaluation. All transport & disposal activities will be coordinated through a subcontractor.

4.11.3 Storm Water Pollution Prevention

While the activities will not dictate the need for a Storm Water Pollution Prevention Plan, AECOM will take all precautions necessary to prevent the discharge of storm, and decontamination water from the site in order to minimize storm water pollution.

5.0 HAZARD ASSESSMENT

5.1 HAZARD ANALYSIS

AHAs are used as a technique to identify hazards and hazard controls associated with a specific job function. AHAs focus on the relationship between the workers, the task, resources required to complete the task, and the work environment. These variables must be evaluated to identify the potential hazards associated with the task. Once identified, steps can be taken to eliminate, reduce, or control the hazards to an acceptable risk level. Guidelines for developing AHAs are located in S3NA-209-PR, Project Hazard Assessment and Planning.

Section 2.2 describes the work activities anticipated to be performed during this project. Individual AHAs for the tasks associated with this work can be found in Attachment A.

5.1.1 Unanticipated Work Activities/Conditions

Operations at the Site may require additional tasks not identified in Section 2.2 or addressed in Attachment A, AHAs. Before performing any task not covered in this HASP an AHA must be prepared, and approved by the Safety Professional.

5.2 ENVIRONMENTAL CONTAMINANT EXPOSURE HAZARDS

The following is a discussion of the hazards presented to worker personnel during this project from on-site chemical and radiological hazards known or suspected to be present on-site. Hazards associated with chemical products brought to the site during work operations are addressed separately, under the Hazard Communication process described in Section 4.3.

Exposure symptoms and applicable first aid information for each suspected Site contaminant are located in the following subsections.

5.2.1 Volatile and Semi-Volatile Organic Compounds

Volatile organic compounds (VOCs) refer to a group of volatile compounds or mixtures that are relatively stable chemically and that exists in the liquid state at temperatures of approximately 32 to 82 °F.

(VOCs are typically organic solvents used for extracting, dissolving, or suspending materials such as fats, waxes, and resins that are not soluble in water. The removal of the solvent from a solution permits the recovery of the solute intact with its original properties. Solvents are used in paints, adhesives, glues coatings, and degreasing/ cleaning agents.

Semi-volatile organic compounds are less volatile chemicals that tend to persist in the environment.

Inhalation and percutaneous absorption are the primary routes of exposure. Organic compounds are metabolized or they accumulate in the lipid-rich tissues such as the liver, fat cells, or the nervous system.

Solvent inhalation by workers can cause effects ranging from an alcohol-like intoxication to narcosis and death from respiratory failure. Symptoms may include drowsiness, headache, dizziness, dyspepsia, and nausea.

5.2.2 Metals

As a group, the heavy metals (including lead and arsenic,) are toxic to a number of organs and organ systems in the body including the liver, kidneys, blood-forming organs (primarily located in the bones), and the central nervous system (CNS),especially lead. Acute exposure to metals can produce symptoms such as stomach distress and vomiting, mental confusion and sluggishness, heart palpitations, breathing difficulties, and renal (kidney) failure. Chronic exposures can be characterized by deterioration in function of the liver and kidneys, CNS degradation, and abnormal changes in blood cell counts (especially white blood cells). Exposure to chromium may also lead to formation of lung and gastric cancers.

The primary route of exposure to heavy metals of concern during this project is contact with contaminated soils and water, which can lead to entry through open wounds or contamination and ingestion of food. Preventing

these routes of exposure necessitates the use of dust control measures and appropriate protective clothing and decontamination procedures.

Common toxic metals found at industrial sites include Arsenic, Cadmium, Chromium, Lead, Mercury, Nickel, Silver and Zinc. The metal contaminate level at this site is expected to be below worker health and safety levels of concern.

Metals can enter the body by:

- Ingesting small amounts present in food and water
- Drinking contaminated water near manufacturing or waste sites
- Drinking contaminated water or a beverage that has been stored in metal containers or flows through pipes that have been coated with zinc to resist rust
- Breathing zinc particles in the air at manufacturing sites.

Many of these metals are required in trace amounts for normal human metabolic process. Harmful health effects generally begin at levels from 10-15 times the Recommended Daily Amount (in the 1 to 250 mg/day range). Doses in this range can cause irritability, hypertension, stomach cramps, nausea, and vomiting.

Breathing large amounts of the metals (as dust or fumes) can cause a specific short-term disease called metal fume fever. This is believed to be an immune response affecting the lungs and body temperature.

5.2.3 Lead

CAS 7439-92-1; RTECS OF7525000

Inorganic lead, includes lead oxides, metallic lead, lead salts, and organic salts such as lead soaps, but excludes lead arsenate and organic lead compounds. Lead is a blue-grey metal which is very soft and malleable.

Metallic lead is used for lining tanks, piping, and other equipment where pliability and corrosion resistance are required such as in the chemical industry in handling corrosive gases and liquids used in the manufacture of sulfuric acid; in petroleum refining; and in halogenation, sulfonation, extraction, and condensation processes; and in the building industry.

It is also used as an ingredient in solder, a filler in the automobile industry, and a shielding material for x-rays and atomic radiation; in manufacture of tetraethyl lead and organic and inorganic lead compounds, pigments for paints and varnishes, storage batteries, flint glass, vitreous enameling, ceramics as a glaze, litharge rubber, plastics, and electronic devices. Lead is utilized in metallurgy and may be added to bronze, brass, steel, and other alloys to improve their characteristics. It forms alloys with antimony, tin, copper, etc. It is also used in metalizing to provide protective coatings and as a heat treatment bath in wire drawing.

Exposures to lead dust may occur during mining, smelting, and refining, and to fume, during high temperature (above 500° C [degrees Celcius]) operations such as welding or spray coating of metals with molten lead. There are numerous applications for lead compounds, some of the more common being in the plates of electric batteries and accumulators, as compounding agents in rubber manufacture, as ingredients in paints, glazes, enamels, glass, pigments, and in the chemical industry.

In addition to these usual levels of exposure from environmental media, there exists miscellaneous sources which are hazardous. The level of exposure resulting from contact is highly variable. Certain adults may also be exposed to hazardous concentrations of lead in the workplace, notably in lead smelters and storage battery manufacturing plants. Again, the range of exposure is highly variable. Women in the workplace are more likely to experience adverse effects from lead exposure than men due to the fact that their hematopoietic system is more lead-sensitive than men's.

Lead is regulated under 29 CFR 1910.1025. The PEL for lead is 50 µg/m3 (0.05 mg/m3) with an action level of 30 µg/m3 (0.03 mg/m3). The NIOSH recommended exposure limit (REL) is less than 0.1 mg/m3 and the ACGIH TLV is 0.05 mg/m3. The immediately dangerous to life or health (IDLH) value is 100 mg/m3.

Routes of entry are ingestion of dust, inhalation of dust or fume and skin and eye contact. The points of attack are the kidneys, blood, gingival tissue, gastrointestinal system, and central nervous system.

Lead is a cumulative poison. Increasing amounts can build up in the body eventually reaching a point where symptoms and disability occur. Lead dust carried home on contaminated clothing can result in exposure and symptoms in other family members. Standards only protect for inhalation exposure. Extra precautions should be taken if skin exposure also occurs. Harmful effects and symptoms of short-term exposure are as follows:

> *Inhalation* - The effects of exposure to fumes and dusts of inorganic lead may not develop quickly. Symptoms may include decreased physical fitness, fatigue, sleep disturbance, headache, aching bones and muscles, constipation, abdominal pains and decreased appetite. These effects are reported to be reversible if exposure ceases. Inhalation of large amounts of lead may lead to seizures, coma and death.
>
> *Skin* - May cause irritation.
>
> *Eyes* - May cause irritation.
>
> *Ingestion* - See effects listed for inhalation. Ingestion of large amounts of lead may lead to seizures, coma and death.

Long-term exposure involves the accumulation of lead in the body over a period of time. Therefore, long-term exposure to lower levels can result in a build-up of lead in the body and more severe symptoms. These may include anemia, pale skin, a blue line at the gum margin, decreased hand-grip strength, abdominal pain, severe constipation, nausea, vomiting, and paralysis of the wrist joint. Prolonged exposure may also result in kidney damage. If the nervous system is affected, usually due to very high exposures, the resulting effects include severe headache, convulsions, coma, delirium and death. In non-fatal cases, recovery is slow and not always complete. Alcohol ingestion and physical exertion may bring on symptoms. Continuous exposure can result in decreased fertility. Elevated lead exposure of either parent before pregnancy can increase the chances of miscarriage or birth defects. Exposure of the mother during pregnancy can cause birth defects.

Both the Mask Safety Association and North Safety approve level C PPE use up to 2.5 mg/m3 (full face with high efficiency particulate air (HEPA) cartridge). Above this value, level B PPE must be used. Determination in air is via collection on a filter and analysis adhering to NIOSH Method 7082 or 7105.

5.2.4 Mercury

CAS 7439-97-6; RTECS 0V4550000; UN 2809

Mercury is a silvery, mobile, odorless liquid. It boils at 356 to 357° C. A synonym is Quicksilver. Mercury is used as a liquid cathode in cells for the electrolytic production of caustic and chlorine. Mercury is also used in electrical apparatus (lamps, rectifiers and batteries) and in control instruments (switches, thermometers and barometers).

The notation "skin" applies indicating the possibility of cutaneous absorption for mercury vapor. The IDLH level is 10 mg/m3. The PEL is 0.05 mg/m3, REL is 0.1 mg/m3, and the TLV is 0.025 mg/m3.

Route of entry is through inhalation, skin absorption, eye and skin contact. Harmful effects and symptoms of short-term exposure are as follows:

> *Inhalation* - Exposure to levels below 1 mg/m^3 has been shown to produce nonspecific symptoms such as shyness, insomnia, anxiety and loss of appetite. At higher levels (1 to 3 mg/m^3 for 2 to 5 hours) exposure may cause headache, salivation, metallic taste, chills, cough, fever, tremors, abdominal cramps, diarrhea, nausea, vomiting, tightness in the chest, difficult breathing, fatigue, lung irritation and possible lung tissue damage. Symptoms may begin several hours after exposure and may last a week. Large doses may result in flu-like symptoms, which, in severe cases, may result in death due to pneumonia.
>
> *Skin* - Can be absorbed through the skin. May cause irritation. Prolonged contact with skin can result in symptoms listed above.

Eyes - Can cause eye irritation.

Ingestion - Generally does not produce ill effects.

Harmful effects and symptoms of long-term exposure - Mercury accumulates in the brain quickly during exposure but is released from the brain very slowly. This will result in a build-up in brain tissue over a long time. The liver and kidneys may also be damaged by mercury accumulation. It may cause headache, dizziness, restlessness, irritability, sleepiness, tremors, defective muscle control, increased salivation, loose teeth, irritation of the gums with a blue line between teeth and gums, loss of appetite, nausea, vomiting, diarrhea, liver damage, changes in urine, raised red areas and blisters of skin, impaired memory and possibly permanent brain damage.

Frequency of complaints and severity of symptoms increase with levels of exposure, most notably above 0.1 mg/m3. However, many of these symptoms have been reported at levels below recommended limits due to the accumulation of mercury over long-term exposure.

Level C PPE with a mercury vapor/HEPA cartridge is permitted up to 10 mg/m3. Determination in air is via adsorption on silvered Chromosorb P, thermal desorption, and analysis by flameless atomic absorption spectrometry. See NIOSH Method 6009.

5.2.5 Cadmium

(FOR CADMIUM METAL) CAS 7440-43-9; RTECS EU9800000

(FOR CADMIUM COMPOUNDS) UN 2570

Cadmium is a bluish-white metal. The only cadmium mineral, greenockite, is rare; however, small amounts of cadmium are found in zinc, copper, and lead ores. It is generally produced as a by-product of these metals, particularly zinc, copper, and lead ores. Cadmium is insoluble in water but is soluble in acids. "Cadmium dust" includes dust of various cadmium compounds such as CdCI2. "Cadmium fume" has the composition Cd/CdO.

Cadmium is highly corrosion resistant and is used as a protective coating for iron, steel, and copper; it is generally applied by electroplating, but hot dipping and spraying are possible. Cadmium may be alloyed with copper, nickel, gold, silver, bismuth, and aluminum to form easily fusible compounds. These alloys may be used as coatings for other materials, welding electrodes, solders, etc. It is also utilized in electrodes of alkaline storage batteries, as a neutron absorber in nuclear reactors, a stabilizer for polyvinyl chloride plastics, a deoxidizer in nickel plating, an amalgam in dentistry, in the manufacture of fluorescent lamps, semiconductors, photocells, and jewelry, in process engraving, in the automobile and aircraft industries, and to charge Jones reductors.

Various cadmium compounds find use as fungicides, insecticides, nematocides, polymerization catalysts, pigments, paints, and glass. They are used in the photographic industry and in glazes. Cadmium is also a contaminant of superphosphate fertilizers.

Human exposure to cadmium and certain cadmium compounds occurs through inhalation and ingestion. The entire population is exposed to low levels of cadmium in the diet because of the entry of cadmium into the food chain as a result of its natural occurrence. Tobacco smokers are exposed to an estimated 17 ug/cigarette. Cadmium is present in relatively low amounts in the earth's crust, as a component of zinc ores, and cadmium may be released into the environment around smelters.

The PEL for cadmium dust, as indicated in 29 CFR 1910.1027, is 0.005 mg/m3. The OSHA action level is 0.0025 mg/m3. The TLV is 0.01 mg/m3 for inhalable fraction and 0.002 mg/m3 for the respirable fraction of cadmium dust. The IDLH is 9 mg/m3.

Routes of entry are through inhalation or ingestion of fumes or dust. Points of attack are the respiratory system, lungs, kidneys, prostrate and blood. Harmful effects and symptoms of short-term exposure are as follows:

Inhalation - Dust may cause irritation of the nose and throat. Non-fatal lung inflammation has been reported from concentrations of 0.5 to 2.5 mg/m^3. In 4 to 10 hours after exposure severe chest pain, with persistent cough and difficult breathing, headache, chills, muscle aches, nausea, vomiting, and diarrhea can

occur. Fluid in the lungs and dark-purple coloration of the skin may occur. Breathing becomes more difficult and is accompanied by wheezing or coughing of blood. Other symptoms which may occur 12 to 36 hours after exposure in addition to those above include dizziness, irritability, gastrointestinal disturbances, shortness of breath, fever, profuse sweating, exhaustion and inflammation of the lungs. Death may result within 7 to 10 days after exposure. The average concentrations of fume responsible for fatalities have been 40 to 50 mg/m^3 for 1 hour, 9 mg/m^3 for 5 hours, or 5 mg/m^3 for 8 hours.

Skin - Absorption is negligible.

Eyes - Cadmium compound dust may cause irritation. No injury to the eyes of human beings has been reported.

Ingestion - A dose of 15-30 mg (1/1000 oz.) of metal or soluble compounds may cause increased salivation, choking, vomiting, abdominal pain, anemia, kidney malfunction, diarrhea, and persistent desire to empty the bladder. Symptoms may occur within 15-30 minutes after ingestion. May cause heart and lung failure.

Long term exposure to low levels of cadmium in air may cause irreversible lung injury, abnormal lung function and kidney disease. Other consequences of cadmium exposures are inflammation of the nose and throat, open sores in the nose, soreness, bleeding and reduced nose size, loss of sense of smell, damage to the olfactory nerve, yellow cadmium stains on teeth, sleeplessness, nausea, lack of appetite, weight loss, anemia, lung distention with scar formation, and liver damage. Bone disease characterized by softening, bending and reduction in bone size may occur. Difficulty walking, pain in back and extremities, and spontaneous fractures may result. Inhalation of 0.06 mg/m3-0.68 mg/m3 for 4 to 8 years may cause throat irritation, cough, chest pain, upset stomach and fatigue. Exposure to levels of 3.0 - 15.0 mg/m3 of fumes or dust over a period of 20 years has caused lung distention, anemia, protein in urine and kidney dysfunction. Studies indicate that there is an increased incidence of prostatic cancer and possible kidney and respiratory cancer in cadmium workers.

Level C (full-face with a HEPA filter) can be worn up to 0.25 mg/m3 for dust. Level B is required above this value. Determination in air is via collection of particles on a filter adhering to NIOSH Methods 7048 and 7300.

5.2.6 Chromium

All forms of chromium can be toxic at high levels, but chromium (VI) salts (Chromates) are more toxic than chromium (II) and (III). Breathing very high levels of chromium (VI) as dust or mist in air can damage and irritate your nose, lungs, stomach, and intestines. People who are allergic to chromium may also have asthma attacks after breathing high levels of either chromium (VI) or (III). Long term exposures to high or moderate levels of chromium (VI) cause damage to the nose (bleeding, itching, sores) and lungs, and can increase your risk of non-cancer lung diseases.

Hexavalent chromium (Cr(VI)) compounds are a large group of chemicals with varying chemical properties, uses, and workplace exposures. Their properties include corrosion-resistance, durability, and hardness. Workers may be exposed to airborne Cr(VI) when these compounds are manufactured from other forms of chromium (e.g., the production of chromates from chromite ore); when products containing Cr(VI) are used to manufacture other products (e.g., chromate-containing paints, electroplating); or when products containing other forms of chromium are used in processes that result in the formation of Cr(VI) as a by-product (e.g., welding).

All Cr(VI) compounds are considered to be occupational carcinogens. Cr(VI) is a well-established carcinogen associated with lung, nasal, and sinus cancer. Some of the industries in which the largest numbers of workers are exposed to high concentrations of airborne Cr(VI) compounds include electroplating, welding, and chromate painting. A hierarchy of controls, including elimination, substitution, engineering controls, administrative controls, and the use of personal protective equipment, should be followed to control workplace exposures. Dermal exposure to Cr(VI) should also be prevented to reduce the risk of skin irritation, corrosion, ulcers, sensitization, and allergic contact dermatitis.

5.2.7 Sodium Cyanide

CAS 143-33-9; RTECS VZ7525000; UN1689

Sodium cyanide is a white solid with a faint almond odor. Synonyms are potassium cyanide or cyanide. The PEL and TLV is 5 mg/m3 as CN and there is no set STEL. The IDLH level is 50 mg/m3.

Routes of entry are via inhalation; skin absorption; ingestion; eye and skin contact. Harmful effects and symptoms include weakness, headaches, confusion, nausea, vomiting, eye and skin irritation, and slow gasping respiration.

Level B can be used up to 50 mg/m3. Determination in air is via collection with a filter and impinger using potassium hydroxide adhering to NIOSH Method 7904, measurement by ion-specific electrode.

5.2.8 Polychlorinated Biphenyls

CAS 42% chlorine 53469-21-9; RTECS TQ1356000

CAS 54% chlorine 11097-69-1; RTECS TQ1360000

Polychlorinated biphenyls (PCBs) are a series of technical mixtures, consisting of many isomers and compounds that vary from mobile oily liquids to white crystalline solids and hard non-crystalline resins. The variability is based upon the degree of chlorination (and location of chlorine atoms) on the diphenyl rings that act as the skeleton for PCBs. The name Aroclor® 1221, 1232, 1242, 1248, 1254, 1260 etc. correspond as to the percentage that the diphenyl rings have been instituted (i.e., 21%, 32%, 42%, etc.). The most commonly encountered PCBs are chlorodiphenyl (42% chlorine) [Aroclor® 1242] and chloridiphenyl (54% chlorine) [Aroclor® 1254]. These compounds are light, straw-colored liquids with typical chlorinated aromatic odors; 42% chlorodiphenyl is a mobile liquid and 54% chlorodiphenyl is a viscous liquid. Chlorodiphenyl (42% chlorine) boils between 617° and 691° and freezes at -2°F. Chlorodiphenyl (54% chlorine) boils between 689° and 734°F and freezes at 50°F. The synonyms for PCBs are chlorodiphenyls, Aroclors, and Kanechlors. Names further defining PCBs, based upon chlorine substitution are Aroclor® 1221, 1232, 1242, 1248, 1254, 1260, 1262, 1268, 2565, 4465, 5442, 5460 and Kanechlor 300, 400, 500. PCBs are incompatible with strong oxidizers.

PCBs are used alone and in combination with chlorinated naphthalenes. They are stable, thermoplastic, and non-flammable, and find chief use in insulation for electric cables and wires, in the production of electric condensers, as additives for extreme pressure lubricants, and as a coating in foundry use. PCBs are one member of a class of chlorinated aromatic organic compounds which are of increasing concern because of their apparent ubiquitous dispersal, persistence in the environment, and tendency to accumulate in food chains, with possible adverse effects on animals at the top of food webs, including man. The OSHA PEL and ACGIH TLV are 1 mg/m3 for chlorodiphenyl 42% Cl and 0.5 mg/m3 for 54% Cl. The NIOSH REL for both 42% and 54% are 0.001 mg/m3. The IDLH level is 5 mg/m3.

Routes of entry are via inhalation of fume or vapor and percutaneous absorption of liquid, ingestion, eye and skin contact. Harmful effects from short term exposure are as follows:

Inhalation - May produce irritation to nose, throat, and lungs. Levels above 10 mg/m^3 are reported to be unbearable. Inhalation may contribute significantly to all symptoms of long term exposure.

Skin - Absorption is moderate. Sensitized individuals may develop a rash after 2 days exposure by contact or inhalation.

Eyes - May produce irritation. Levels of 10 mg/m^3 are severely irritating.

Ingestion - Absorption in the digestive system contributes significantly to all symptoms of long term exposure. There are no reported deaths of humans due to a single ingestion. However, experiments in animals suggest that ingestion of 6 to 10 fluid ounces would cause death to a healthy 150 pound adult.

Long term exposure to PCBs at high levels of 1 to 10 mg/m3 may produce a burning feeling in the eyes, nose and face; dry throat; lung and throat irritation; nausea, dizziness, chloracne, and the aggravation of existing acne. Liver damage and digestive disturbance have been reported in some individuals. OSHA has identified PCBs as a dermal carcinogen. PCBs may impair the function of the immune system. PCBs at high levels have been shown to produce cancer and birth defects in laboratory animals. Whether PCBs produce these effects in humans is not known.

North and MSA do not approve the use of APRs for protection against 42% and 54% chlorodiphenyl as a Determination in air is via collection on a particulate filter or with a florisil tube, adhering to NIOSH Method 5503 for PCBs' vapor. However, if it is a particulate concern via adhering to soil, level C with HEPA filters can be used.

5.2.9 Pesticides

The past 35 years have seen the development of a wide variety of pesticides, which are a group of chemical substances manufactured for the use of destroying pests/rodents/fungi which destroy crops, flowers, and plants. These types of pesticides include insecticides, fungicides, and rodenticides. Another variety of pesticides include herbicides, which are plant-killing chemicals.

Pesticides can be classified in a number of different ways; (1) By their target (insecticides, herbicides, fungicides, rodenticides, algicides, nematocides, etc.); (2) by their chemical nature (natural organic compounds, inorganic compounds, chlorinated hydrocarbons, organophosphates, carbamates); (3) by their physical state (dusts, dissolved solutions, suspended solutions, volatile solids); or (4) by their mode of actions (stomach poisons, contact poisons, fumigants, and others).

The effects of overexposure to pesticides are varied and numerous, but some symptoms include nausea, vomiting, diarrhea, cramps, sweating, salivation, blurred vision, and muscular tremors. Concern also exists about possible carcinogenic, mutagenic, and teratogenic effects of pesticides. These effects have been documented in chronic exposure to animals. Since pesticides are extremely dangerous by both inhalation and dermal contact, it is important that site personnel are adequately protected during potential contact with drums that contain pesticides. This will include adequate respiratory and skin protection to minimize exposure routes.

5.3 ASSESSMENT OF EXPOSURE HAZARDS

Inhalation – Sometimes chemicals are present in the air as small particles (dust or mist). Appropriate dust and fugitive emission controls, as well as monitoring and the use of appropriate PPE will greatly minimize the potential for significant occupational exposures.

Skin Contact – Contact with contaminated soils and water can lead to contaminate entry through skin and open wounds. Preventing this route of exposure necessitates the use of appropriate protective clothing and decontamination procedures.

Ingestion – The potential entrainment of contaminated soils and water presents an ingestion hazard to site workers during sampling activities. Protection against exposure via ingestion can be accomplished by performance of proper decontamination procedures when exiting contaminated work areas (see Section 8.2).

5.4 PHYSICAL HAZARDS

The physical hazards anticipated during this project are discussed below.

- Hazardous Noise – Workers may be exposed to hazardous levels of noise from pressure washers and supporting equipment.
- Forklifts/ Heavy Equipment – During facility equipment disassembly and decontamination operations, heavy equipment such as forklifts and scissor lifts are recurrently raised overhead. Thus, workers may be exposed to swinging equipment during lifting, or may be exposed to crushing hazards if equipment

falls or is carelessly lowered. Loose clothing may become entangled in cables used to raise and lower equipment or on the equipment. Rough edges or spaces on cables may cause cuts and abrasions.

- Pressure Washers – Steam pressure washing may expose workers to thermal or burn hazards, eye hazards due to flying projectiles dislodged during washing, slip hazards from wet surfaces, and noise hazards.
- Overhead Electrical Lines – Forklifts, scissor lifts, and other heavy equipment can contact overhead electrical lines causing electrocution of nearby workers or workers who were in contact with the equipment. The equipment could also catch fire when exposed to high voltage.
- Subsurface Utilities – Hand augers can drill into subsurface utility lines (e.g., electrical, fiber optic, gas line, etc.).
- Heat Stress – Summer in New Mexico can present outdoor workers with extreme heat stress resulting from temperatures in excess of 100 ^{o}F along with the high humidity.
- Power Hand/Manual Hand Tools – The use of manual hand or power tools presents workers with hazards such as cuts, abrasions, contusions, and electrocution (power tools only).
- Severe Weather – The SSHO will monitor local radio, National Oceanic and Atmospheric Administration weather radio, Internet weather sites, or other weather warning systems to plan for and identify possible severe weather situations at the project site. Site work may be delayed, postponed, or cancelled due to severe weather. Vehicle and equipment use at a site may also be restricted under unfavorable weather conditions.
- Lightning
    - Lightning can strike up to a distance of 10 miles, but thunder can only be heard at a distance of eight miles. If you can hear thunder, you are at risk of being struck by lightning.
    - Therefore, if site personnel working outdoors hear thunder or see lightning, work will be stopped and personnel will move to an indoor location.
    - If indoor facilities are not available, personnel should seek shelter inside passenger vehicles such as cars and pickups. Avoid touching metal parts of the vehicle.
    - During a thunderstorm avoid trees/poles, standing water, high areas, very low areas and streams, and metal structures (e.g., fences, scaffolding, etc.).
    - Work may resume 30 minutes following the final sound of thunder or observance of lightning, and when the storm is moving away from the work area.

5.5 UV HAZARDS

Exposure to UV radiation is typically the result of exposure to direct sunlight. Personnel are susceptible to extremely high to high levels of UV exposure ranging from April to mid-September. Protective clothing that is loose fitting and covers the arms provide protection against sunlight. Hats should shade the face, neck, and ears and have a wide brim (8 to 10 centimeters). Sunscreen should provide UVA and UVB protection and be a minimum of SPF 30. Sunglasses should be a close fitting wrap-round design and block at least 99% UV radiation. Chronic exposure to direct sunlight can cause skin cancer.

6.0 ACTIVITY SPECIFIC REQUIREMENTS

6.1 SUPPLEMENTAL SAFETY PROCEDURES

As discussed in Section 5.0, personnel may be exposed to a variety of chemical, physical, radiological, and biological hazards resulting from task- or equipment-specific activities. The requirements for the control of many of these hazards are discussed in SOPs found in the 300 to 500 Series of the U.S. Operations SH&E Manual.

Specific procedures applicable to this project include:

- S3NA-302-PR Electrical General
- S3NA-305-PR Hand and Power Tools
- S3NA-308-PR Manual Lifting
- S3NA-309-PR Mobile or Heavy Equipment
- S3NA-313-PR Wildlife, Plants and Insects
- S3NA-417-PR Utilities, Underground
- S3NA-505-PR Cold Stress Prevention
- S3NA-507-PR Hazard Materials Communication / WHMIS
- S3NA-508-PR Hazardous Materials Handling and Shipping
- S3NA-509-PR Hazardous Waste Operations and Emergency Response
- S3NA-511-PR Heat Stress Prevention
- S3NA-520-PR Spill Response, Incidental
- S3NA-521-PR Decontamination

In addition, the following supplemental procedures have been developed to address requirements not covered within the established AECOM SOPs (SH&E 300 to 500-series). SOPs and supplemental procedures are specified on a task-specific basis in the individual AHAs found in Attachment A.

6.1.1 Slips, Trips, Falls, and Protruding Objects

A variety of conditions may exist that may result in injury from slips, trips, falls, and protruding objects. Slips and trips may occur as a result of wet, slippery, or uneven walking surfaces. To prevent injuries from slips and trips, always keep work areas clean; keep walkways free of objects and debris; and report/clean up liquid spills. Serious injuries may occur as a result of falls from elevated heights. Always wear fall protection while working at heights of six feet or greater above the next lower level. Protruding objects are any object that extends into the path of travel or working area that may cause injury when contacted by personnel. Always be aware of protruding objects and when feasible remove or label the protruding object with an appropriate warning.

6.1.2 Hazardous Noise Environments

Working around pressure washers and other heavy equipment often creates excessive noise. The effects of noise can include physical damage to the ear, pain, and temporary and/or permanent hearing loss. Workers can also be startled, annoyed, or distracted by noise during critical activities.

AECOM has compiled noise monitoring data that indicates that work locations within 25 feet of operating mechanized equipment (e.g., power washers) can result in exposure to hazardous levels of noise (levels greater than 90 decibels (dBA). Accordingly, all personnel are required to use hearing protection (earplugs or earmuffs) within 25 feet of any operating piece of heavy equipment.

6.1.3 Manual Lifting

Most materials associated with investigation, remedial, or construction-related activities are moved by hand. The human body is subject to severe damage in the forms of back injury, muscle strains, and hernia if caution is not observed in the handling process. Whenever possible, use at least two people to lift, or roll/lift with your arms as close to the body as possible. Under no circumstances should any one person lift more than 49 pounds unassisted. For additional requirements refer to S3NA-308-PR Manual Lifting, Field. Additional measures related to manual materials handling activities may be applicable.

6.1.4 Ladder Safety

The following safe work practices will be adhered to during use of ladders:

- Assess work areas for fall hazards; a fall protection system is required if work is conducted six feet or higher
- Use Type 1A rated ladders
- Make sure ladder rungs are sturdy and free of cracks
- Use ladders with secure safety feet
- Pitch ladders at a 4:1 ratio
- Secure ladders at the top or have another person at the bottom to help stabilize it
- Ladders used to access an upper landing surface shall extend at least three feet above the upper landing surface
- Use non-conductive ladders near electrical wires
- The top platform of a stepladder should not be used as a step
- Do not carry any object or load that could cause a loss of balance or a fall

6.1.5 Flame, Heat, or Spark Producing Operations (Hot Work)

Because of the possibility of flammable materials being present at this site, flame, heat, or spark producing operations shall be limited. If a case arises where hot work is necessary, it shall be performed in accordance with AECOM S3NA-206-PR Fire Protection, Field.

This procedure requires a hot work permit and shall be inspected by the SSHO prior to commencing hot work. Combustible materials shall be removed from the area before the start of hot work. A fire watch shall be posted and the atmosphere shall be tested for combustible gases. A hot work permit shall be completed by the SSHO. The permit shall indicate the area, the employees involved, air monitoring results, fire protection systems, and fire department phone number. All flammable materials/fuels shall be stored in safety containers and backflow preventers shall be required for welding/cutting torches.

6.1.6 Fire Prevention and Protection

Clothes, cotton waste, and other combustible materials that might constitute a fire hazard will be placed in closed metal containers and placed outside or destroyed at the end of each day. AECOM will provide and maintain portable fire extinguishers in the following manner:

- Portable fire extinguishers will be provided, where needed, and inspected on a monthly basis. A visual inspection will be made to ensure that extinguishers are fully charged and in an operable condition.

- Hoses, nozzles, brackets, and supports will be inspected for deficiencies and corrected. Gauge pressure will be checked on pressurized units on a monthly basis to ensure units are fully charged and non-pressurized units will have their cartridges weighed on an annual basis. The chemical within dry chemical extinguishers will be inspected on an annual basis to ensure that it is powdery and in a free-running condition. An inspection tag will be attached to all extinguishers to designate that they have received an annual inspection. Fire extinguishers will be suitably placed, distinctly marked, and readily accessible.

- A fire extinguisher with a rating of not less than 10-B will be located within 50 feet or wherever more than five gallons of flammable gas are being used on the work site (this does not apply to integral fuel tanks of motor vehicles).
- A fire extinguisher with a rating of not less than 20-B will be located outside of and within 10 feet of the door opening into any room, building, or trailer used for storage of more than 60 gallons of flammable or combustible liquids.
- If flammable liquids are being stored in an outside location, at least one portable fire extinguisher with a rating of not less than 20-B will be located at least 25 feet from the storage area, but not more than 75 feet away.
- All tank trucks or vehicles used for transporting and/or dispensing flammable or combustible liquids will have a portable fire extinguisher with not less than a 20-BC rating.
- A portable fire extinguisher with a rating of not less than 20-BC will be placed within 50 feet of each service or fueling area at the project site.
- Fire extinguishers will be placed in storage areas so they are capable of extinguishing materials being stored.
- All fire extinguishers will be approved by a nationally recognized testing laboratory.
- A fire extinguisher with a rating of not less than 2-A will be provided where torches or open flames are in use.
- At least one dry chemical or carbon dioxide fire extinguisher, with a 5-BC rating minimum, will be available for placement on each unit of heavy equipment, and each site vehicle (excluding rental cars).
- Fuel handling is another hazard which will be present during this task. Refueling of the mechanical equipment poses burn hazards. All refueling and fuel handling equipment must be Underwriters Laboratories listed and Factory Mutual approved. The refueling must be done in a designated area to prevent contamination from minor spills and to reduce the risk of fires. The following guidelines must be followed whenever personnel are dispensing flammable and combustible liquids:
- Flammable liquid dispensing systems will be electrically bonded and grounded. All tanks, hoses, and containers of five gallons or less will be kept in metallic contact while flammable liquids are being transferred; transfer of flammable liquids in containers in excess of five gallons will be done only when the containers are electrically bonded.
- Flammable or combustible liquids will be drawn from, or transferred into, vessels, containers, or tanks within a building or outside only through a closed piping system, from safety cans, by means of a device drawing through the top, or from a container, or portable tanks, by gravity or pump, through an approved self closing valve. Transferring by means of air pressure on the container or portable tanks is prohibited.
- Areas in which flammable or combustible liquids are transferred in quantities greater than five gallons from one tank or container to another will be separated from other operations by at least 25 feet or a barrier having a fire resistance of at least one hour. Drainage or other means will be provided to control spills.
- Natural or mechanical ventilation will be provided to maintain the concentration of flammable vapor at or below 10% of the lower explosive level.
- Dispensing units will be protected against collision damage.
- Dispensing nozzles and devices for flammable liquids will be of an approved type.

- Lamps, lanterns, heating devices, and similar equipment will not be filled while hot. These devices will be filled only in well-ventilated rooms free of open flames or in open air and shall not be filled in storage buildings.

6.1.7 Small Quantity Flammable Liquids

Small quantities of flammable liquids shall be stored in safety cans and properly labeled as to their contents.

6.1.8 Powered Hand Tools

The use of any powered hand tool will comply with the requirements in S3NA-305-PR Hand and Power Tools. All electrically powered hand tools will be connected through a ground fault circuit interrupter (GFCI). All tools will be inspected prior to use. For those tool(s) that are damaged or otherwise defective, the tool will be red tagged and taken out of service. Workers utilizing powered hand tools will be provided with the applicable Equipment Safety Cards in Attachment C and briefed regarding the hazards presented by that particular tool. All workers must be trained on the use of the particular tool they are utilizing and this training must be documented. The SSHO/Site Supervisor will maintain the training records onsite.

6.1.9 Soil Sampling

Soil samples can be collected from Geo-probe points, hand auguring and from the surface. During sampling activities, appropriate air monitoring will be conducted and the appropriate chemical resistant PPE will be worn to protect against exposure. The major activities involved with collecting samples from the site and surrounding properties include the following:

- Pre-sampling event notifications and approval
- Set-up for sampling activities
- Sample preparation and sample shipping
- Administrative activities

6.1.10 Lockout/Tagout of Hazardous Energy Sources

Lockout/tagout procedures will be implemented to assure the safety of personnel during servicing or maintenance of machines and equipment where the unexpected release of stored energy or the energization of these machines or equipment could cause employee injury. These procedures are contained in S3NA-410-PR Hazardous Energy Control and comply with the requirements established in 29 CFR 1926.417. All portable electrical equipment and extension cords shall be protected with a GFCI as part of the circuit. The applicable requirements found in 29 CFR 1926, Subpart K, Electrical shall be implemented and S3NA-302-PR Electrical, General.

Subcontractors may implement their own lockout/tagout procedure if the Safety Professional has approved its use and verifies that it is no less protective than the AECOM procedure.

It is the responsibility of AECOM employees to verify that all remediation equipment is locked out before AECOM employees perform any maintenance or repair work on the system. The source must be locked out. It is not enough to push the power switch to off and disconnect the breaker. Anyone can re-engage power under these circumstances. Locking out the power source is the only way to guarantee that the power will not be inadvertently reactivated.

A lock-out/tag-out kit will be located on site. The kit includes standard locks, keys and lock-out notices.

The site specific lock-out/tag-out information must be completed. These forms will then be placed within the Holloman AFB field office so all field technicians performing operations and maintenance work on the system are familiar with how to lock-out the system when necessary.

6.1.11 Electrical Power

All electrical equipment must have a GFCI as part of the circuit. All equipment must be suitable and approved for the class of hazard. Temporary wiring conductors installed for operation of construction tools and equipment will be either Type TW or THW contained in metal raceways, or will be hard usage or extra hard usage multi-conductor cord. Temporary wiring will be secured above the ground or floor in a workmanlike manner and will not present an obstacle to persons or equipment. Applicable OSHA standards for electrical power, 29 CFR 1926 Subpart K and S3NA-302-PR Electrical, General shall apply.

6.1.12 Heavy Equipment Safety

There may be various types of heavy construction equipment that AECOM may be using during the execution of this project. All operators of this equipment will be familiar with the requirements for inspection and operation of the equipment they will be using. Before equipment is placed into use, it will be inspected by the operator to ensure that it is in safe operating condition. The following guidelines will be adhered to while operating heavy construction equipment:

- Equipment will not be operated in a manner that will endanger persons or property nor will the safe operating speeds or loads be exceeded.
- Getting off or on any equipment while it is in motion is prohibited.
- Use the three-point contact rule when getting on and off of equipment.
- Always clear the tracks with debris to ensure good footing and to prevent slippage, especially in wet conditions.
- Spotters will be used to back-up equipment and direct traffic in all “blind” areas.
- Equipment will be operated in accordance with the manufacturer’s instructions and recommendations.
- Determinations of road conditions and structures will be made in advance to assure that clearances and load capacities are safe for the passage of equipment.
- All machinery or equipment will be shut down and positive means taken to assure that clearances and load capacities are safe for the passage of equipment.
- No guard, safety appliance, or device will be removed from machinery or equipment, or made ineffective except for making immediate repairs, lubrications, or adjustments, and them only after the power has been shut off. All guards and devices will be replaced immediately after completion of repairs and adjustments and before power is turned on.
- Mechanized equipment will be shut down prior to and during fueling operations. Closed systems, with automatic shut-off which will prevent spillage if connections are broken, may be used to fuel diesel powered equipment left running.
- All self-propelled construction equipment, whether moving alone or in combination, be equipped with a reverse signal alarm.
- Standard hand signals will be used to communicate between operators and ground crew.
- All heavy equipment will be equipped with operable seat belts; belts will be used by all operators.

In order to assure that all equipment used on-site presents no unwarranted safety hazards, the owner of each piece of heavy equipment must perform a safety evaluation and certification in accordance with the procedures and requirements found in S3NA-309-PR Mobile or Heavy Equipment. The owner/vendor supplying the heavy equipment must complete the S3NA-309-FM1 Certification Form for Machinery and Mechanized Equipment and then submit the completed form to the SSHO prior to the equipment’s use onsite. Each operator must complete the S3NA-309-FM2 Heavy Equipment Pre-Operations Inspection Checklist daily and submit the completed form(s) to the SSHO at the end of the week/month.

6.1.13 Traffic Safety

In order to ensure the safety of pedestrians, local traffic, and site workers, traffic control measures will be established for the site activities that may be required in high traffic zones, streets, parking lots, or other locations where vehicular traffic may present a potential hazard to workers. All individuals working on this site must wear a Type II or Type III reflective traffic safety vest. All traffic routes and traffic diversion measures such as road closures, lanes closures, and the establishment of barricades or other traffic diversion signals (if needed) will meet the minimum requirements identified in S3NA-303-PR Highway and Road Work.

6.1.14 Elevated Work Platforms and Aerial Lifts

The use of aerial lifts presents a unique set of hazards to employees using, and working around the equipment. Proper training on the safe usage of the specific type of lift being utilized is essential to the safe execution of work tasks with the equipment. Besides the daily inspections and safe usage of the equipment, there are numerous other safety related issues that need to be assessed during their use, to include fall protection, safe working surfaces, and overhead power lines.

6.1.15 Working at Heights

Although working at heights is not anticipated during this project, the following are U.S. standards. Fall Protection - Fall Protection Systems shall comply with OSHA Regulations (Standards – 29 CFR) Standard # 1926.502 Fall Protection Systems Criteria and Practices and OSHA Standard # 1926.502(d) – 1926 Subpart M App C Personal Fall Arrest Systems.

Specifically, anyone working in an area exposed to a fall greater than six feet must use appropriate fall protection. Such protection includes: guardrail systems, safety net systems or personal fall arrest systems. Other protection methods include hole-covers, positioning devices, equipment guards, fences and barricades. Fall protection shall be provided as required in OSHA Regulations 29CFR1910 and 29CFR1926, reference: standard 1926.501 Duty to Have Fall Protection.

Work above a height of six feet requires a fall protection system. This project requires 100% tie off using full-body harness (Class III or IV) with dual shock-absorbing lanyard (shorter than fall distance and a maximum six feet long) equipped with double-locking hooks connected to a proper tie-off attachment point capable of handling potential fall loads of 5,000 pounds.

Fall protection systems classified as “job made” (not purchased approved fall prevention devices from a fall protection supplier) shall be designed by a Registered Professional Engineer. Fall protection or restraining methods shall be in place when employees are within six feet of the leading or exposed edge, where a fall hazard exceeding six feet exists, such as during decking activities, inspecting structures, climbing, trenching, etc.

6.1.16 Subsurface Utilities

Various forms of underground/overhead utility lines or pipes may be encountered during site activities. Prior to the start of intrusive operations, utility clearance is mandated, and authorization is obtained from all concerned public utility department offices. Should intrusive operations cause equipment to come into contact with utility lines, the SSHO and the Safety Professional will be notified immediately. Work will be suspended until the applicable utility agency is contacted and the appropriate actions for the particular situations can be taken. For this project, the national one-call 811 number may be used.

6.1.17 Overhead Utilities

All overhead lines will be considered “energized” unless properly de-energized, grounded and tested by the utility company before working within the clearance distance as defined below. The AECOM SSHO must observe de-energizing process and reconfirm that the lines are de-energized on a daily basis. Any vehicle or mechanical equipment that is capable of having parts of its structure elevated near energized overhead lines shall be operated so that a minimum clearance of 10 feet is maintained at all times. This 10 foot distance shall be increased a minimum of 0.4 inches for each 1 kilovolt over 50 kilovolt. If the voltage of the overhead line is unknown, maintain a clearance of 35 feet.

Precautions must be taken when handling lengths of pipe or tubing that can approach overhead power and utility lines. When working with pipe or tubing, maintain a distance equal to the length of pipe plus the clearance distance defined above.

6.1.18 Confined Space Entry

If any operation is conducted in an area classified as a permit-required confined space by OSHA, a "Confined Space Entry Permit" will be completed and all applicable procedures meeting the requirements of 29 CFR 1910.146 will be implemented.

Confined spaces pose unique problems due to their unique contents and/or configuration. Some confined spaces, for example, pose entrapment hazards for entrants, while others restrict air circulation so that hazardous atmospheres may accumulate quickly. Confinement itself can increase the risk of injury or death by making personnel work closer to hazards than they would otherwise. OSHA considers an area to be a Permit Required Confined Space if it is an enclosed space which:

- Is large enough and so configured that an employee can bodily enter and perform assigned work;
- Has limited or restricted means for entry and exit (e.g., tanks, vessels, silos, storage bins, hoppers, vaults, pits, and diked areas);
- Is not designed for continuous employee occupancy; or
- Has one or more of the following characteristics:
  - -Contains or has a potential to contain a hazardous atmosphere;
  - -Contains a material with the potential for engulfment of an entrant;
  - -Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls, or a floor which slopes downward and tapers to a smaller cross-section; or
  - -Contains any other recognized serious safety or health hazard.

Does this project require personnel to enter a Permit Required Confined Space as defined above?

No: ☒	**Yes:** ☐

If the answer is **NO**, proceed to the next section. If the answer is **YES**, OSHA regulations for Confined Space Entry (29 CFR 1910.146) must be implemented and personnel must comply with all Confined Space Entry procedures, as follows:

- Complete and submit a Confined Space Entry Permit
- Certify that all personnel have completed the OSHA 40-hour course in Health and Safety and are current with their 8-hour refresher training
- Certify that all personnel are enrolled in a medical surveillance program and are physically capable of performing a confined space entry
- Certify that all personnel have successfully passed a respirator fit-test within the past year
- Identify entrants and ensure they are properly trained and understand their duties
- Identify attendants and ensure they are properly trained and understand their duties
- Identify a rescue team or make arrangements with an outside agency for rescue assistance. If site personnel are assigned to a rescue team, ensure that the personnel are properly trained and are familiar with the operation, capabilities, and maintenance of rescue equipment
- Ensure that at least one member of the rescue team is current in his/her First Aid and CPR certification
- Ensure that the entry permit contains the required information before authorizing entry
- Determine that the necessary procedures, practices, and equipment for safe entry are in effect before allowing entry
- Determine, at appropriate intervals, that entry operations remain consistent with the terms of the entry permit, and that acceptable entry conditions are present
- Cancel the entry authorization and terminate entry whenever acceptable conditions are not present
- Take the necessary measures for concluding an entry operation, such as closing off a permit space and canceling the permit, once the work authorized by the permit has been completed
- Take the appropriate measures to remove unauthorized personnel who are in or near permit spaces

6.1.19 Dust and Odor Control

Specific controls will be in place to prevent dust generation. If dust is observed reaching or approaching the site boundary, activities causing the dust will be immediately stopped. Dust control measures (water spray, soil covers, slower work pace, or change in work activities) will be deployed prior to resuming work. Corrective measures will be documented in the daily report.

Due to the nature of the contaminant at the site, odors are not anticipated to be of concern. In the event that an odor complaint is received, the SSHO and/or SSHO will immediately assess site conditions and determine the probable cause or causes. Appropriate odor mitigation measures will be deployed. These measures may include covering sediment piles, deploying odor suppressing foam, implementation of air monitoring or discontinuing activities that are generating the odor. Corrective measures will be documented in the daily report.

6.1.20 Spill Prevention

Work activities may involve the use of hazardous materials (i.e., fuels, solvents) or work involving drums or other containers. The following procedures will be used to prevent or contain spills:

- All hazardous material will be stored in appropriate containers
- Tops/lids will be placed back on containers after use
- Containers of hazardous materials will be stored appropriately away from moving equipment

At least one spill response kit, to include an appropriate empty container, materials to allow for booming or diking the area to minimize the size of the spill, and appropriate clean-up material (i.e., speedy dri) shall be available at each work site (more as needed). All hazardous commodities in use (i.e., fuels) shall be properly labeled. Containers shall only be lifted using equipment specifically manufactured for that purpose.

6.2 EXPOSURE MONITORING PROCEDURES

Monitoring procedures will be employed during site characterization activities to assess employee exposure to chemical and physical hazards (if required). Monitoring will consist primarily of onsite determination of various parameters (e.g., airborne contaminant concentrations and heat stress effects), but may be supplemented by more sophisticated monitoring techniques, if necessary.

6.2.1 Real-Time Exposure Measurement

Monitoring shall be performed within the work area on-site in order to detect the presence and relative levels of toxic substances, if required. The data collected throughout monitoring shall be used to determine the appropriate levels of PPE. Monitoring shall be conducted as specified in each AHA (Attachment A) as work is performed. Due to present site conditions, no monitoring is planned to be conducted at this time.

Table 6-1 specifies the real-time monitoring equipment, which will be used for this project as required.

Table 6-1: Monitoring Parameters and Equipment

INSTRUMENT	MANUFACTURER/MODEL*	SUBSTANCES DETECTED
Particulate Monitor	MIE Model PDM-3 mini-RAM	Aerosols, mist, dust, and fumes

*Or similar unit, as approved by the SH&E Professional

6.2.1.1 Health and Safety Action Levels

An action level is a point at which increased protection is required due to the concentration of contaminants in the work area or other environmental conditions. The concentration level (above background level) and the ability of the PPE to protect against that specific contaminant determine each action level. The action levels are based on concentrations in the breathing zone.

If ambient levels are measured which exceed the action levels in areas accessible to unprotected personnel, necessary control measures (barricades, warning signs, and mitigative actions, etc.) must be implemented prior to commencing activities at the specific work area.

Personnel should also be able to upgrade or downgrade their level of protection with the concurrence of SSHO or the Safety Professional.

Reasons to upgrade:

- Known or suspected presence of dermal hazards
- Occurrence or likely occurrence of gas, vapor, or dust emission
- Change in work task that will increase the exposure or potential exposure to hazardous materials

Reasons to downgrade:

- New information indicating that the situation is less hazardous than was originally suspected
- Change in site conditions that decrease the potential hazard
- Change in work task that will reduce exposure to hazardous materials

6.2.1.2 Monitoring Procedures

Table 6-2 specifies the project-specific monitoring procedures and equipment.

Table 6-2: Monitoring Procedures and Action Levels

PARAMETER	ZONE LOCATION AND MONITORING INTERVAL	RESPONSE LEVEL (A.L, ABOVE BACKGROUND)	RESPONSE ACTIVITY
Aerosols (total by aerosol monitor)	Breathing zone every 30 minutes during excavation	0-5 mg/m3	Continue work in Level D and continue monitoring
		>05-10 mg/m3	Upgrade to Level C, Implement dust suppression measures; contact the SSO & SP
		>10 mg/m3	Cease activities, implement more effective dust suppression measures; contact the SSO & SP

6.2.1.3 Monitoring Equipment Calibration

All instruments used will be calibrated at the beginning and end of each work shift, in accordance with the manufacturer's recommendations. If the owner's manual is not available, the personnel operating the equipment will contact the applicable office representative, rental agency or manufacturer for technical guidance for proper calibration. If equipment cannot be pre-calibrated to specifications, site operations requiring monitoring for worker exposure or off-site migration of contaminants will be postponed or temporarily ceased until this requirement is completed.

6.2.1.4 Personal Sampling

Should site activities warrant performing personal sampling to better assess chemical exposures experienced by AECOM employees, the SSHO, under the direction of a Certified Industrial Hygienist (CIH), will be responsible for specifying the monitoring required. Within five working days after the receipt of monitoring results, the CIH will notify each employee, in writing, of the results that represent that employee's exposure. Copies of air sampling results will be maintained in the project files.

If the site activities warrant, the subcontractor will ensure its employees' exposures are quantified via the use of appropriate sampling techniques. The subcontractor shall notify the employees sampled in accordance with health and safety regulations, and provide the results to the SSHO for use in determining the potential for other employees' exposure.

6.2.2 Biological Hazard Injury and Illness Prevention

Contact with bodies of water, animals, insects, and plants can cause injury and illness to personnel. Care must be taken to ensure that these types of injuries are avoided. Preventative measures are outlined in S3NA-313-PR Wildlife, Plants and Insects. Some examples of biological hazards include:

1. Natural and artificial bodies of water (e.g., lakes, rivers, ponds, lagoons, etc.) may contain a variety of microorganisms. Microorganisms, in particular, present a significant hazard to personnel who may come into contact with water bodies. Contact with microorganisms in water may result in dermatitis, infection (i.e., in cuts/lacerations), digestive distress, and other diseases. Always be aware of areas that may contain excessive amounts of microorganisms. Such areas may include areas of standing water; areas of warm water (i.e., cooling tower effluents, etc.); and areas downstream of municipal wastewater treatment. To prevent exposure to microorganisms in water, always adhere to the following:
    a. Wear protective gloves (i.e., nitrile, etc.) and other appropriate PPE to prevent skin contact with water.
    b. Never drink from natural or artificial bodies of water. Such water is considered non-potable and is not safe for drinking.
2. Wild animals, such as snakes, raccoons, squirrels, and rats. These animals not only can bite and scratch, but can carry transmittable diseases (e.g., rabies). Avoid the animals whenever possible. If bitten, go to the nearest medical facility.
3. Insects such as mosquitoes, ticks, bees, and wasps. Mosquitoes can potentially carry and transmit the West Nile Virus. Ticks can transmit Lyme disease or Rocky Mountain Spotted Fever. Bees and wasps can sting by injecting venom, which causes some individuals to experience anaphylactic shock (extreme allergic reaction). Whenever you will enter areas that provide a habitat for insects (e.g., grass areas, woods), wear light-colored clothing, long pants and shirt, and spray exposed skin areas with a DEET-containing repellent. Keep away from high grass wherever possible. Keep your eyes and ears open for bee and wasp nests. If bitten by insects, see a doctor if there is any question of an allergic reaction.
4. Plants such as poison ivy and poison oak can cause severe rashes on exposed skin. Be careful where you walk, wear long pants, and minimize touching exposed skin with your hands after walking through thickly vegetated areas until after you have thoroughly washed your hands with soap and water. Examples of common poisonous or irritating plant species, common to the U.S., are shown in Table 6-3.

Table 6-3: Hazardous Plant Identification Guide

Poison Ivy • Grows in West, Midwest, Texas, East • Several forms – vine, trailing shrub, or shrub • Three leaflets (can vary 3-9) • Leaves green in summer, red in fall • Yellow or green flowers • White berries	
Poison Oak • Grows in the East (New Jersey to Texas), Pacific Coast • Six foot tall shrubs or long vines • Oak-like leaves, clusters of three • Yellow berries	

Poison Sumac • Grows in boggy areas, especially in the Southwest and Northern states • Shrub up to 15 feet tall • Seven to 13 smooth-edged leaflets • Glossy pale yellow or cream-colored berries	

6.2.2.1 Response Measures for Contact with Hazardous Plants

If you have been exposed to poison ivy, oak, or sumac, act quickly because the toxin in the plants penetrates the skin within minutes. If possible, stay outdoors until you complete the first two steps:

1. Cleanse the exposed skin with generous amounts of isopropyl alcohol.
2. Wash the skin with water.
3. Take a regular shower with soap and warm water. Do not use soap until this point because it will pick up the toxin from the surface and move it around.
4. Wash clothes, tools, and anything else that may have been in contact with the toxin, with alcohol and water. Be sure to wear hand protection during that process.

Signs and symptoms of exposure include redness and swelling that appears five minutes to two hours after exposure. Blistering and itching will follow. If you have had a severe reaction in the past, you should see an occupational physician right away. After binding, plain soap and water may not be effective in removing urushiol (the oil commonly disseminated by these particular plants). Otherwise, according to the Federal Drug Administration, there are quite a few effective over-the-counter (OTC) products to help with symptoms, including Cortaid and Lanacort, baking soda, Aveeno oatmeal bath, and calamine lotion. These OTC remedies may produce mild and temporary relief of the itch but will not remove the oil. Again, cleanse immediately after exposure w/plain soap/water, and then wash with products like OTC Zanfel per package instructions. Wash all clothing/bedding in hot soapy water since urushiol oil from the plant will stay on them and if worn/touched, will continue to re-expose if contracted with any part of one's skin. AECOM's occupational care consultant, or a pharmacist, can help you make an educated choice.

6.2.3 Snakes

Venomous snakes can be encountered on or near the project site. Efforts should be made to keep away from all snakes.

If bitten, stay calm and seek help. Do NOT cut the bite area, but use a snakebite kit if available. Try to be able to identify the snake to medical personnel. Remember that bites of non-venomous snakes can become infected. Get medical attention for any animal bite.

The following photos provide an illustration of common venomous snakes that may be found throughout portions of New Mexico. Those working in the field should never attempt to handle snakes.

6.2.4 Rodents

Rodents, such as rats and deer mice, can potentially carry Hantavirus. Rats differ from related mice by their larger size and teeth. Deer mice, such as mesas, usually live at higher elevations, and can be distinguished from

other rodents by their small size (Two to four inches long) and by their bi-colored tail. However, the Centers for Disease Control believes that other rodents also have the potential to carry the virus, so precautions must be taken when dealing with any species of rodent. It is not possible to distinguish whether a rodent carries the Hantavirus by observation.

Hantavirus affects the respiratory system in humans. The first symptoms of infection can occur at any time up to 45 days after exposure, and includes one or more of the following: fever, muscle aches, headache, or coughing. These symptoms progress rapidly into a severe lung disease that often requires intensive care treatment. Hantavirus can be transferred to humans, primarily from breathing infected rodent excreta particles that have become airborne or ingesting excreta particles that cling to hands or clothing. It can also be contracted from rodent bites or transferred through broken skin. Though the illness caused by Hantavirus is severe, it is relatively rare and can be prevented by simple precautions and common sense.

The best way to avoid contact with the Hantavirus is to avoid contact with rodents and their excreta. Do not leave food or garbage where rodents have access to them; this includes leaving food items and wrappers in vehicles. When possible, seal any opening greater than ¼ inch diameter with steel wool to prevent rodent access in vehicles or structures.

Minor amounts of rodent excreta and rodents caught in mouse traps may be disposed of by personnel, provided precautions are taken. A suggested procedure is:

- When excreta or dead rodents are discovered in an enclosed area, ventilate the area for 30 minutes; the more air flow the better
- Wear the proper PPE
- Implement dust suppression techniques (such as use of a “bug” sprayer filled with water and a small amount of detergent to lightly spray the floor prior to entry)
- To dispose of wastes, place the rodent excreta or dead rodents in a plastic bag. Rinse gloved hands with bleach solution of one part bleach or 10 parts water, then rinse off any PPE in proper order, placing disposable items such as boot covers and respirator cartridges, in with the wastes. Place the respirator, if any, into a plastic bag, and mark the bag as “POTENTIALLY INFECTIOUS.” Wet the wastes with the bleach solution, seal the plastic bag, place it into a second bag, and seal this bag also. Spray the outside of the plastic bag with commercial spray disinfectant. The waste may be disposed of as regular garbage
- After the wastes are properly bagged, spray the surfaces where the wastes originally were found with disinfectant
- Thoroughly wash hands, face, and forearms with soap and water

6.2.5 Ticks

Ticks are vectors of many different diseases, including Rocky Mountain spotted fever, Q fever, tularemia, Colorado tick fever, and Lyme disease. They attach to their host’s skin and intravenously feed on blood, creating an opportunity for disease transmission. Covering exposed areas of the body and the use of tick repellent are two ways to prevent tick bites. Periodically during the workday, employees will inspect themselves for the presence of ticks. If a tick is discovered, the following procedure should be used to remove it:

- Do not try to detach a tick with bare fingers; bacteria from a crushed tick may be able to penetrate even unbroken skin. Fine-tipped tweezers should be used
- Grip the tick as close to the skin as possible and gently pull it straight away from the skin until it releases its hold
- Do not twist the tick while pulling, and do not squeeze its bloated body. That may actually inject bacteria into the skin
- Thoroughly wash hands and the bite area with soap and water, and apply an antiseptic to the bite area

- Save the tick in a small container and note the date, the body location of the bite, and where the tick came from
- Notify the SSHO of tick bites as soon as possible

Recently, Lyme disease has been the most prevalent type of disease transmitted by ticks in the U.S.

6.2.6 Chiggers

Probably no creature on earth can cause as much torment for its size than the tiny chigger. Tiny six-legged chigger larvae attack campers, picnickers, hikers, bird watchers, berry pickers, fishermen, soldiers, and homeowners in low, damp areas where vegetation is rank such as woodlands, berry patches, orchards, along lakes and streams, and even in drier places where vegetation is low such as lawns, golf courses, and parks. They are most numerous in early summer when grass, weeds and other vegetation are heaviest. Chiggers do not burrow into the skin, but insert their mouthparts in a skin pore or hair follicle. Their bites produce small, reddish welts on the skin accompanied by intense itching as irritating as acute cases of poison ivory or poison sumac. These symptoms often are the only way of learning that an outdoor area is infested since chiggers are so small that most cannot be seen without a magnifying glass. Chiggers feed on a wide variety of snakes, turtles, birds, and small mammals as well as humans.

Prevention Mowing of briars, weeds, and thick vegetation and close clipping of lawns, to eliminate shade and moisture, will reduce chigger populations, and permit sunlight and air to circulate freely. Chigger larvae can penetrate many types of clothing, but high boots and trousers of tightly woven fabric tucked into stockings or boots help deter them. Before going into an area where chiggers may be present, protect yourself by using a repellent such as deet (Off MGK, Muskol, Detamide, Metadelphene, Repel, Diethy-toluamide) or permethrin available at many drugstores or hardware stores. Deet-based repellents are effective for only a few hours, whereas permethrin-based repellents are for use only on clothing and effective for several days. Apply the repellent to both the skin (permethrin should not be sprayed on skin) and clothing, especially on hands, arms, or legs, if uncovered, and to clothing openings at cuffs, neck, waistband, and upper edges of socks. Follow label directions since repellents may damage plastics, nail polish, and painted or varnished surfaces. Do not use indiscriminately as severe human allergies can develop. Keep moving since the worst chigger infestations occur when sitting or laying down in a sunny spot at midday with temperatures above 60 °F. If possible, stick to roads and trails.

6.2.7 Scorpions

Several species of scorpions are found in the south. Only one species, the Bark Scorpion, is regarded as life threatening. The Bark Scorpion may be distinguished from other less toxic species by its more slender tail segments and pincers. Reaching only 1 1/2 inches at maturity, it is a relatively small scorpion. Scorpions are relatively inactive during the daylight hours. The majority of scorpion bites occur at night during warm summer months. The most effective way to prevent scorpion bites is to avoid conducting work at night, visually inspect work areas prior to activities, and protect hands and legs by wearing the proper PPE.

Symptoms Scorpion stings can cause immediate local pain with minimal swelling. Numbness and tingling are frequently reported. The injured area may be hypersensitive to touch, pressure, heat, and cold. Small children are at highest risk, as demonstrated by “roving eye” symptoms and hyperactivity.

Treatment Most scorpion stings can be treated in the field. Clean the bitten area with soap and press a cool compress on the sting. Elevate the stricken limb to the approximate heart level. Take an analgesic to relieve minor pain, as needed. If symptoms are severe, seek immediate medical assistance at an emergency room or urgent care facility.

6.2.8 Venomous Arthropods

Many of the organisms in the phylum Arthropoda can produce venomous bites. The black widow and brown recluse spiders are included in the phylum.

Black Widow Spider

Physical Description The adult female is glossy black with short, almost microscopic hairs. Most female black widow spiders have a crimson hourglass marking on the underside of the abdomen. The spider reaches an overall length of 1 1/2 inches.

Habitat The female spider is found with her web and egg sacs in protected places such as vacant rodent burrows and under stones, logs, long grass, hollow stumps, and brush piles. They are also found in dark corners of barns, stables, garages, and piles of boxes and crates.

Symptoms After the bite, a dull, numbing pain in the affected extremity occurs. Also, pain and some muscular rigidity in the abdomen, back, and chest occur. The bite may also produce pain on inspiration (inhalation), headache, dizziness, skin rash, nausea, vomiting, anxiety, and weakness. Increased skin temperature over the affected area may be observed.

Treatment Ice may be placed over the bite to reduce the pain. Seek immediate medical attention.

Brown Recluse Spider

Physical Description The brown recluse is a spider of medium size (body 10 to 15 mm in length). It is brown in color, and the legs are long and lack unpaired claws.

Habitat This spider is found outdoors under rocks and rubble.

Symptoms After the bite, some localized pain develops within an hour. The bite area becomes swollen and skin temperature increases. The lesion has the appearance of a bull's eye and often becomes larger, ruptures, and leaves an ulcer that may involve underlying tissues, including muscle. Systemic symptoms and signs may develop, including nausea and vomiting.

Treatment. Ice may be placed over the bite to reduce the pain. Seek immediate medical attention.

7.0 PERSONAL PROTECTIVE EQUIPMENT

The purpose of PPE is to provide a barrier, which will shield or isolate individuals from the chemical and/or physical hazards that may be encountered during work activities. S3NA-208-PR PPE Program lists the general requirements for selection and usage of PPE. Table 7-1 lists the minimum PPE required during site operations and additional PPE that may be necessary. The specific PPE requirements for each work task are specified in the individual AHAs found in Attachment A.

By signing this HASP you are agreeing that you have been properly trained in the use, limitations, care and maintenance of the protective equipment you will use at this project. If you have not received training on the proper use, care, and, limitations of the PPE required for this project. Contact the PM or SSHO for the proper training prior to signing this HASP.

Table 7-1: Personal Protective Equipment

TYPE	MATERIAL	ADDITIONAL INFORMATION
Minimum PPE (Level D)		
Safety Vest	ANSI Type II high-visibility	Must have reflective tape/be visible from all sides
Boots	Leather	ANSI approved safety toe
Safety Glasses	Polycarbonate lenses	ANSI Approved; ≥98% UV protection
Hard Hat	High density polyethylene	ANSI Approved; recommended wide-brim
Work Uniform	May be cotton, polyester, rayon (normal clothing components)	No shorts/cutoff jeans or sleeveless shirts
Additional PPE		
Hearing Protection	Ear plugs and/ or muffs	In hazardous noise areas (Noise Reduction Rating of 26 or higher)
Gloves	Leather	If working with sharp objects or powered equipment
Protective Chemical Gloves	Nitrile rubber	Must be PCB resistant
Sunscreen	SPF 30 or higher	

7.1 RESPIRATORY PROTECTION

Respiratory protection, as described below, is required if airborne dust levels in the workers' breathing zone, as measured on the mini-RAM or equivalent dust monitoring method, are sustained above the action limit in Table 7-2. No respiratory protection is thought to be needed for this project at this time.

Table 7-2: Respiratory Protection

TASK	ACTION LIMIT	RESPIRATORY PROTECTION
Tasks producing noticeable airborne dust	5 mg/m^3 for 15 minutes on the mini-RAM	Full Face respirator with (Magenta) HEPA cartridges and Organic Vapor Cartridges

Respiratory protection should also be donned if significant visible airborne dust is being produced during any operations.

All employees who are expected to don respiratory protection must have successfully passed a qualitative or quantitative fit-test within the past year for the brand, model and size respirator. Employees must be clean shaven, must have been trained in respiratory protection, and must have passed their annual medical exam in order to wear a respirator.

7.2 PPE DOFFING AND DONNING INFORMATION

The following information is to provide field personnel with helpful hints that, when applied, make donning and doffing of PPE a more safe and manageable task:

- Never cut disposable booties from your feet with basic utility knives. This has resulted in workers cutting through the booty and the underlying sturdy leather work boot, resulting in significant cuts to the legs/ankles. Recommend using a pair of scissors or a package/letter opener (cut above and parallel with the work boot) to start a cut in the edge of the booty, then proceed by manually tearing the material down to the sole of the booty for easy removal.
- When applying duct tape to PPE interfaces (wrist, lower leg, around respirator, etc.) and zippers, leave approximately one inch at the end of the tape to fold over onto itself. This will make it much easier to remove the tape by providing a small handle to grab while still wearing gloves. Without this fold, trying to pull up the tape end with multiple gloves on may be difficult and result in premature tearing of the PPE.
- Have a “buddy” check your ensemble to ensure proper donning before entering controlled work areas. Without mirrors, the most obvious discrepancies can go unnoticed and may result in a potential exposure situation.
- Never perform personal decontamination with a pressure washer.

7.3 DECONTAMINATION

7.3.1 General Requirements

All possible and necessary steps shall be taken to reduce or minimize contact with chemicals and contaminated/impacted materials while performing field activities (e.g., avoid sitting or leaning on, walking through, dragging equipment through or over, tracking, or splashing potential or known contaminated/impacted materials, etc).

All personal decontamination activities shall be performed with an attendant (“buddy”) to provide assistance to personnel that are performing decontamination activities. Depending on specific site hazards, attendants may be required to wear a level of protection that is equal to the required level in the EZ.

All persons and equipment entering the EZ shall be considered contaminated, and thus, must be properly decontaminated prior to entering the Support Zone (SZ).

Decontamination procedures may vary based on site conditions and nature of the contaminant(s). If chemicals or decontamination solutions are used, care should be taken to minimize reactions between the solutions and contaminated materials. In addition, personnel must assess the potential exposures created by the decontamination chemical(s) or solutions. The applicable SDS must be reviewed, implemented, and filed by personnel contacting the chemicals/solutions.

All contaminated PPE and decontamination materials shall be contained, stored and disposed of in accordance with site-specific requirements determined by site management.

7.3.2 Decontamination Equipment

The equipment required to perform decontamination may vary based on site-specific conditions and the nature of the contaminant(s). The following equipment is commonly used for decontamination purposes:

- Soft-bristle scrub brushes or long-handled brushes to remove contaminants;
- Hoses, buckets of water or garden sprayers for rinsing;
- Large plastic/galvanized wash tubs or children's wading pools for washing and rinsing solutions;

- Large plastic garbage cans or similar containers lined with plastic bags for the storage of contaminated clothing and equipment;
- Metal or plastic cans or drums for the temporary storage of contaminated liquids; and
- Paper or cloth towels for drying protective clothing and equipment.

7.3.2.1 PCB Wipe Sampling Decontamination

In general, decontamination procedures must provide an organized process in which the extent and degree of contamination are systematically reduced. This should include procedures that take into account containment, collection, and disposal of contaminated solutions and residues generated during the incident and cleanup. Separate facilities should be provided for decontamination of large equipment. The EPA's Guide for Decontaminating Buildings, Structures, and Equipment at Superfund Sites provides information for developing a decontamination strategy.

Each stage of decontamination, such as gross decontamination and repetitive wash/rinse cycles, should be conducted separately, either by using different locations or by spacing in time. Access to the decontamination area should be separate from the path between the contaminated and clean areas. Decisions concerning decontamination end points are often based on the lack of visible contamination; however, the absence of observable surface contamination does not necessarily indicate the absence of contaminants absorbed into the material. Reusable clothing and equipment should, therefore, be analyzed for residual contamination before reuse or storage.

Final cleanup methods should include washing surfaces with non-phosphate surfactant in water. Waxed and polished surfaces tend to absorb contaminants from the air. Cleaning with organic solvents is useful for nonporous electrical and mechanical equipment where contact with water-based cleaning fluids may damage the equipment. Organic solvents, such as kerosene, mineral spirits, and trichlorotrifluoroethane, may carry contaminants deeper into porous materials and should not be used on these surfaces.

7.3.3 Personal/Equipment Decontamination

All equipment leaving the EZ shall be considered contaminated and must be properly decontaminated to minimize the potential for exposure and off-site migration of impacted materials. Such equipment may include, but is not limited to: sampling tools, heavy equipment, vehicles, PPE, support devices (e.g., hoses, cylinders, etc.), and various handheld tools.

All employees performing equipment decontamination shall wear the appropriate PPE to protect against exposure to contaminated materials. The level of PPE may be equivalent to the level of PPE required in the EZ. Other PPE may include splash protection, such as face-shields and splash suits, and knee protectors. Following equipment decontamination, employees may be required to follow the proper personal decontamination procedures above.

For larger equipment, a high-pressure washer may need to be used. Some contaminants require the use of a detergent or chemical solution and scrub brushes to ensure proper decontamination.

For smaller equipment, use the following steps for decontamination:

1. Remove majority of visible gross contamination in EZ.
2. Wash equipment in decontamination solution with a scrub brush and/or power wash heavy equipment.
3. Rinse equipment.
4. Visually inspect for remaining contamination.
5. Follow appropriate personal decontamination steps outlined above.

All decontaminated equipment shall be visually inspected for contamination prior to leaving the Contaminant Reduction Zone (CRZ). Signs of visible contamination may include an oily sheen, residue or contaminated soils left on the equipment. All equipment with visible signs of contamination shall be discarded or re-decontaminated until clean. Depending on the nature of the contaminant, equipment may have to be analyzed using a wipe method or other means.

8.0 SITE CONTROL

8.1 GENERAL

The purpose of site control is to minimize potential contamination of workers, protect the public from site hazards, and prevent vandalism. The degree of site control necessary depends on the site characteristics, site size, and the surrounding community.

Controlled work areas will be established at each work location, and if required, will be established directly prior to the work being conducted. Diagrams designating specific controlled work areas will be drawn on-site maps, posted in the support vehicle or trailer and discussed during the daily safety meetings. If the site layout changes, the new areas and their potential hazards will be discussed immediately after the changes are made. General examples of zone layouts have been developed for drilling and earth moving activities (e.g., excavating, trenching, etc.) and are attached to this section.

8.2 CONTROLLED WORK AREAS

Each HAZWOPER controlled work area will consist of the following three zones:

- EZ: Contaminated work area
- CRZ: Decontamination area
- SZ: Uncontaminated or "clean area" where personnel should not be exposed to hazardous conditions

Each zone will be periodically monitored in accordance with the air monitoring requirements established in this HASP. The EZ and the CRZ are considered work areas. The SZ is accessible to the public (e.g., vendors, inspectors).

8.2.1 EZ

The EZ is the area where primary activities occur, such as sampling, remediation operations, installation of wells, cleanup work, etc. This area must be clearly marked with hazard tape, barricades or cones, or enclosed by fences or ropes. Only personnel involved in work activities, and meeting the requirements specified in the applicable AHA and Sections 4.1 and 4.2 will be allowed in an EZ.

The extent of each area will be sufficient to ensure that personnel located at/beyond its boundaries will not be affected in any substantial way by hazards associated with sample collection activities. To meet this requirement, the following minimum distances will be used:

- **Forklift Operations**. A distance of 20 feet in all directions will be cleared from the rig.
- **Soil, PCB Wipe, and Rinsate Sampling**. A distance of 10 feet will be cleared in all directions from the sampling location in order to accommodate additional sampling equipment.

All personnel should be alert to prevent unauthorized, accidental entrance into controlled-access areas (the EZ and CRZ). If such an entry should occur, the trespasser should be immediately escorted outside the area, or all HAZWOPER-related work must cease. All personnel, equipment, and supplies that enter controlled-access areas must be decontaminated or containerized as waste prior to leaving (through the CRZ only).

8.2.2 CRZ

The CRZ is the transition area between the contaminated area and the clean area. Decontamination is the main focus in this area. The decontamination of workers and equipment limits the physical transfer of hazardous substances into the clean area. This area must also be clearly marked with hazard tape and access limited to personnel involved in decontamination. Decontamination procedures are further explained in Section 7.3.

8.2.3 SZ

The SZ is an uncontaminated zone where administrative and other support functions, such as first aid, equipment supply, emergency information, etc., are located. The SZ shall have minimal potential for significant exposure to contaminants (i.e., background levels).

Employees will establish a SZ (if necessary) at the site before the commencement of site activities. The SZ would also serve as the entry point for controlling site access.

8.3 SITE ACCESS DOCUMENTATION

If implemented by the PM, all personnel entering the site shall complete the "Site Entry/Exit Log" located at the site trailer or primary site support vehicle.

8.3.1 Visitor Access

Visitors to any HAZWOPER controlled-work area must comply with the health and safety requirements of this HASP or of the HASP designated by the AFCEC, and demonstrate an acceptable need for entry into the work area. All visitors desiring to enter any controlled work area must observe the following procedures:

1. A written confirmation must be received by AECOM documenting that each of the visitors has received the proper training and medical monitoring required by this HASP, as applicable. Verbal confirmation can be considered acceptable provided such confirmation is made by an officer or other authorized representative of the visitor's organization.
2. Each visitor will be briefed on the hazards associated with the site activities being performed and acknowledge receipt of this briefing by signing the appropriate tailgate safety briefing form.
3. All visitors must be escorted by an AECOM or AFCEC designated employee.

If the site visitor requires entry to any EZ, but does not comply with the above requirements, all work activities within the EZ must be suspended. Until these requirements have been met, entry will not be permitted.

8.4 SITE SECURITY

Site security is necessary to:

- Prevent the exposure of unauthorized, unprotected people to site hazards
- Avoid the increased hazards from vandals or persons seeking to abandon other wastes on the site
- Prevent theft
- Avoid interference with safe working procedures

To maintain site security during working hours:

1. Maintain security in the SZ and at access control points.
2. Establish an identification system to identify authorized persons and limitations to their approved activities.
3. Assign responsibility for enforcing authority for entry and exit requirements.
4. When feasible, install fencing or other physical barrier around the site.
5. If the site is not fenced, post signs around the perimeter and whenever possible, use guards to patrol the perimeter. Guards must be fully apprised of the hazards involved and trained in emergency procedures.
6. Have the PM or Site Supervisor approve all visitors to the site. Make sure they have valid purpose for entering the site. Have trained site personnel accompany visitors at all times and provide them with the appropriate protective equipment.

To maintain site security during off-duty hours:

1. If necessary, assign trained, in-house technicians for site surveillance. They will be familiar with the site, the nature of the work, the site's hazards, and respiratory protection techniques.
2. If necessary, use security guards to patrol the site boundary. Such personnel may be less expensive than trained technicians, but will be more difficult to train in safety procedures and will be less confident in reacting to problems around hazardous substances.
3. If necessary, enlist public enforcement agencies, such as the local police department, if the site presents a significant risk to local health and safety.
4. Secure the equipment.

9.0 EMERGENCY RESPONSE PLANNING

9.1 EMERGENCY ACTION PLAN

Although the potential for an emergency to occur is remote, an emergency action plan has been prepared in accordance with S3NA-603-PR Emergency Response Planning, Field for this project should such critical situations arise. The only significant type of onsite emergency that may occur is physical injury or illness to a member of the AECOM team. The Emergency Action Plan (EAP) will be reviewed by all personnel prior to the start of field activities. A test of the EAP will be performed within the first three days of the project field operations. This test will be evaluated and documented in the project records.

Three major categories of emergencies could occur during site operations:

1. Illnesses and physical injuries (including injury-causing chemical exposure)
2. Catastrophic events (fire, explosion, earthquake, or chemical)
3. Safety equipment problems

9.1.1 Emergency Coordinator

The duties of the emergency coordinator include:

- Implement the EAP based on the identified emergency condition
- Notify the appropriate project and SH&E Department personnel of the emergency (Table 9-3)
- Verify emergency evacuation routes and muster points are accessible
- Conduct routine EAP drills and evaluate compliance with the EAP

9.1.2 Site-Specific Emergency Procedures

Prior to the start of site operations, the emergency coordinator will complete Table 9-1 with any site-specific information regarding evacuations, muster points, communication, and other site-specific emergency procedures.

Table 9-1: Emergency Planning

Emergency	Response Procedures		
	Communications	**Mitigation/Control**	**Evacuation**
Medical Emergency	If life-threatening, **contact 911** immediately and notify site supervisor.	If qualified, perform First Aid-CPR. Keep victim calm and watch for symptoms of shock. Emergency response personnel will transport victims to hospital.	Do not move victim unless imminent threat (e.g., fire, explosion, chemical exposure, etc.) is present.
Chemical Exposure	Report incident to site supervisor immediately.	Refer to chemical safety card or SDS for appropriate treatment measures.	Remove individual from danger area.
Other Incident/Near Miss	Report incident to site supervisor immediately. Site supervisor will contact safety department.	For non-life threatening injuries or illness, transport victim to the hospital listed in Figure 9-1.	None anticipated
Severe Weather	Site supervisor will notify personnel via radio when severe weather is approaching or use the following signal:	Allow sufficient time for decontamination and shut down of operations.	If severe weather is imminent, evacuate to the following shelter(s):
Tornado	Site supervisor will notify personnel via radio if severe weather may result in tornado activity **or use the following signal:**	Allow sufficient time for decontamination and shut down of operations.	**Tornado shelter location(s):**
Small Fire *Less than the size of a small trash can*	Notify site supervisor to **contact 911** immediately. **Notify all personnel evacuate or use the following signal:**	Determine if fire can be safely contained with a fire extinguisher.	See evacuation route map(s). **Exit facility and muster at the following location(s):**
Large Fire/Explosion	Notify site supervisor to **contact 911** immediately. **Notify all personnel to evacuate or use the following signal:**	None anticipated. Evacuate immediately.	See evacuation route map(s). **Exit facility and muster at the following location(s):**
Spills/Release	Notify site supervisor. Site supervisor will contact OSC and determine if additional agencies must be notified.	Don Level B PPE (see HASP). Complete THA. Use spill kit and diking procedures to contain spill.	See evacuation route map(s). Exit facility and move upwind at least 1000 feet.
Security Threat	Notify site supervisor. **Contact 911**.	Keep vehicles locked and valuables out of sight.	None anticipated.
Confined Space Emergency	See Permit.	See Permit.	See Permit.

9.1.3 Spill Containment Procedure

Work activities may involve the use of hazardous materials (i.e., fuels, solvents) or work involving drums or other containers. Where these activities exist, a Site-Specific Spill Reporting Card will be developed. Procedures in S3NA-520-PR Spill Response, Incidental as well as those outlined below will be used to prevent or contain spills:

- All hazardous material will be stored in appropriate containers
- Tops/lids will be placed back on containers after use
- Containers of hazardous materials will be stored appropriately away from moving equipment

At least one spill response kit, to include an appropriate empty container, materials to allow for booming or diking the area to minimize the size of the spill, and appropriate clean-up material (i.e. speedy dri) shall be available at each work site (more as needed)

- All hazardous commodities in use (i.e., fuels) shall be properly labeled
- Containers shall only be lifted using equipment specifically manufactured for that purpose
- For drums/containers, follow the procedures in S3NA-308-PR, Manual Lifting, Field, to minimize spillage

9.1.4 Safety Accident/Incident Reporting

All accidents and incidents that occur on-site during any field activity will be promptly reported to the SSHO and the immediate supervisor in accordance with S3NA-004-PR Incident Reporting.

If any AECOM employee is injured and requires medical treatment, the Site Supervisor will contact the **Regional Safety Manager, AECOM's Incident Reporting Line at (800) 348-5046, and the applicable Account Manager immediately**. The Site Supervisor will initiate a written report, using the ***Supervisor's Report of Incident*** form (see SH&E 004-PR). The Site Supervisor will complete the first two sections of this form and forward to the PM for completion of Section 3. The report will then be provided to the SH&E Professional before the end of the following shift.

If any employee of a subcontractor is injured, documentation of the incident will be accomplished in accordance with the subcontractor's procedures; however, copies of all documentation (which at a minimum must include the OSHA Form 301 or equivalent) must be provided to the SSHO within 24 hours after the accident has occurred.

All accidents/incidents will be investigated in accordance with S3NA-603-PR, Incident Investigation and Review. Copies of all subcontractor accident investigations, whether accomplished in accordance with their own procedures or S3NA-603, will be provided to the SSHO within five days of the accident/incident.

9.1.5 Environmental Spill/Release Reporting

All environmental spills or releases of hazardous materials (e.g., fuels, solvents, etc.), whether in excess of the Reportable Quantity or not, will be reported according to the sequence identified in the *Site-Specific Spill Reporting Card*. In determining whether a spill or release must be reported to a regulatory agency, the Site Supervisor will assess the quantity of the spill or release and evaluate the reporting criteria against the state-specific reporting requirements, your applicable regulatory permit, and/or client-specific reporting procedures. In order to support the Site Supervisor and expedite the decision to report to a state regulatory agency, a Site-Specific Spill Reporting Card will be developed (Attachment D). **If reporting to a state or Federal regulatory agency is required, AECOM has 15 minutes from the time of the spill/release to officially report it. Coordinate with client first.**

Chemical-specific CERCLA Reportable Quantities for the acknowledged chemicals onsite are shown in Table 9-2.

Table 9-2: CERCLA Reportable Quantities

Hazardous Substance	Regulatory Synonyms	Final Reportable Quantity (pounds)
Mercury	N/A	1
Lead	N/A	10
Chromium	N/A	5,000
Cadmium	N/A	10
Methylene Chloride	N/A	1,000
Sodium Cyanide	N/A	10
Polychlorinated Biphenyls	PCBs	1
Hexane	N/A	5,000

CERCLA Reportable Quantities can be found at: http://www.epa.gov/oem/docs/er/302table01.pdf

Table 9-3: Emergency Contacts

Name	Title/Workstation	Telephone Number	Mobile Phone
John Hamann	Hazardous Waste Manager, USAF ACC 49 CES/CEAN	(575) 572-6655	
Mark Phillips	DLA, Holloman CSU Facility POC	(575) 572-7860	
Kent Rohlof	AFCEC Project Manager/COR	(210) 395-8665	
Josh Miller	AECOM, Project Manager	(210) 253-7517	(972) 922-9974
Raymond Castillo	AECOM, Site Supervisor/Site Safety Officer	(210) 253-7530	(210) 724-3118
Dan Schillings	AECOM, District Safety Manager	(210) 253-7567	(210) 601-4129
Nash Doyle	AECOM, Regional SH&E Manager	(312) 373-7813	(312) 593-8489
Incident Reporting	**Incident Reporting Line**	**(800) 348-5046**	
Eric Olson	DOT/IATA Shipping Expert	(864) 906-7309	(864) 297-3102

Organization / Agency	
Name	**Telephone Number**
Holloman Police Department/Non Emergency	911
Holloman Fire Department	911
State Police	911
Ambulance Service; ***(EMT will determine appropriate hospital for treatment)***	911
Non-Emergency Clinic ***(Use by site personnel is only for non-emergency cases)***	
Concentra Medical Center 2170 E. Lohman Ave., Suite C Las Cruces, NM 88001	(505) 524-8888
Non-Emergency Clinic Route: See Figure 9-1, Hospital See Figure 9-2	
WorkCare: 24-hr On-Call Occupational Nurse (*Non-Emergency assistance only*, ***call SH&E first***)	(800) 455-6155
Poison Control Center	(800) 222-1222
Pollution Emergency	(800) 292-4706
National Response Center	(800) 424-8802
Info-Trac: 24-hr Response Services– *Account # 74984*	(800) 535-5053
Tier II or SARA Title III Hot Line	(800) 424-9346

Public Utilities	
Name	**Telephone Number**
Common Ground Alliance Nationwide *Call Before You Dig*	811

Legend

- Non Emergency Driving Route
- Holloman AFB
- Concentra Medical Center

Address:

Concentra Medical Center
2170 E. Lohman Ave., Suite C
Las Cruces, NM 88001
(505) 524-8888

Driving Directions:

1. Left on US-82E
   7.4 miles.
2. Take US-54N
   this turns into North White Sands Blvd
   4.9 miles
3. Turn right onto North Scenic Drive
   2.1 miles

7 0 7 Miles

U.S. AIR FORCE

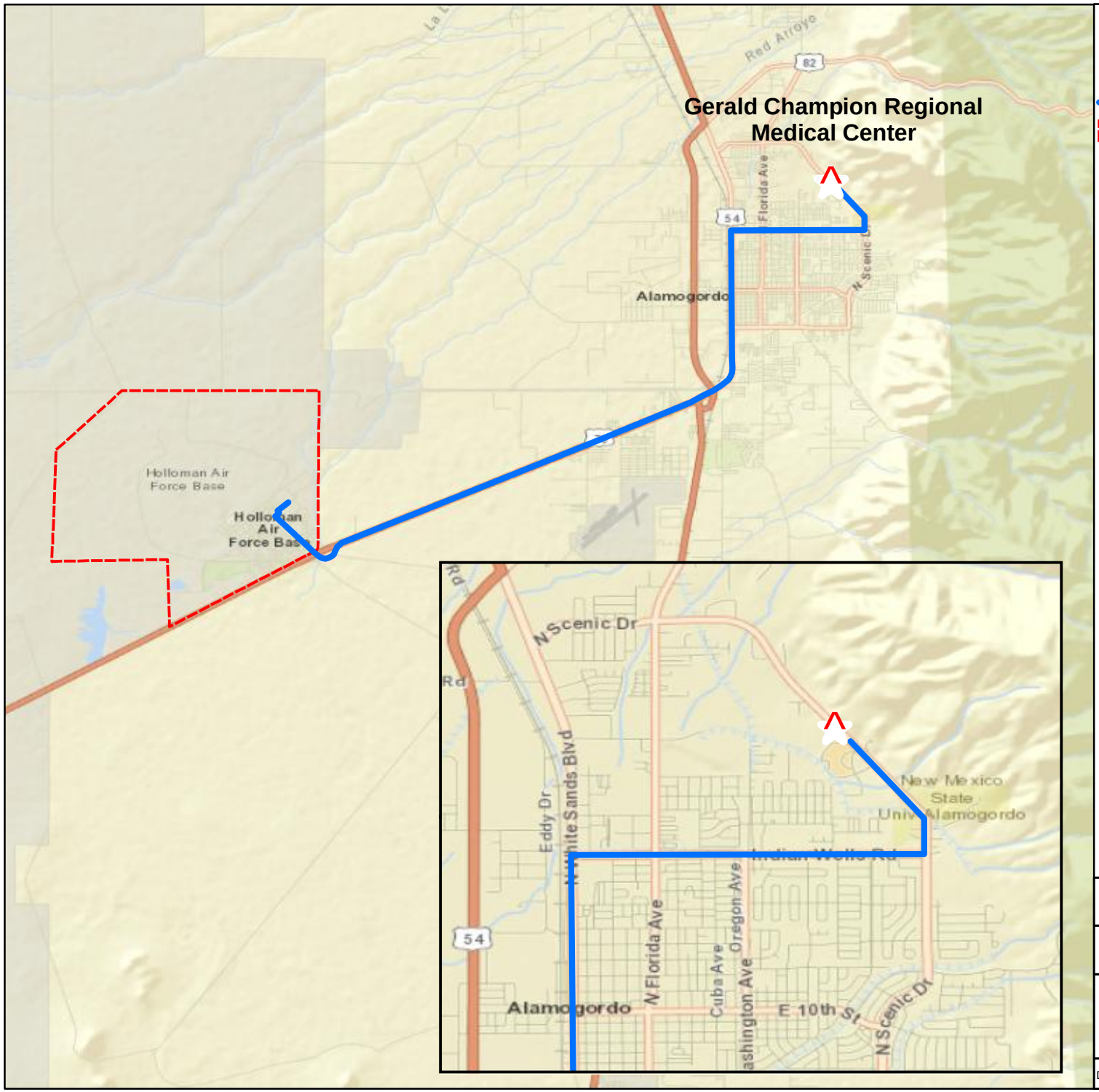
RCRA Facility Closure

Non Emergency Hospital Driving Directions

AECOM

AECOM Technical Services, Inc.
112 East Pecan, Suite 400
San Antonio, TX 78205
www.aecom.com
TBPE Reg. No. F-3580

Date	October 2013	Project	60304917	Figure	9-1



Legend

- Gerald Champion Regional Medical Center
- Emergency Driving Route
- Holloman AFB

Address:

Gerald Champion Regional Medical Center
2669 North Scenic Drive
Alamogordo, NM 88330
(505) 439-6100

Driving Directions:

1. Start out goig WEST on US-70 W/US-82 W. 54.8 miles.
2. Merge onto I-25 S toward EL PASO 2.8 miles
3. Take the LOHMAN AVENUE exit- EXIT 3. 0.2 miles
4. Turn RIGHT onto NM-342 W/E LOHMAN AVE. 0.4 miles
5. Make a U-TURN at S WALNUT ST. onto NM-342 E/E LOHMAN AVE. <0.1 miles
6. End at 2170 E LOHMAN AVE.

2.5 0 2.5 Miles

U.S. AIR FORCE

RCRA Facility Closure

Emergency Hospital Driving Directions

AECOM

AECOM Technical Services, Inc.
112 East Pecan, Suite 400
San Antonio, TX 78205
www.aecom.com
TBPE Reg. No. F-3580

Date	October 2013	Project	60304917	Figure	9-2

10.0 PERSONNEL ACKNOWLEDGEMENT

By signing below, the undersigned acknowledges that he/she has read and reviewed the AECOM Health and Safety Plan for Holloman AFB. The undersigned also acknowledges that he/she has been instructed in the contents of this document and understands the information pertaining to the specified work, and will comply with the provisions contained therein.

PRINT NAME	SIGNATURE	ORGANIZATION	DATE

Attachment A: Activity Hazard Analyses

S3NA-209-FM TASK HAZARD ANALYSIS

AECOM	Project Name: RCRA FACILITY CLOSURE	Project Number: 60304917	Client: AFCEC
	Supervisor: Raymond Castillo	Project Manager: Josh Miller	Location: Holloman AFB, NM
	AHA Developed By: Dan Schillings		Date: Oct 2013 thru Oct 2014
ACTIVITY HAZARD ANALYSIS	Task Name: Hand Auger Sampling		Regularity of Task: One-time ☐ Routine ☑

	Job Event Sequence (List the major steps of the individual task)	Hazards (List primary hazards)	Hazard Classification (before controls) Severity	Likelihood	Risk Level	Hazard Classification	Controls (List controls that AECOM will implement)
1	Tail gate safety briefing,inspect equipment	None	1	1	1	Low	Standard PPE ensemble; training, meters, equipment
2	Determine sampling area	Slips, trips, falls, biological	1	1	1	Low	Standard PPE ensemble; training
3	Verify subsurface utility clearances were completed	Slips, trips, falls, biological	2	2	4	Low	Standard PPE ensemble; training
4	Assembel sample collection media, tools and supplies	Slips,trips,falls,cuts,lifting,pinch points	3	4	12	Medium	Standard PPE ensemble; training, meters, equipment
5	Don appropriate PPE	None	3	4	12	Medium	Standard PPE ensemble; training
6	Correct any equipment deficiencies	Slips,trips,falls,cuts,lifting,pinch points	3	4	12	Medium	Standard PPE ensemble; training, meters, equipment
7	Position had auger in front of you and establish footing	Slips,trips,falls,cuts,lifting,pinch points	3	4	12	Medium	Standard PPE ensemble; training, meters, equipment
8	Position hand auger into soil and slowly turn	Slips,trips,falls,cuts,lifting,bio	2	3	6	Medium	Standard PPE ensemble; training, meters, equipment
9	Remove hand auger from ground & set on plastic sheeting	Slips,trips,falls,cuts,lifting,bio	3	4	12	Medium	Standard PPE ensemble; training, meters, equipment
10	Use hand trowel to collect soil at bottom of hole, record depth	Slips,trips,falls,cuts,lifting,pinch points	3	4	12	Medium	Standard PPE ensemble; training, meters, equipment
11	Place soil sample(s) with hand trowel into sample media & seal	Slips,trips,falls,cuts,lifting,pinch points	2	3	6	Medium	Standard PPE ensemble; training, meters, equipment
12	Decontaminate sampling tools and impervious supplies	Slips, trips, falls, biological	2	2	4	Low	Standard PPE ensemble; training, meters, equipment
13	Collect IDW for characterization & disposal determination	Slips,trips,falls,cuts,lifting,pinch points	2	2	4	Low	Standard PPE ensemble; training, meters, equipment
14	Prepare samples for shipment to designated laboratory	Slips,trips,falls,cuts,lifting,pinch points	2	2	4	Low	Standard PPE ensemble; training
15							
16							
17							

Hazard Classification Guidelines

Severity

1 Remote potential for injury, property damage/$ loss, or env damage

2 Potential for minor first aid injury, property damage/$ loss, or environmental damage

3 Potential for moderate personnel injuries, including medical treatment, property damage/$ loss, environmental damage, or negative public impact

4 Potential for a serious injury, major property damage/$ loss, serious impact to the environment, and public health

5 Catastrophic damage to people, property/equipment, environment, or public health

Likelihood of Occurrence

1 Very unlikely

2 Unlikely

3 Likely

4 Very likely

5 Certain

Hazard Classification Matrix

Likelihood \ Severity	1	2	3	4	5
1	1	2	3	4	5
2	2	4	6	8	10
3	3	6	9	12	15
4	4	8	12	16	20
5	5	10	15	20	25

Risk Level
Low
Medium
High

Risk Level = Likelihood x Severity

S3NA-209-FM TASK HAZARD ANALYSIS

AECOM	Project Name: RCRA FACILITY CLOSURE	Project Number: 60304917	Client: AFCEC
	Supervisor: Raymond Castillo	Project Manager: Josh Miller	Location: Holloman AFB, NM
	AHA Developed By: Dan Schillings		Date: Oct 2013 thru Oct 2014

SUMMARY OF CONTROLS	Task Name: Hand Auger Sampling	Regularity of Task: One-time ☐ Routine ☑

Personal Protective Equipment (*check all that apply*)

- ☑ CSA/ANSI Safety-Toed Boots (Leather or Rubber)
- ☑ CSA/ANSI Safety Glasses or Goggles
- ☑ CSA/ANSI-approved Hard Hat
- ☑ CSA/ANSI Type II/III Reflective Traffic Safety Vest
- ☑ Leather Gloves/Nitrile Gloves for Sampling
- ☑ Hearing Protection
- ☐
- ☐
- ☐
- ☐

Air Monitoring (reference HASP monitoring plan)

☑ No air monitoring required ☐ Air monitoring required (*see procedures below*)

Parameter	Location/Monitoring Interval	Response/Action Levels	Response Activity

Required Training (associated with this THA)	Key SOPs (associated with this THA)		Client & Other Requirements
1 Tool specific training	S3NA-308-PR Manual Lifting, Field		HAZWOPER, DOT Level 1 Shipping Course, Safeland Training
2 Equipment specific training	S3NA-307-PR Housekeeping, Worksite		
3	S3NA-405-PR Drilling and Boring		
4	S3NA-417-PR Utilities, Underground		
5	S3NA-517-PR Radiation, Non-Ionizing		
6	S3NA-520-PR Spill Response, Incidental		

Acknowledgement / Signatures

Project Manager / Supervisor (signature): Date:

Name	Signature	Company	Date	Name	Signature	Company	Date

S3NA-209-FM TASK HAZARD ANALYSIS

AECOM	Project Name: RCRA FACILITY CLOSURE	Project Number: 60304917	Client: AFCEC
	Supervisor: Raymond Castillo	Project Manager: Josh Miller	Location: Holloman AFB, NM
	AHA Developed By: Dan Schillings		Date: Oct 2013 thru Oct 2014
EMERGENCY RESPONSE PLAN	Task Name: Hand Auger Sampling	Regularity of Task: One-time ☐ Routine ☑	

Check-in Procedures

Check-in Times	Check-in Person	Phone Number	Cell Phone Number
8:00 am & 5:00 pm	Raymond Castillo	(210) 253-7520	(210) 724-3118
Alternate:			

Emergency Coordinators / Key Personnel

Name	Title	Phone Number	Cell Phone Number
Raymond Castillo	On-site First Aid Attendant	(210) 253-7520	(210) 724-3118
Mark Phillips	Client POC	(575) 572-7860	
Josh Miller	Project Manager	(210) 253-7517	(972) 922-9974
Raymond Castillo	Site Supervisor/Site Safety Officer	(210) 253-7520	(210) 724-3118
Nash Doyle	Regional SH&E Manager	(312) 373-7813	(312) 593-8489
Dan Schillings	District SH&E Manager	(210) 253-7567	(210) 601-4129
	Incident Reporting Line (BY THE END OF THE SHIFT)	1.800.348.5046	
Eric Olson	DOT/IATA Shipping Expert	(864) 297-3102	(303) 694-4410

Emergency Agencies / Public Utilities

Name	Type	Details	Phone Number
Holloman AFB	Police		911
Holloman AFB	Fire		911
Holloman AFB	Ambulance		911
Gerald Champion Regional Medical Center	Nearest Hospital / Clinic	2669 North Scenic Drive, Alamogordo, NM	575.439.6100
	Poison Control Center		800.222.1222
	Pollution / Environmental		800.292.4706
	INFOTRAC *(AECOM's Account # 74984)*		800.535.5053
	Tier II or SARA Title III Hot Line		800.424.9346

Emergency Equipment & Supplies

- ☑ First Aid Kit - Type:
- ☐ Blankets / Survival:
- ☑ Fire Extinguishers Type:
- ☑ Communication Device
- ☑ Vehicle Safety Equipment
- ☑ Eye Wash
- ☐ Spill Kit
- ☐ Other:

Other Emergency Plan Details

Concentra
2170 E. Lohman Ave., Suite C
Las Cruces, NM 88001
(505) 524-8888

S3NA-209-FM TASK HAZARD ANALYSIS

AECOM	Project Name: RCRA FACILITY CLOSURE	Project Number: 60304917	Client: AFCEC
	Supervisor: Raymond Castillo	Project Manager: Josh Miller	Location: Holloman AFB, NM
	AHA Developed By: Dan Schillings		Date: Oct 2013 thru Oct 2014
ACTIVITY HAZARD ANALYSIS	Task Name: High Pressure Washer Operations		Regularity of Task: One-time ☐ Routine ☑

	Job Event Sequence (List the major steps of the individual task)	Hazards (List primary hazards)	Hazard Classification (before controls) Severity	Likelihood	Risk Level	Hazard Classification	Controls (List controls that AECOM will implement)
1	Tailgate safety meeting	None	1	1	1	Low	Standard PPE ensemble; training
2	Pre-op inspection of equipment	Slips,trips,falls,cuts,lifting,pinch points	1	1	1	Low	Standard PPE ensemble; training
3	Inspect and don appropriate PPE	None	2	2	4	Low	Standard PPE ensemble; training
4	Start pressure washer, clean surfaces	Slips,trips,falls, noise, overspray	3	4	12	Medium	Standard PPE ensemble; training, equipment
5	Shut off and allow engine to cool	Slips,trips,falls, biological, cuts	3	4	12	Medium	Standard PPE ensemble; training, equipment
6	Fil fuel tank to 1/2" below bottom of filler neck	Slips,trips,fall,bio,gasoline	3	3	9	Medium	Standard PPE ensemble; training, ground metal gas can
7	Wipe us spilled fuel before restarting engine	Skin exposure to fuels, heat	2	2	4	Low	Standard PPE ensemble; training, equipment
8	Stop work before dark to clean up the work area	Slips,trips,falls,bio,lifting,pinch points	2	2	4	Low	Standard PPE ensemble; training
9							
10							
11							
12							
13							
14							
15							
16							
17							

Hazard Classification Guidelines

Severity

1 Remote potential for injury, property damage/$ loss, or env damage

2 Potential for minor first aid injury, property damage/$ loss, or environmental damage

3 Potential for moderate personnel injuries, including medical treatment, property damage/$ loss, environmental damage, or negative public impact

4 Potential for a serious injury, major property damage/$ loss, serious impact to the environment, and public health

5 Catastrophic damage to people, property/equipment, environment, or public health

Likelihood of Occurrence

1 Very unlikely

2 Unlikely

3 Likely

4 Very likely

5 Certain

Hazard Classification Matrix

Likelihood \ Severity	1	2	3	4	5
1	1	2	3	4	5
2	2	4	6	8	10
3	3	6	9	12	15
4	4	8	12	16	20
5	5	10	15	20	25

Risk Level
Low
Medium
High

Risk Level = Likelihood x Severity

S3NA-209-FM TASK HAZARD ANALYSIS

AECOM	Project Name: RCRA FACILITY CLOSURE	Project Number: 60304917	Client: AFCEC
	Supervisor: Raymond Castillo	Project Manager: Josh Miller	Location: Holloman AFB, NM
	AHA Developed By: Dan Schillings		Date: Oct 2013 thru Oct 2014
SUMMARY OF CONTROLS	Task Name: High Pressure Washer Operations		Regularity of Task: One-time ☐ Routine ☑

Personal Protective Equipment (*check all that apply*)	
☑	CSA/ANSI Safety-Toed Boots (Leather or Rubber)
☑	CSA/ANSI Safety Glasses or Goggles
☑	CSA/ANSI-approved Hard Hat
☑	CSA/ANSI Type II/III Reflective Traffic Safety Vest
☑	Leather Gloves
☑	Hearing Protection (where required)
☑	Face shield, apron, butyl rubber gloves
☐	
☐	
☐	

Air Monitoring (reference HASP monitoring plan)

☑ No air monitoring required ☐ Air monitoring required (*see procedures below*)

Parameter	Location/Monitoring Interval	Response/Action Levels	Response Activity

Required Training (associated with this THA)	Key SOPs (associated with this THA)		Client & Other Requirements
1 Tool specific training	S3NA-305-PR Hand and Power Tools	S3NA-517-PR Radiation, Non-Ionizing	Qualified equipment operators
2 Equipment specific training	S3NA-307-PR Housekeeping, Worksite		
3	S3NA-308-PR Manual Lifting, Field		
4	S3NA-309-PR Mobile or Heavy Equipment		
5	S3NA-510-PR Hearing Conservation Program		
6	S3NA-511-PR Heat Stress Prevention		

Acknowledgement / Signatures

Project Manager / Supervisor (signature): Date:

Name	Signature	Company	Date	Name	Signature	Company	Date

S3NA-209-FM TASK HAZARD ANALYSIS

AECOM	Project Name: RCRA FACILITY CLOSURE	Project Number: 60304917	Client: AFCEC
	Supervisor: Raymond Castillo	Project Manager: Josh Miller	Location: Holloman AFB, NM
	AHA Developed By: Dan Schillings		Date: Oct 2013 thru Oct 2014
EMERGENCY RESPONSE PLAN	Task Name: High Pressure Washer Operations	Regularity of Task: One-time ☐ Routine ☑	

Check-in Procedures

Check-in Times	Check-in Person	Phone Number	Cell Phone Number
8:00 am & 5:00 pm	Raymond Castillo	(210) 253-7520	(210) 724-3118
Alternate:			

Emergency Coordinators / Key Personnel

Name	Title	Phone Number	Cell Phone Number
Raymond Castillo	On-site First Aid Attendant	(210) 253-7520	(210) 724-3118
Mark Phillips	Client POC	(575) 572-7860	
Josh Miller	Project Manager	(210) 253-7517	(972) 922-9974
Raymond Castillo	Site Supervisor/Site Safety Officer	(210) 253-7520	(210) 724-3118
Nash Doyle	Regional SH&E Manager	(312) 373-7813	(312) 593-8489
Dan Schillings	District SH&E Manager	(210) 253-7567	(210) 601-4129
	Incident Reporting Line (BY THE END OF THE SHIFT)	1.800.348.5046	
Eric Olson	DOT/IATA Shipping Expert	(864) 297-3102	(303) 694-4410

Emergency Agencies / Public Utilities

Name	Type	Details	Phone Number
Holloman AFB	Police		911
Holloman AFB	Fire		911
Holloman AFB	Ambulance		911
Gerald Champion Regional Medical Center	Nearest Hospital / Clinic	2669 North Scenic Drive, Alamogordo, NM	575.439.6100
	Poison Control Center		800.222.1222
	Pollution / Environmental		800.292.4706
	INFOTRAC *(AECOM's Account # 74984)*		800.535.5053
	Tier II or SARA Title III Hot Line		800.424.9346

Emergency Equipment & Supplies

- ☑ First Aid Kit - Type:
- ☐ Blankets / Survival:
- ☑ Fire Extinguishers Type:
- ☑ Communication Device
- ☑ Vehicle Safety Equipment
- ☑ Eye Wash
- ☐ Spill Kit
- ☐ Other:

Other Emergency Plan Details

Concentra
2170 E. Lohman Ave., Suite C
Las Cruces, NM 88001
(505) 524-8888

S3NA-209-FM TASK HAZARD ANALYSIS

AECOM	Project Name: RCRA FACILITY CLOSURE	Project Number: 60304917	Client: AFCEC
	Supervisor: Raymond Castillo	Project Manager: Josh Miller	Location: Holloman AFB, NM
	AHA Developed By: Dan Schillings		Date: Oct 2013 thru Oct 2014
ACTIVITY HAZARD ANALYSIS	Task Name: Mob and Demob	Regularity of Task: One-time ☐ Routine ☑	

	Job Event Sequence (List the major steps of the individual task)	Hazards (List primary hazards)	Hazard Classification (before controls) Severity	Likelihood	Risk Level	Hazard Classification	Controls (List controls that AECOM will implement)
1	Tail gate safety briefing, Inspect equipment	None	1	1	1	Low	
2	Go over equipment safety cards where applicable	None	1	1	1	Low	
3	Brief and follow local safety criteria for the site visiting	None	1	1	1	Low	
4	All loads in excess of 49 pounds require use of mechanical	None	1	1	1	Low	Obtain correct equipment to assist or additional personnel
5	aids or assistance from other personnel.	None	1	1	1	Low	
6	Use spotters when loading/unloading heavy equipment,	None	1	1	1	Low	Safety cones, additional personnel
7	forklifts, etc. Stand clear of these operations.	None	1	1	1	Low	
8	Do not enter tank, vats, sumps, holes, or other potential	None	1	1	1	Low	Permits, training, evaluations
9	confined spaces without a Confined Space Entry Procedure,	None	1	1	1	Low	
10	Hazard Evaluation, and Permit completed.	None	1	1	1	Low	
11	Ensure all project supplies are suitable for transportation.	None	1	1	1	Low	Is equipment too sensitive for transport
12	Ensure that equipment, materials, chemicals, etc. have been	None	1	1	1	Low	Pretrip evaluation checklist, tie downs
13	secured for transportation	None	1	1	1	Low	
14	DO NOT overload trucks, trailers, etc. If more room is needed,	None	1	1	1	Low	GVWR
15	or loads are to large, obtain additional transportation.	None	1	1	1	Low	
16	Inspect Equipment / complete equip. inspection forms	None	1	1	1	Low	
17	Correct any deficiency	None	1	1	1	Low	

Hazard Classification Guidelines

Severity

1 Remote potential for injury, property damage/$ loss, or env damage

2 Potential for minor first aid injury, property damage/$ loss, or environmental damage

3 Potential for moderate personnel injuries, including medical treatment, property damage/$ loss, environmental damage, or negative public impact

4 Potential for a serious injury, major property damage/$ loss, serious impact to the environment, and public health

5 Catastrophic damage to people, property/equipment, environment, or public health

Likelihood of Occurrence

1 Very unlikely

2 Unlikely

3 Likely

4 Very likely

5 Certain

Hazard Classification Matrix

Likelihood \ Severity	1	2	3	4	5
1	1	2	3	4	5
2	2	4	6	8	10
3	3	6	9	12	15
4	4	8	12	16	20
5	5	10	15	20	25

Risk Level
Low
Medium
High

Risk Level = Likelihood x Severity

S3NA-209-FM TASK HAZARD ANALYSIS

AECOM	Project Name: RCRA FACILITY CLOSURE	Project Number: 60304917	Client: AFCEC
	Supervisor: Raymond Castillo	Project Manager: Josh Miller	Location: Holloman AFB, NM
	AHA Developed By: Dan Schillings		Date: Oct 2013 thru Oct 2014
SUMMARY OF CONTROLS	Task Name: Mob and Demob		Regularity of Task: One-time ☐ Routine ☑

Personal Protective Equipment (*check all that apply*)

- ☑ CSA/ANSI Safety-Toed Boots (Leather or Rubber)
- ☑ CSA/ANSI Safety Glasses or Goggles
- ☐ CSA/ANSI-approved Hard Hat
- ☑ CSA/ANSI Type II/III Reflective Traffic Safety Vest
- ☑ Leather Glover
- ☐ Hearing Protection
- ☐
- ☐
- ☐
- ☐

Air Monitoring (reference HASP monitoring plan)

☑ No air monitoring required ☐ Air monitoring required (*see procedures below*)

Parameter	Location/Monitoring Interval	Response/Action Levels	Response Activity

Required Training (associated with this THA)	Key SOPs (associated with this THA)		Client & Other Requirements
1 Tool specific training	S3NA-305-PR Hand and Power Tools		
2	S3NA-308-PR Manual Lifting, Field		
3			
4			
5			
6			

Acknowledgement / Signatures

Project Manager / Supervisor (signature): Date:

Name	Signature	Company	Date	Name	Signature	Company	Date

S3NA-209-FM TASK HAZARD ANALYSIS

AECOM	Project Name: RCRA FACILITY CLOSURE	Project Number: 60304917	Client: AFCEC
	Supervisor: Raymond Castillo	Project Manager: Josh Miller	Location: Holloman AFB, NM
	AHA Developed By: Dan Schillings		Date: Oct 2013 thru Oct 2014
EMERGENCY RESPONSE PLAN	Task Name: Mob and Demob	Regularity of Task: One-time ☐ Routine ☑	

Check-in Procedures

Check-in Times	Check-in Person	Phone Number	Cell Phone Number
8:00 am & 5:00 pm	Raymond Castillo	(210) 253-7520	(210) 724-3118
Alternate:			

Emergency Coordinators / Key Personnel

Name	Title	Phone Number	Cell Phone Number
Raymond Castillo	On-site First Aid Attendant	(210) 253-7520	(210) 724-3118
Mark Phillips	Client POC	(575) 572-7860	
Josh Miller	Project Manager	(210) 253-7517	(972) 922-9974
Raymond Castillo	Site Supervisor/Site Safety Officer	(210) 253-7520	(210) 724-3118
Nash Doyle	Regional SH&E Manager	(312) 373-7813	(312) 593-8489
Dan Schillings	District SH&E Manager	(210) 253-7567	(210) 601-4129
	Incident Reporting Line (BY THE END OF THE SHIFT)	1.800.348.5046	
Eric Olson	DOT/IATA Shipping Expert	(864) 297-3102	(303) 694-4410

Emergency Agencies / Public Utilities

Name	Type	Details	Phone Number
Holloman AFB	Police		911
Holloman AFB	Fire		911
Holloman AFB	Ambulance		911
Gerald Champion Regional Medical Center	Nearest Hospital / Clinic	2669 North Scenic Drive, Alamogordo, NM	575.439.6100
	Poison Control Center		800.222.1222
	Pollution / Environmental		800.292.4706
	INFOTRAC *(AECOM's Account # 74984)*		800.535.5053
	Tier II or SARA Title III Hot Line		800.424.9346

Emergency Equipment & Supplies

- ☑ First Aid Kit - Type:
- ☐ Blankets / Survival:
- ☑ Fire Extinguishers Type:
- ☑ Communication Device
- ☑ Vehicle Safety Equipment
- ☑ Eye Wash
- ☐ Spill Kit
- ☐ Other:

Other Emergency Plan Details

Concentra
2170 E. Lohman Ave., Suite C
Las Cruces, NM 88001
(505) 524-8888

S3NA-209-FM TASK HAZARD ANALYSIS

AECOM	Project Name: RCRA FACILITY CLOSURE	Project Number: 60304917	Client: AFCEC
	Supervisor: Raymond Castillo	Project Manager: Josh Miller	Location: Holloman AFB, NM
	AHA Developed By: Dan Schillings		Date: Oct 2013 thru Oct 2014
ACTIVITY HAZARD ANALYSIS	Task Name: Soil Sampling	Regularity of Task: One-time ☐ Routine ☑	

	Job Event Sequence (List the major steps of the individual task)	Hazards (List primary hazards)	Hazard Classification (before controls) Severity	Likelihood	Risk Level	Hazard Classification	Controls (List controls that AECOM will implement)
1	Tail gate safety briefing, Inspect equipment	None	1	1	1	Low	Standard PPE ensemble; training, meters, equipment
2	Brief and follow local safety criteria for the site visiting	None	1	1	1	Low	Standard PPE ensemble; training
3	Determine sampling locations to characterize sediments/soils	Biological	2	3	6	Medium	Standard PPE ensemble; training, meters, equipment
4	Ensure sample collection media, tools/supplies are available	None	1	1	1	Low	Standard PPE ensemble; training, meters, equipment
5	Don appropriate PPE (after visual inspection)	None	1	1	1	Low	Standard PPE ensemble; training, meters, equipment
6	Collect sediment/soil samples, log points & measurements	Slips, trips and falls, falling in lagoon	3	4	12	Medium	Standard PPE ensemble; training, meters, equipment
7	Decontaminate sampling tools and impervious supplies	Splash	2	3	6	Medium	Standard PPE ensemble; training, meters, equipment
8	Dispose of task related waste, i.e., rinsate, Tyvek ☐ suit,	Splash	2	3	6	Medium	Standard PPE ensemble; training, meters, equipment
9	leather/nitrile gloves, etc. (IDW)				0		
10	Prepare samples for shipping to designated laboratory	None	1	1	1	Low	Standard PPE ensemble; training, meters, equipment
11	(DOT Level I qualified & verify with DOT Level II Shipper)				0		
12					0		
13					0		
14					0		
15					0		
16					0		
17					0		

Hazard Classification Guidelines

Severity

1 Remote potential for injury, property damage/$ loss, or env damage

2 Potential for minor first aid injury, property damage/$ loss, or environmental damage

3 Potential for moderate personnel injuries, including medical treatment, property damage/$ loss, environmental damage, or negative public impact

4 Potential for a serious injury, major property damage/$ loss, serious impact to the environment, and public health

5 Catastrophic damage to people, property/equipment, environment, or public health

Likelihood of Occurrence

1 Very unlikely

2 Unlikely

3 Likely

4 Very likely

5 Certain

Hazard Classification Matrix

Likelihood \ Severity	1	2	3	4	5
1	1	2	3	4	5
2	2	4	6	8	10
3	3	6	9	12	15
4	4	8	12	16	20
5	5	10	15	20	25

Risk Level
Low
Medium
High

Risk Level = Likelihood x Severity

S3NA-209-FM TASK HAZARD ANALYSIS

AECOM	Project Name: RCRA FACILITY CLOSURE	Project Number: 60304917	Client: AFCEC
	Supervisor: Raymond Castillo	Project Manager: Josh Miller	Location: Holloman AFB, NM
	AHA Developed By: Dan Schillings		Date: Oct 2013 thru Oct 2014
SUMMARY OF CONTROLS	Task Name: Soil Sampling		Regularity of Task: One-time ☐ Routine ☑

Personal Protective Equipment (*check all that apply*)

- ☑ CSA/ANSI Safety-Toed Boots (Leather or Rubber)
- ☑ CSA/ANSI Safety Glasses or Goggles
- ☑ CSA/ANSI-approved Hard Hat
- ☑ CSA/ANSI Type II/III Reflective Traffic Safety Vest
- ☑ Leather gloves and/or nitrile gloves for sampling
- ☑ Hearing Protection
- ☐
- ☐
- ☐
- ☐

Air Monitoring (reference HASP monitoring plan)

☑ No air monitoring required ☐ Air monitoring required (*see procedures below*)

Parameter	Location/Monitoring Interval	Response/Action Levels	Response Activity

Required Training (associated with this THA)	Key SOPs (associated with this THA)		Client & Other Requirements
1 Tool specific training	S3NA-307-PR Housekeeping, Worksite	S3NA-520-PR Spill Response, Incidental	HAZWOPER, DOT Level I Shipping
2 Equipment specific training	S3NA-308-PR Manual Lifting, Field		
3	S3NA-305-PR Hand and Power Tools		
4	S3NA-507 PR Hazardous Materials Communication		
5	S3NA-509-PR Hazardous Waste Operations and Em		
6	S3NA-511-PR Heat Stress Prevention		

Acknowledgement / Signatures

Project Manager / Supervisor (signature): Date:

Name	Signature	Company	Date	Name	Signature	Company	Date

S3NA-209-FM TASK HAZARD ANALYSIS

AECOM	Project Name: RCRA FACILITY CLOSURE	Project Number: 60304917	Client: AFCEC
	Supervisor: Raymond Castillo	Project Manager: Josh Miller	Location: Holloman AFB, NM
	AHA Developed By: Dan Shillings		Date: Oct 2013 thru Oct 2014
EMERGENCY RESPONSE PLAN	Task Name: Soil Sampling	Regularity of Task: One-time ☐ Routine ☑	

Check-in Procedures

Check-in Times	Check-in Person	Phone Number	Cell Phone Number
8:00 am & 5:00 pm	Raymond Castillo	(210) 253-7520	(210) 724-3118
Alternate:			

Emergency Coordinators / Key Personnel

Name	Title	Phone Number	Cell Phone Number
Raymond Castillo	On-site First Aid Attendant	(210) 253-7520	(210) 724-3118
Mark Phillips	Client POC	(575) 572-7860	
Josh Miller	Project Manager	(210) 253-7517	(972) 922-9974
Raymond Castillo	Site Supervisor/Site Safety Officer	(210) 253-7520	(210) 724-3118
Nash Doyle	Regional SH&E Manager	(312) 373-7813	(312) 593-8489
Dan Schillings	District SH&E Manager	(210) 253-7567	(210) 601-4129
	Incident Reporting Line (BY THE END OF THE SHIFT)	1.800.348.5046	
Eric Olson	DOT/IATA Shipping Expert	(864) 297-3102	(303) 694-4410

Emergency Agencies / Public Utilities

Name	Type	Details	Phone Number
Holloman AFB	Police		911
Holloman AFB	Fire		911
Holloman AFB	Ambulance		911
Gerald Champion Regional Medical Center	Nearest Hospital / Clinic	2669 North Scenic Drive, Alamogordo, NM	575.439.6100
	Poison Control Center		800.222.1222
	Pollution / Environmental		800.292.4706
	INFOTRAC *(AECOM's Account # 74984)*		800.535.5053
	Tier II or SARA Title III Hot Line		800.424.9346

Emergency Equipment & Supplies

- ☑ First Aid Kit - Type:
- ☐ Blankets / Survival:
- ☑ Fire Extinguishers Type:
- ☑ Communication Device
- ☑ Vehicle Safety Equipment
- ☑ Eye Wash
- ☐ Spill Kit
- ☐ Other:

Other Emergency Plan Details

Concentra
2170 E. Lohman Ave., Suite C
Las Cruces, NM 88001
(505) 524-8888

S3NA-209-FM TASK HAZARD ANALYSIS

AECOM	Project Name: RCRA FACILITY CLOSURE	Project Number: 60304917	Client: AFCEC
	Supervisor: Raymond Castillo	Project Manager: Josh Miller	Location: Holloman AFB, NM
	AHA Developed By: Dan Schillings		Date: Oct 2013 thru Oct 2014
ACTIVITY HAZARD ANALYSIS	Task Name: Waste Sampling	Regularity of Task: One-time ☐ Routine ☑	

	Job Event Sequence (List the major steps of the individual task)	Hazards (List primary hazards)	Hazard Classification (before controls) Severity	Likelihood	Risk Level	Hazard Classification	Controls (List controls that AECOM will implement)
1	Tail gate safety briefing, inspect equipment, review THA	None	1	1	1	Low	Standard PPE ensemble; training, supplies, permits
2	Vehicle Inspection/Mob to Sampling Site	Traffic and Vehicle Safety	2	2	4	Low	Standard PPE ensemble; training, equipment
3	Ensure sample collection media/balance/manifest/supplies are available	Slips/trips/falls; bio hazards	1	1	1	Low	Standard PPE ensemble; training, equipment
4	Setup work area under tent	Slips/trips/falls; back strain; pinch points	3	3	9	Medium	Standard PPE ensemble; training, equipment
5	Collect Sample with appropriate tool (e.g. disposable scoop)	Slips/trips/falls; biological hazards; back strain	3	3	9	Medium	Standard PPE ensemble; training, equipment
6	Measure out 100 grams of sample for Paint Filter test	Slips/trips/falls; biological hazards	1	1	1	Low	Standard PPE ensemble; training, equipment
7	Place a 100 grams aliquot in baggie for TPH sample and place baggie in cooler	Slips/trips/falls; biological hazards; back strain	1	1	1	Low	Standard PPE ensemble; training, equipment
8	Complete manifest, PF test log, TPH log, and field log entries	Slips/trips/falls; biological hazards; back strain	2	2	4	Low	Standard PPE ensemble; training, equipment
9	Surplus waste can be put back into waste pile for disposal	Slips/trips/falls; back strain; pinch points	3	3	9	Medium	Standard PPE ensemble; training, equipment
10	Demob from site and take samples to Core Logging Station (3.2)	Traffic and Vehicle Safety	2	2	4	Low	Standard PPE ensemble; training, equipment
11	Clean equipment/tools at Core Logging Station (3.2)	Slips/trips/falls; bio hazards	1	1	1	Low	Standard PPE ensemble; training, equipment
12	Relinquish Samples to Sample receving at Core Logging Station (3.2)	Slips/trips/falls; bio hazards	1	1	1	Low	Standard PPE ensemble; training, equipment
13					0		
14					0		
15					0		
16					0		
17					0		

Hazard Classification Guidelines

Severity

1 Remote potential for injury, property damage/$ loss, or env damage

2 Potential for minor first aid injury, property damage/$ loss, or environmental damage

3 Potential for moderate personnel injuries, including medical treatment, property damage/$ loss, environmental damage, or negative public impact

4 Potential for a serious injury, major property damage/$ loss, serious impact to the environment, and public health

5 Catastrophic damage to people, property/equipment, environment, or public health

Likelihood of Occurrence

1 Very unlikely

2 Unlikely

3 Likely

4 Very likely

5 Certain

Hazard Classification Matrix

Likelihood \ Severity	1	2	3	4	5
1	1	2	3	4	5
2	2	4	6	8	10
3	3	6	9	12	15
4	4	8	12	16	20
5	5	10	15	20	25

Risk Level
Low
Medium
High

Risk Level = Likelihood x Severity

S3NA-209-FM TASK HAZARD ANALYSIS

AECOM	Project Name: RCRA FACILITY CLOSURE	Project Number: 60304917	Client: AFCEC
	Supervisor: Raymond Castillo	Project Manager: Josh Miller	Location: Holloman AFB, NM
	AHA Developed By: Dan Schillings		Date: Oct 2013 thru Oct 2014
SUMMARY OF CONTROLS	Task Name: Waste Sampling		Regularity of Task: One-time ☐ Routine ☑

Personal Protective Equipment (*check all that apply*)	
☑	CSA/ANSI Safety-Toed Boots (Leather/Rubber)
☑	CSA/ANSI Safety Glasses or Goggles
☑	CSA/ANSI-approved Hard Hat
☑	CSA/ANSI Type II Reflective Traffic Safety Vest
☑	Leather gloves/nitrile
☑	DEET
☐	USCG-approved Type III or V PFD
☑	Ladder
☐	
☐	

Air Monitoring (reference HASP monitoring plan)

☑ No air monitoring required ☐ Air monitoring required (*see procedures below*)

Parameter	Location/Monitoring Interval	Response/Action Levels	Response Activity

Required Training (associated with this THA)	Key SOPs (associated with this THA)		Client & Other Requirements
1 Site safety training	S3NA-308-PR Manual Lifting, Field	S3NA-520-PR Spill Response, Incidental	
2 Biological Hazards	S3NA-312-PR Stairways and Ladders		
3 DOT Level 1 Training	S3NA-313-PR Wildlife, Plants & Insects		
4	S3NA-507 PR Hazardous Materials Communication		
5	S3NA-508-PR Hazardous Materials Handling and S		
6	S3NA-509-PR Hazardous Waste Operations and En		

Acknowledgement / Signatures

Project Manager / Supervisor (signature): Date:

Name	Signature	Company	Date	Name	Signature	Company	Date

S3NA-209-FM TASK HAZARD ANALYSIS

AECOM	Project Name: RCRA FACILITY CLOSURE	Project Number: 60304917	Client: AFCEC
	Supervisor: Raymond Castillo	Project Manager: Josh Miller	Location: Holloman AFB, NM
	AHA Developed By: Dan Schillings		Date: Oct 2013 thru Oct 2014
EMERGENCY RESPONSE PLAN	Task Name: Waste Sampling	Regularity of Task: One-time ☐ Routine ☑	

Check-in Procedures

Check-in Times	Check-in Person	Phone Number	Cell Phone Number
8:00 am & 5:00 pm	Raymond Castillo	(210) 253-7520	(210) 724-3118
Alternate:			

Emergency Coordinators / Key Personnel

Name	Title	Phone Number	Cell Phone Number
Raymond Castillo	On-site First Aid Attendant	(210) 253-7520	(210) 724-3118
Mark Phillips	Client POC	(575) 572-7860	
Josh Miller	Project Manager	(210) 253-7517	(972) 922-9974
Raymond Castillo	Site Supervisor/Site Safety Officer	(210) 253-7520	(210) 724-3118
Nash Doyle	Regional SH&E Manager	(312) 373-7813	(312) 593-8489
Dan Schillings	District SH&E Manager	(210) 253-7567	(210) 601-4129
	Incident Reporting Line (BY THE END OF THE SHIFT)	1.800.348.5046	
Eric Olson	DOT/IATA Shipping Expert	(864) 297-3102	(303) 694-4410

Emergency Agencies / Public Utilities

Name	Type	Details	Phone Number
Holloman AFB	Police		911
Holloman AFB	Fire		911
Holloman AFB	Ambulance		911
Gerald Champion Regional Medical Center	Nearest Hospital / Clinic	2669 North Scenic Drive, Alamogordo, NM	575.439.6100
	Poison Control Center		800.222.1222
	Pollution / Environmental		800.292.4706
	INFOTRAC *(AECOM's Account # 74984)*		800.535.5053
	Tier II or SARA Title III Hot Line		800.424.9346

Emergency Equipment & Supplies

- ☑ First Aid Kit - Type:
- ☐ Blankets / Survival:
- ☐ Fire Extinguishers Type:
- ☑ Communication Device
- ☐ Vehicle Safety Equipment
- ☑ Eye Wash
- ☐ Spill Kit
- ☐ Other:

Other Emergency Plan Details

Concentra
2170 E. Lohman Ave., Suite C
Las Cruces, NM 88001
(505) 524-8888

Attachment B: Safety Data Sheets

WHMIS MATERIAL SAFETY DATA SHEET

603 N Monitor Road
Springdale, AR 72764
PH: (479) 756-5874

BREAKTHROUGH!

FOR CHEMICAL EMERGENCY, SPILL, LEAK, FIRE, EXPOSURE CALL: CHEMTREC 1-800-424-9300 OUTSIDE US CALL 1-703-527-3887	FOR MEDICAL EMERGENCY CALL ROCKY MOUNTAIN POISON CENTER: 1-303-623-5716	HEALTH HAZARD: (0 None > 4 Extreme) Health = 2 Flammability = 0 Reactivity = 0

SECTION 1 – HAZARDOUS INGREDIENTS

HAZARDOUS COMPONENTS	CAS. NO.	Per-Cent	LD 50	LC50
Ethoxylated Alcohol	68439-45-2	1-5%	5100 mg/Kg Rat	NAV
Ethylene Glycol Monobutyl Ether	111-76-2	1-5%	470 mg/Kg Rat	700 ppm 7 hrs Rat
Sodium Metasilicate	6834-92-0	1-5%	800 mg/Kg Rat	NAV
Sodium Dodecylbenzene Sulfonate	25155-30-0	1-5%	2600 mg/Kg Rat	NAV

SECTION 2 – PREPARATION INFORMATION

PREPARED BY: EHS Manager

DATE PREPARED: May 15, 2009

SECTION 3 – PRODUCT INFORMATION

MANUFACTURERS NAME: Hotsy Detergent Division
STREET ADDRESS: 603 N Monitor Road
CITY, STATE, ZIP: Springdale, Arkansas 72764 PHONE: (479) 756-5874

DISTRIBUTED BY:
STREET ADDRESS:
CITY, PROVINCE, POSTAL CODE:
PHONE:

FOR MEDICAL EMERGENCY: CALL ROCKY MOUNTAIN POISON CENTER (303) 623-5716

FOR CHEMICAL EMERGENCY, SPILL, LEAK, FIRE, EXPOSURE CALL: CHEMTREC (703) 527-3887

PRODUCT NAME: BREAKTHROUGH! MSDS NO: C52650.06

SHIPPING CLASSIFICATION: Class 55, Non-hazardous cleaning compound

PRODUCT USE: Detergent

SECTION 4 – PHYSICAL DATA

PHYSICAL STATE: Liquid

ODOUR AND APPEARANCE: Red liquid "butyl" odor

ODOUR THRESHOLD: NAV

SPECIFIC GRAVITY: 1.09

VAPOUR PRESSURE: 23 mmhg @ 70 F

VAPOUR DENSITY: (Air=1) : 1.2

EVAPORATION RATE: NAV

BOILING POINT: 212 F

FREEZING POINT: 32 F

pH: 5% Solution = 11.7

COEFFICIENT OF WATER/OIL DISTRIBUTION: NAV

SECTION 5 – FIRE OR EXPLOSION DATA

CONDITIONS OF FLAMMABILITY: Boiling away the water content

MEANS OF EXTINCTION: Water, Dry Chemical, Carbon Dioxide, Foam

FLASH POINT AND METHOD OF DETERMINATION: > 212 F ASTM D-56

UPPER FLAMMABLE LIMIT: NAP

LOWER FLAMMABLE LIMIT: NAP

AUTO-IGNITION TEMPERATURE: NAP

HAZARDOUS COMBUSTION PRODUCTS: NAP

EXPLOSION DATA (SENSITIVITY TO MECHANICAL IMPACT): NAP

EXPLOSION DATA (SENSITIVITY TO STATIC DISCHARGE): NAP

SECTION 6 – REACTIVITY DATA

CONDITIONS UNDER WHICH THE PRODUCT IS CHEMICALLY UNSTABLE: NAP

NAME OF ANY SUBSTANCE OR CLASS OF SUBSTANCE

WITH WHICH THE PRODUCT IS INCOMPATIBLE: Strong acids and oxidizing agents

CONDITIONS OF REACTIVITY: Contact

HAZARDOUS DECOMPOSITION PRODUCTS: Heat

SECTION 7 – TOXICOLOGICAL PROPERTIES

ROUTE OF ENTRY:

SKIN CONTACT: Undiluted can cause skin irritation

SKIN ABSORPTION: NAV

EYE CONTACT: Undiluted can cause eye irritation or burns

INHALATION: NAP

INGESTION: Undiluted can cause stomach and throat irritation

EFFECTS OF ACUTE EXPOSURE: Eye and skin irritation

EFFECTS OF CHRONIC EXPOSURE: None Known

EXPOSURE LIMITS: 25 ppm Skin Ethylene Glycol Monobutyl Ether ACGIH TLV

IRRITANCY OF PRODUCT: Irritating or corrosive depending on concentration

SENSITIZATION TO PRODUCT: No **CARCINOGENICITY: No**

REPRODUCTIVE TOXICITY: No **TERATOGENICITY: No**

MUTAGENICITY: No

NAME OF TOXICOLOGICALLY SYNERGISTIC PRODUCTS: None known

SECTION 8 – PREVENTIVE MEASURES

PERSONAL PROTECTIVE EQUIPMENT TO BE USED: Safety glasses or goggles, chemically resistant gloves such as rubber, PVC or neoprene

SPECIFIC ENGINEERING CONTROLS TO BE USED: General ventilation

PROCEDURES TO BE FOLLOWING IN CASE OF SPILL OR LEAK: Shut off leak, if this can be done without injury. Flush area with water. Large spills should be diked with earth; then pump to a salvage tank.

WASTE DISPOSAL: Consult local, provincial and federal agencies for proper methods of disposal.

HANDLING PROCEDURES AND EQUIPMENT: Wash thoroughly after handling

STORAGE REQUIREMENTS: Store in a cool dry area. Do not freeze. Keep container closed when not in use

SPECIAL SHIPPING INFORMATION: Class 55, Non-hazardous cleaning compound

SECTION 9 – FIRST AID MEASURES:

EYES: Immediately flush with water for 15 minutes. GET MEDICAL ATTENTION IMMEDIATELY!

SKIN: Wash thoroughly with water. Get medical attention if irritation persists.

INHALATION: NAP

INGESTION: Drink water, do not induce vomiting call a physician immediately.

NAP = Not Applicable **NAV = Not Available**

The information provided in this Material Safety Data Sheet has been compiled from our experience and data presented in various technical publications. It is the users responsibility to determine the suitability of this information for the adoption of safety precautions as may be necessary. We reserve the right to revise Material Safety Data Sheets from time to time as new technical information becomes available. The information herein is furnished without warranty of any kind.

North America's #1 Name in
High-Pressure Cleaning Equipment

BreakThrough!

Concentrated Biodegradable Detergent

Degreaser

Special Features:

This highly concentrated detergent is effective for tackling crude oil and caked-on buildup of fifth-wheel grease...yet it's gentle enough for the fine finishes on cars and for general cleaning purposes. Helps restore all types of oxidized paint surfaces.

Highly concentrated
- A little goes a long way
- Dilution ratio up to 150:1

Competitively priced
- Excellent value for cost
- Economical cost per gallon

High-quality detergents
- Specially designed for pressure washers
- Designed for high temperature cleaning

Safety approvals & registration
- Chemtrec registered

Hotsy's Exclusive Continuous Clean Additive (HCC)
- Protects your pressure washer

Excellent service
- 130 North American Service Centers
- Expert chemist support

Biodegradable
- Safe for the environment

- **Biodegradable**
- **#1 Customer Choice**
- **Approved by USDA & CFIA**
- **Kosher Approved**

BREAKTHROUGH! Degreaser

- 5-Gal Pails P/N 8.905-136.0
- 55-Gal Drums P/N 8.905-137.0
- Hotsy Bulk Pak *(Ask your Hotsy Distributor for details)*

RECOMMENDED USES:

- *Vehicles / Trucks*
- *Drilling Rigs*
- *Farm Equipment*
- *Food industry*
- *Construction*
- *Equipment*
- *Stainless Steel*
- *Oxidized Paint*
- *Aluminum*
- *Painted / Unpainted Surfaces*
- *Degreasing*
- *Asphalt / Tar*
- *Baked-on Carbon*
- *Grease / Oils*
- *Road Film*
- *Diesel Smoke*
- *Floors / Walls*

Bulk Pak for Cost Savings

Ask your Hotsy Distributor how you can arrange to have your Hotsy Detergent supplied on a regular monthly schedule, pumped into your own HOTSY BULK PAK container, that's plumbed directly to your pressure washers. It's convenient, dependable, clean and efficient. SAVE TIME, by having a regular monthly service call! SAVE MONEY with our low bulk rates! SAVE the INCONVENIENCE of disposing of empty 55-gallon drums.

Spend some time with a Hotsy Expert

Hotsy has more than 130 local distributors in North America, all factory-trained to properly evaluate your high-pressure cleaning needs.

Over 80% of Hotsy's distributors have been supporting Hotsy systems for more than 20 years.

This seasoned network of local application specialists will ensure you get the safest, most effective and most efficient cleaning solution to your specific cleaning need.

Distributed by:

BREAKTHROUGH! Specifications

Formulation:	This highly concentrated detergent is effective for tackling crude oil and caked-on buildup of fifth-wheel grease... yet it's gentle enough for the fine finishes on cars and for general cleaning purposes. Helps restore all types of oxidized paint surfaces.
% of Active Ingredients:	19%
Biodegradability:	Breakthrough! is fully biodegradable and contains no caustic soda (sodium hydroxide).
pH at 5% Solution:	11.8 to 12.0
VOC Content:	28 grams
Foaming Action:	High
Reaction in Hard Water (TDS):	Best
Dilution Ratio:	Up to 150:1
Color:	Reddish / Orange
Scent:	None
Exclusive Hotsy Additives	
Advanced Formula HCC:	"Continuous Clean Additives" help to prevent and remove scale build-up in coils, pumps, valves and fittings of pressure washers and steam cleaners.
Corrosion Inhibitors:	Breakthrough! contains Hotsy's full line of corrosion-inhibiting additives, which protect metal surfaces long after washing is completed, giving your equipment protection that can last until it's next cleaning.
Product Analysis:	USDA Approved. Canadian Agriculture Approved. Kosher Certified.
Product Safety:	An OSHA Material Safety Data Sheet is available. For emergency spills call CHEMTREC 1-800-424-9300, outside US call 703-527-3887.
Damage Certification:	This product will NOT damage pressure washers, steam cleaners or related products.
Smog & Ozone:	This does not contain photochemically reactive ingredients that contribute to smog problems or attack the earth's ozone layer.
Containers:	Available in 5-gal pails, 55-gal drums and BulkPaks.

Nothing Cleans Like a Hotsy!

Tel: (800) 525-1976 Fax: (888) 880-9631
www.Hotsy.com email: info@Hotsy.com

P/N 8.914-204.0 Effective 4/10 Specifications and product descriptions subject to change without notice. ©2010 Hotsy

Attachment C: Equipment Safety Cards

SAFETY NOW
NO OTHER WAY

AECOM

SAFETY CARD

COMPRESSORS

Objective / Overview:

Compressors should be used with extreme caution in order to prevent personal injury. When using a compressor it's important to follow the manufacturer's instructions to avoid injuring someone or damaging your compressor. Allow only trained, authorized personnel to operate the compressor. Along with training, other safety measures include: proper maintenance of equipment and personal protective equipment.

Safe Operating Guidelines:

Follow manufactures recommended operating instructions, every compressor is not the same. Maintain adequate ventilation. Gas and Diesel powered generators emit carbon monoxide (CO). Never operate a fuel-powered compressor in an enclosed building without proper ventilation. Turn the compressor off to refuel. Gasoline and its vapors may ignite if they come into contact with hot components or an electrical spark, store fuel in a properly designed container in a secure location. Operators shall perform a pre-operational check of all air hoses, couplings, and connections to determine if leakage or other damage exists. Tag unsafe equipment and take out of service immediately. Decompress air from the compressor prior to removing any caps or air equipment attachments such as jackhammers, drills, etc. Keep oil and flammable material clear of air fittings and joints. Make sure connections are secure to avoid a hose coming loose during use. To avoid a shock, make sure that your hands are dry and you're standing in a dry place whenever you operate the compressor. Use only UL-listed, three-prong extension cords. Be sure the extension cord is the proper size (wire-gauge) to handle the electric load that will be plugged into it.

Potential Hazards:

- Burns from contact with the hot muffler or engine
- Shocks/electrocution
- Noise exposure
- Inhaling exhaust gases, CO
- Contact with pressurized air

Training Requirements:

- Review of Applicable SOPs (SH&E 611, *Electrical Safety-Portable Electrical Equipment* & SH&E 618, *Compressed Gasses*
- Demonstrated knowledge on the use of the compressor
- Review of manufacturers operating guidelines

Personal Protective Equipment (Level D PPE) and:

- Leather Gloves
- Hearing Protection
- Long Sleeve Shirt (e.g., to shield from burns, etc.)

Other Safety Tips:

- Have a Class A:B:C fire extinguisher readily available at all times.

SAFETY NOW
NO OTHER WAY

AECOM

SAFETY CARD

CORE DRILLING MACHINE

Objective / Overview:

Core drilling machines are used on all types of jobs. They can be electrical or gas powered and come with a stand or can be hand held. Caution should be used when operating such a machine. It may look harmless and easy to run, but drilling machines have many hazards.

Safe Operating Guidelines:

Clean the flanges before mounting the blade. Make sure the blade is correct for the material being cut and the arrow on the blade corresponds with the direction of rotation of the machine spindle. Avoid tilting the blade when cutting. Use only the machines that have an approved safety guard. Remove the diamond blade from the machine during transit to prevent accidental damage. Inspect the blades frequently to detect cracks or undercutting of the steel center. Don't let excessive heat be generated at the cutting edge of the blade. Use adequate water supply to both sides of the blade. Follow the manufacturers recommended pulley sizes and operating speeds for specific blade diameters. Make sure to tighten drive belts to ensure full available power. Don't force the blade on the blade shaft or mount blade on an undersized spindle.

Potential Hazards:

- Electrical shock
- Flying debris
- Severe cuts
- Hearing loss
- Breathing fumes or dust

Training Requirements:

- Review of Applicable SOPs (SH&E 610, *Hand and Power Tools* & SH&E 611, *Electrical Safety-Portable Electrical Equipment*)
- Demonstrated knowledge on the use of a coring machine
- Review and follow manufacturers operating guidelines

Personal Protective Equipment (Level D PPE) and:

- Leather gloves
- Face shield
- Hearing protection
- Respirator or dust mask

Other Safety Tips:

- Keep fingers and hands away from the cutting edge.
- Hold handle firmly when operating.
- A subsurface utility clearance should be performed prior to initiating drilling operations.

SAFETY NOW
NO OTHER WAY

AECOM

SAFETY CARD

GENERATOR

Objective / Overview:

Portable generators should be used with extreme caution in order to prevent personal injury. When using a portable generator it's important to follow the manufacturer's instructions to avoid injuring someone or damaging your generator or appliances. Allow only trained, authorized personnel to operate the generator. Along with training, other safety measures include: proper maintenance of equipment and personal protective equipment.

Safe Operating Guidelines:

Follow manufacturer's recommended operating instructions, every generator is not the same. Maintain adequate ventilation. Generators emit carbon monoxide (CO). Never operate a generator in an enclosed building without proper ventilation. Turn the generator off to refuel. Gasoline and its vapors may ignite if they come into contact with hot components or an electrical spark, store fuel in a properly designed container in a secure location. To avoid a shock, make sure that your hands are dry and you're standing in a dry place whenever you operate the generator. Turn off equipment and lights supplied by the generator until it is running. Use the right extension cord. Use only UL-listed, three-prong extension cords. Be sure the extension cord is the proper size (wire-gauge) to handle the electric load that will be plugged into it. Make sure the generator is properly grounded prior to each use. If you intend on using a portable generator to tie into the wiring of an existing structure this shall be done only by a licensed electrician.

Potential Hazards:

- Burns from contact with the hot muffler or engine
- Shocks/electrocution
- Noise exposure
- Inhaling exhaust gases, CO

Training Requirements:

- Review of Applicable SOPs (SH&E 611, *Electrical Safety-Portable Electrical Equipment*)
- Demonstrated knowledge on the use of a generator
- Review of manufacturers operating guidelines

Personal Protective Equipment (Level D PPE) and:

- Leather Gloves
- Hearing Protection
- Long Sleeve Shirt (i.e., to shield from burns, etc.)

Other Safety Tips:

- Have a Class A:B:C fire extinguisher readily available at all times.

SAFETY NOW
NO OTHER WAY

AECOM

SAFETY CARD

IMPACT WRENCHES

Objective / Overview:

Impact wrenches are mainly used for tire changing but that does not limit their use. They can be used in all applications when a certain amount of torque is needed to loosen or tighten nuts and bolts. The danger comes in to play when employees try to use the wrong sockets with an air wrench. Employees using air wrenches must have general understanding of how to use them.

Safe Operating Guidelines:

Drain water from air compressor tank and condensation from air lines. Disconnect the tool from the air supply before lubricating or changing sockets. Impact wrench sockets and accessories must be used with this tool. Do not use hand sockets and accessories. Select the required impact socket. Connect tool to air hose of recommended size. The use of a quick connect set makes connecting easier. Never use a wire, soft pin, or nail to hold the socket onto the square spindle of the impact wrench. If the proper retaining device on the tool is broken, the tool should be repaired. On applications where a low or critical level of torque is required, it is recommended that you impact each fastener lightly, and then perform the final tightening with a hand torque wrench.

Potential Hazards:

- Flying debris
- Hearing loss
- Cuts
- Hand / arm vibration syndrome

Training Requirements:

- Review of Applicable SOPs (SH&E 610, *Hand and Power Tools*)
- Demonstrated knowledge on the use of a electric drill
- Review and follow manufacturers operating guidelines

Personal Protective Equipment (Level D PPE) and:

- Leather gloves/anti-vibration gloves
- Hearing protection

Other Safety Tips:

- Be sure no one is below when using the tool in high locations.
- The proper fastening torque may differ depending upon the kind or size of the bolt.
- Check the torque with a torque wrench.

SAFETY NOW
NO OTHER WAY

AECOM

SAFETY CARD

POWER DRILL

Objective / Overview:

Available in a variety of types and capacities, portable power drills are undoubtedly the most used power tools. Because of their handiness and application to a wide range of jobs, drills often receive heavy use. For this reason, you'll need to carefully check your drill's capacity limitations and accessory recommendations.

Safe Operating Guidelines:

Check carefully for loose power cord connections and frays or damage to the cord. Replace damaged tool and extension cords immediately. Be sure the chuck is tightly secured to the spindle. This is especially important on reversible type drills. Tighten the bit securely as prescribed by the owner / operator's manual. The chuck key must be removed from the chuck before starting the drill. A flying key can be an injury-inflicting missile. Check auxiliary handles, if part of the tool. Be sure they are securely installed. Always use the auxiliary drill handle when provided. It gives you more control of the drill, especially if stalled conditions occur. Grasp the drill firmly by insulated surfaces. Always hold or brace the tool securely. Brace against stationary objects for maximum control. If drilling in a clockwise -- forward -- direction, brace the drill to prevent a counter-clockwise reaction. Don't force a drill. Apply enough pressure to keep the drill bit cutting smoothly. If the drill slows down, relieve the pressure. Forcing the drill can cause the motor to overheat, damage the bit and reduce operator control.

Potential Hazards:

- Electrical shock
- Leaving chuck wrench in tool
- Puncture wounds
- Flying debris
- Severe cuts
- Fire
- Burns (hot bits)
- Sprains/strains (wrist)

Training Requirements:

- Review of Applicable SOPs (SH&E 610, *Hand and Power Tools* & SH&E 611, *Electrical Safety-Portable Electrical Equipment*)
- Demonstrated knowledge on the use of a power drill
- Review and follow manufacturers operating guidelines

Personal Protective Equipment (Level D PPE) and:

- Leather Gloves

Other Safety Tips:

- Electric drills must be double-insulated or plugged into a GFCI outlet.
- Never carry tool by cord or yank it to disconnect from receptacle.
- Keep cord away from sharp edges.

SAFETY NOW
NO OTHER WAY

AECOM

SAFETY CARD

PRESSURE WASHERS

Objective / Overview:

High pressure washers can operate up to pressures of 5,000 psi and come in a variety of types ranging from gas operated to electrical. If not used correctly and safely, pressure washers can be a dangerous piece of work equipment. Earth Tech only allows trained, authorized personnel to operate the high pressure washers. Along with training, other safety measures include: reviewing the manufacturers instructional booklet, proper maintenance of equipment, and personal protective equipment.

Safe Operating Guidelines:

The gun valve must always be pointed at the work area, NEVER point the gun valve at yourself or another person. High pressure washers shall be used to clean or decontaminate equipment, surfaces or structures only. High pressure washers WILL NOT be used to clean or decontaminate workers or personal protective equipment while it is being worn. Always set the tripper safety lock when the gun valve is not in use.

Potential Hazards:

- Kickback – Sudden and violent reverse movement of the gun
- Flying debris
- Slips and trips on wet surfaces and hoses
- Exhaust fumes/carbon monoxide (CO) in enclosed spaces
- Severe cuts

Training Requirements:

- Review of Applicable SOPs (SH&E 613, *Pressure Washers*)
- Demonstrated knowledge on the use of a pressure washer
- Review of manufacturers operating guidelines

Personal Protective Equipment (Level D PPE) and:

- Hard hat with faceshield
- Heavy gloves
- Hearing protection
- PVC (or equivalent) rain suit

Other Safety Tips:

- Never fill a pressure washer fuel tank with fuel while the engine is running or if the engine is still hot
- Non-operators must remain a minimum of 25 feet from the operator
- High pressure washing equipment should be cleaned often to avoid dirt buildup, especially around the trigger and guard area
- Always set the trigger safety lock when the gun valve is not in use
- Relieve the pressure in the system before coupling and uncoupling hoses
- Visually inspect the full length of high pressure discharge hose and inspect other high pressure fluid-handling components for abrasions or cuts, damage caused by exposure to chemicals and for damage caused by kinks in the hose

SAFETY NOW
NO OTHER WAY

AECOM

SAFETY CARD

ROUGH TERRAIN FORKLIFTS

Objective / Overview:

According to OSHA, an estimated 100 fatalities and 95,000 injuries annually are caused by unsafe operation of forklifts. This includes rough terrain forklifts (e.g., lulls, Skytrak telehandlers, etc.). A rough terrain forklift is a wheel-type truck designed primarily as a lift truck having a vertical mast or pivoted boom (sometimes both). Rough terrain forklifts also have a variable length reach and may be equipped with attachments. This type of forklift is intended for operation on improved natural terrain and at many construction sites. Along with mandatory operator training, measures to promote safe operation include reviewing the manufacturer's instructional booklet, proper maintenance procedures, and use of PPE.

Safe Operating Guidelines:

Prevention measures are numerous, but a few things are clear: operator training, pre-task planning, and proper equipment maintenance/inspections are the cornerstones of safe use of all mobile equipment, including rough terrain forklifts. In accordance with SH&E 606, *Forklifts*, operators must, prior to being permitted to operate a forklift, provide a copy of their driver's license and a valid Industrial Lift Truck Card issued by an authorized source. Loads must not exceed rated lift capacity as unstable and dangerous machine conditions will result. Only lift the load vertically; never drag or tow a load horizontally.

Training Requirements:

- Operators must pass a combination oral/written/operational performance test approved by the SH&E Manager that demonstrates the ability to safely use a rough terrain forklift. Operators will receive refresher training every 3 years or when an accident, near-miss, or indication of unsafe operation occurs.
- Observance of all provisions and operating rules contained in SH&E 606, *Forklifts.*
- Review of manufacturer's operating guidelines for each specific type/model of rough terrain forklift and proper THA/JSA reviewed/completed for the task.
- Review of methods for properly performing a daily pre-operation forklift inspection. A sample pre-operation inspection checklist is provided as an Attachment to SH&E 606, *Forklifts.*

Other Safety Tips:

- Do not exceed the truck manufacturer's capacity of the rough terrain forklift truck as equipped for handling suspended loads
- Conditions that may affect stability include ground/floor conditions, speed, counterweight location, operator judgment, grade, loading, wheelbase, and improper tire inflation.

SAFETY NOW
NO OTHER WAY

AECOM

SAFETY CARD

UTILITY KNIVES / RAZORS

Objective / Overview:

Utility knives serve a variety of purposes at worksites, and can be a useful tool, when used safely and correctly. Learning proper positioning and correctly using a utility knife will drastically reduce the potential of cut related injuries.

Safe Operating Guidelines:

Always be sure that knives are sharp and not dull. A dull blade will require more force to cut, increasing the likelihood of slipping. Be sure to blade is seated in the frame of the knife correctly, closed, and fastened together properly. Always keep body parts away from the cut line, (e.g., fingers), and ensure that the material being cut is on firm ground and not against a body part (cutting rope against your leg). Always pull the knife, never push the knife (the blade may break, and momentum could cause the body to come into contact with broken blade). Always retract the blade when not in use.

Potential Hazards:

- Lacerations from direct contact with the blade
- Lacerations from blade breaking or shattering
- Ergonomics

Training Requirements:

- Review of Applicable SOPs (SH&E 610, *Hand and Power Tools*)
- Demonstrated knowledge on the safe use of a utility knives
- Review and follow manufacturers operating guidelines for specialized or unusual knives.

Personal Protective Equipment (Level D PPE) and:

- Cut resistant gloves (Kevlar, thick leather, etc.).

Other Safety Tips:

- Purchase safety equipped utility knives with guarding or automatically retracting blades
- Replace dull blades – When knife begins to tear rather than cut, it is a good indicator the blade is dull.
- Always wear a cut resistant glove on your free hand.
- Always use the right tool for the job – NEVER use the blade as a screwdriver or prying tool.
- When using a knife to cut thicker materials, use several passes. Increased force on the blade can cause it to stray from the intended cut path, or break the blade.
- When changing blades, always handle from the non-sharp side. Cover blade with duct tape and dispose.
- Use an alternate tool when possible (scissors, wire cutters, etc.)

Utility Knives with Gaurding

Attachment D: Site-Specific Spill Reporting Card

ENVIRONMENTALRELEASE/SPILL EMERGENCY PROCEDURES

In the event of an environmental release or spill (REGARDLESS OF QUANTITY), the following procedures will be followed:

1. Secure the area and contain the release or spill, if possible.
2. If emergency services are required, call appropriate emergency services numbers to report the quantity and contents of the release or spill.
3. Contact the AECOM Project Manager, Josh Miller, at (210) 253-7517 (office) or (972) 922-9974 (cell) to report the details of the incident.
4. Notify the Site Supervisor/Safety Officer, Ray Castillo, at (210) 724-3118 (cell) to report the contents and quantity of the release or spill.
5. Notification the Holloman Hazardous Waste Manager, John Hamann, at (575) 572-6655 (office) to report the contents and quantity of the release or spill.
6. Call the AECOM Incident Reporting Line at 800-348-5046 and Dan Schillings at 210-601-4129 to report the incident.
7. If the release or spill meets state, federal or local reporting requirements <u>and</u> AECOM is directed by the Holloman POCs, report the release or spill to the appropriate regulatory agencies (see other side).
8. Provide a written statement summarizing the incident to your Supervisor to be included in the Supervisor's Report of Incident.

REGULATORY AGENCY CONTACT NUMBERS FOR REPORTING CHEMICAL SPILLS AND RELEASES

When a chemical spill or release occurs in New Mexico, there are a number of reporting and notification requirements that must be followed by the agency or individual responsible for the spill. Therefore, prior to notifying a regulatory agency(s) of a release or spill, the appropriate regulations should be consulted to determine reportable quantities, reporting requirements, scenarios, notification timelines, required documentation and/or agencies to contact. In some cases, reporting or notification of a spill or release to a regulatory agency(s) may not be required.

A list of regulatory agencies and contact numbers is provided below, but is not inclusive of all release or spill scenarios, such as transportation accidents involving hazardous substances, releases to air or releases from oil and gas wells or pipelines. In some cases, several regulations overlap requiring notification to multiple agencies. However, in all cases, the Holloman team leaders should be consulted first prior to notification of a regulatory agency.

Agency	Phone #	Examples of When To Call
National Response Center (NRC)	1-800-424-8802	• Releases from a fixed facility that exceed the RQ for that specific chemical (per SARA Title III List of Lists); immediate verbal notification • Releases of petroleum products and certain hazardous substances listed under the Federal Clean Water Act (40CFR Part 116) • Releases of hazardous substances from regulated storage tanks in excess of RQ (40 CFR Part 302.6); report within 24 hours
NMED Environmental Emergency (24-hrs)	505-827-9329	• Releases from a fixed facility that exceeds the RQ for that specific chemical (per SARA Title III List of Lists); immediate verbal notification followed by written • Release of hazardous waste stored in tanks at RCRA permitted facilities and large quantity generators greater than one pound; written notification within 30 days • Releases of any chemical, oil, petroleum product, sewage, etc., no matter how small, which may enter waters of the state (including surface water, ground water and dry gullies or storm sewers leading to surface water); immediate verbal notification; written notification within 5 days • Releases of petroleum products and certain hazardous substances listed under the Federal Clean Water Act (40CFR Part 116)
Otero County Emergency Services Coordinator	Mr. Paul Quairoli 575-437-7427 Spill Phone: 868-428-6535 or 911	• Petroleum releases of 25 gallons or more (or that cause a sheen on nearby surface waters) from regulated storage tanks; verbal notification within 24 hours • Releases of hazardous substances from regulated storage tanks in excess of RQ (40 CFR Part 302.6); report within 24 hours • After-hours contact the NMED's Emergency Spill Reporting Line
NMED District III Main Office: Doña Ana County, Las Cruces, New Mexico	575-524-6300	

Attachment E: Equipment Inspection Checklist

S3NA-309- FM2 Heavy Equipment Pre-Operation Checklist

Project Name/Location:															
Number/Name:							**Make/Model:**								
Hour meter reading:															
Check the following as appropriate	**Operator Name/Date**			**Operator Name/Date**			**Operator Name/Date**			**Operator Name/Date**			**Operator Name/Date**		
	SAT	**UNSAT**	**N/A**	**SAT**	**UNSAT**	**N/A**	**SAT**	**UNSAT**	**N/A**	**SAT**	**UNSAT**	**N/A**	**SAT**	**UNSAT**	**N/A**
1. Operator qualified															
2. Overhead guard (ROPS)															
3. Horn															
4. Lights															
5. Parking brake															
6. Service brakes															
7. Steering															
8. Oil level															
9. Hydraulic oil level															
10. Radiator fluid level															
11. Major fluid leaks															
12. Windows															
13. Backup alarm															
14. Tires (visual)															

PRINTED COPIES ARE UNCONTROLLED. CONTROLLED COPY IS AVAILABLE ON COMPANY INTRANET.

15. Seat belts															
16. Fuel leaks															
17. Fire extinguisher															
18. Fuel lines secure															
19. Electrical lines															
20. Exhaust components															
Comments/Remarks:															

PRINTED COPIES ARE UNCONTROLLED. CONTROLLED COPY IS AVAILABLE ON COMPANY INTRANET.

DRAFT FINAL

QUALITY ASSURANCE PROJECT PLAN

FOR

RCRA FACILITY CLOSURE
HAZARDOUS WASTE CONTAINER STORAGE UNIT FACILITY
(SWMU #75)
HOLLOMAN AFB, NEW MEXICO

Prepared For

Air Force Civil Engineer Center (AFCEC)
and
Holloman Air Force Base

Prepared By

112 East Pecan Street, Suite #400
San Antonio, Texas 78205

Contract Number: FA8903-08-D-8770
Task Order: 0281
Project: 80001Y0000

December 2013

TABLE OF CONTENTS

WORKSHEET #1: TITLE AND APPROVAL PAGE 1
WORKSHEET #2: QAPP IDENTIFYING INFORMATION 2
WORKSHEET #3: DISTRIBUTION LIST 3
WORKSHEET #4: PROJECT PERSONNEL SIGN-OFF SHEET 4
WORKSHEET #5: PROJECT ORGANIZATIONAL CHART 5
WORKSHEET #6: COMMUNICATION PATHWAYS 6
WORKSHEET #7: PERSONNEL RESPONSIBILITIES AND QUALIFICATION TABLE 7
WORKSHEET #8: SPECIAL PERSONNEL TRAINING REQUIREMENTS TABLE 8
WORKSHEET #9: PROJECT SCOPING SESSION PARTICIPANTS SHEET 9
WORKSHEET #10: PROBLEM DEFINITION 10
WORKSHEET #11: PROJECT QUALITY OBJECTIVE/SYSTEMATIC PLANNING PROCESS STATEMENTS 11
WORKSHEET #12: MEASUREMENT PERFORMANCE CRITERIA TABLE 12
WORKSHEET #13: SECONDARY DATA CRITERIA AND LIMITATIONS TABLE 21
WORKSHEET #14: SUMMARY OF PROJECT TASKS 22
WORKSHEET #15: REPORTING LIMITS AND EVALUATION TABLES 24
WORKSHEET #16: PROJECT SCHEDULE TIMELINE 51
WORKSHEET #17: SAMPLING DESIGN AND RATIONALE 52
WORKSHEET #18: SAMPLING LOCATIONS AND METHODS/SOP REQUIREMENTS TABLE 53
WORKSHEET #19: ANALYTICAL SOP REQUIREMENTS TABLE 54
WORKSHEET #20: FIELD QUALITY CONTROL SAMPLE SUMMARY TABLE 55
WORKSHEET #21: PROJECT SAMPLING SOP REFERENCE TABLE 56
WORKSHEET #22: FIELD EQUIPMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION TABLE 57
WORKSHEET #23: ANALYTICAL SOP REFERENCE TABLE 58
WORKSHEET #24: ANALYTICAL INSTRUMENT CALIBRATION TABLE 60
WORKSHEET #25: ANALYTICAL INSTRUMENT AND EQUIPMENT MAINTENANCE, TESTING, AND INSPECTION TABLE 65
WORKSHEET #26: SAMPLE HANDLING SYSTEM 67
WORKSHEET #27: SAMPLE CUSTODY REQUIREMENTS 68
WORKSHEET #28: QC SAMPLE TABLES 69
WORKSHEET #29: PROJECT DOCUMENTS AND RECORDS TABLE 75
WORKSHEET #30: ANALYTICAL SERVICES TABLE 76
WORKSHEET #31: PLANNED PROJECT ASSESSMENTS TABLE 79
WORKSHEET #32: ASSESSMENT FINDINGS AND CORRECTIVE ACTION RESPONSES TABLE 80
WORKSHEET #33: QA MANAGEMENT REPORTS TABLE 81
WORKSHEET #34: VERIFICATION (STEP I) PROCESS TABLE 82

WORKSHEET #35: VALIDATION (STEPS IIA AND IIB) PROCESS TABLE 84
WORKSHEET #36: SAMPLING AND ANALYSIS VALIDATION (STEPS IIA AND IIB) SUMMARY TABLE 85
WORKSHEET #37: DATA USABILITY ASSESSMENT 86

LIST OF TABLES

Table 31-1: Planned Project Assessments Table 79
Table 33-1: Quality Assurance Management Reports Table 81
Table 37-1: Considerations for Usability Assessment 86

LIST OF APPENDICES

APPENDIX A: Laboratory Analytical Standard Operating Procedures

LIST OF ACRONYMS and ABBREVATIONS

°C	degrees Celsius
AECOM	AECOM Technical Services, Inc.
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
CSU	container storage unit
CoC	chain-of-custody
COPC	constituent of potential concern
DLA	Defense Logistics Agency
DoD	U.S. Department of Defense
DQI	data quality indicator
DQO	data quality objective
GC	gas chromatograph
HPLC	high performance liquid chromatography
ICP-MS	inductively coupled plasma mass spectrometry
IDL	instrument detection limit
IDW	investigation derived waste
IS	internal standard
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LOD	limit of detection
MCL	maximum contamination level
MDL	method detection limit
MPC	measurement performance criteria
MS	matrix spike
MSD	matrix spike duplicate
NA	not applicable
ND	non-detected
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
OSWER	Office of Solid Waste and Emergency Response
PCB	polychlorinated biphenyl
PM	Project Manager
PARCCS	precision, accuracy, representativeness, comparability, completeness, and sensitivity
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RCRA	Resource Conservation and Recovery Act
RPD	relative percent difference
RSD	relative standard deviation
SOP	Standard Operating Procedure
TSCA	Toxic Substances Control Act
U.S.	United States
UFP	Uniform Federal Policy
USEPA	U.S. Environmental Protection Agency
WQCC	Water Quality Control Commission

INTRODUCTION

All environmental monitoring and measurement efforts mandated or supported by the United States (U.S.) Environmental Protection Agency (USEPA) are subject to a centrally managed quality assurance (QA) system. A QA system is a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products, and services. The USEPA QA system is based on the American National Standard, ANSI/ASQC E4-1994.

The Uniform Federal Policy (UFP) for Implementing Environmental Quality Systems was developed as a joint initiative between the USEPA, the U.S. Department of Defense (DoD), and the Department of Energy, to consistently implement the quality system requirements of ANSI/ASQC E4-1994. The UFP was transmitted to the USEPA Regional Administrators in June 2005 (USEPA Directive 9272.0-17) from the Office of Solid Waste and Emergency Response (OSWER). The directive determined the scope of the UFP to include mainly federal facilities, but also extends the UFP documentation more broadly for data collection projects conducted under the Comprehensive Environmental Response, Compensation, and Liability Act and the Resource Conservation and Recovery Act (RCRA). USEPA Directive 9272.0-17 also states that Regions are strongly encouraged to consider the use of the UFP for other purposes including the RCRA corrective action program, as well as data collection related to the active management of hazardous waste generated by RCRA facilities. On December 21, 2005, OSWER issued a Memorandum informing Regional Science and Policy Directors that QA Project Plans prepared and approved according to the UFP meet all the QA Project Plan requirements issued by the Office of Environmental Information (QA/R-5).

In response to these directives and QA requirements, AECOM Technical Services, Inc. (AECOM) has prepared this site-specific QAPP, which presents the overall project description, project organization, responsibilities, and QA objectives for the project. This project-specific QAPP complies with all QA requirements and has undergone peer-review. This document was developed through a transparent and collaborative process including intra- and inter-agency use, and sharing and distributing information in correspondence directed to certain key individuals and persons.

The scope of this project is to perform facility decontamination, and media and investigation derived waste (IDW) sampling and analysis for the purpose of obtaining clean closure for the Hazardous Waste container storage unit (CSU) (SWMU #75) Facility at Holloman Air Force Base (AFB).

WORKSHEET #1: TITLE AND APPROVAL PAGE

Site Name/Project Name: RCRA Facility Closure, Hazardous Waste CSU

Site Location: Holloman AFB, New Mexico

Document Title: Draft Final Quality Assurance Project Plan (QAPP)

Lead Organization: Air Force Civil Engineer Center (AFCEC)

Preparer's Name and Organizational Affiliation: Josh Miller, AECOM

Preparer's Address, Telephone Number, and E-mail Address: 112 East Pecan Street, Suite #400, San Antonio, TX 78205, (210) 253-7517, josh.miller@aecom.com

Preparation Date: December 2013

AECOM Project Manager/Date: 12/30/2013
Josh Miller/AECOM

AECOM Project Director/QA Officer/Date: 12/30/2013
Rodney Croslen/AECOM

WORKSHEET #2: QAPP IDENTIFYING INFORMATION

Site Name/Project Name: RCRA Facility Closure, Hazardous Waste CSU

Site Location: Holloman AFB, New Mexico

Contractor Name: AECOM Technical Services, Inc.

Contract Number: FA8903-08-D-8770

Contract Title: RCRA Facility Closure Hazardous Waste Container Storage Unit Facility, Holloman AFB, New Mexico

Task Order: 0281

Project Specific QAPP Guidance: UFP-QAPP guidance dated March 2005

1. **Identify regulatory program:** RCRA
2. **Identify approval entity:** AFCEC
3. **The QAPP is (select one):** ☐Generic ☒Project Specific
4. **List dates of scoping sessions that were held:** Project Kick-off teleconference: July 31, 2013 and Site Inspection Visit: August 19, 2013
5. **List dates and titles of QAPP documents written for previous site work, if applicable:** not applicable (NA)
6. **List organizational partners (stakeholders) and connection with lead organization:**

   Stakeholders: AFCEC, and New Mexico Environment Department (NMED)

   Lead Organizations: Defense Logistics Agency **(**DLA) Battle Creek, MI, and USAF ACC 49 CES/CEAN, Holloman AFB
7. **List data users:**

   AFCEC, NMED, DLA Disposition Services, Holloman AFB and USAF ACC 49 CES/CEAN, Holloman AFB

If any required QAPP elements and required information are NA to the project, then circle the omitted QAPP elements and required information on the attached table. Provide an explanation for their exclusions below:

All required QAPP elements and required information are applicable to the project.

WORKSHEET #3: DISTRIBUTION LIST

QAPP Recipients	Title	Organization	Telephone Number	E-mail Address
Ronald Scherer	Engineering and Environmental Services POC	DLA Installation Support Battle Creek, MI	(269) 961-5911	Ron.Scherer@dla.mil
Greg Santiago	Contracting Officer	772 ESS/PKA	(210)395-8052	gregory.santiago.2@us.af.mil
Kent Rohlof	Project Manager/ COR	AFCEC/CFSN	(210) 395-8665	kent.rohlof@us.af.mil
Malini Lyman	GEITA Support	Portage, Inc.	(210) 395-8661	Malini.lyman.1.ctr@us.af.mil
Mark Phillips	Holloman CSU Facility POC	DLA, Holloman AFB, NM	(575) 572-7860	Mark.Phillips@dla.mil
John Hamann	Hazardous Waste Manager	USAF ACC 49 CES/CEAN Holloman AFB, NM	(575) 572-6655	John.Hamann@holloman.af.mil

Notes and Abbreviations:

AFCEC Air Force Civil Engineer Center
COR Contracting Officer Representative
CSU container storage unit
DLA Defense Logistics Agency
ESS Enterprise Sourcing Squadron
GEITA global engineering, integration, and technical assistance
POC point of contact
QAPP Quality Assurance Project Plan
USAF United States Air Force

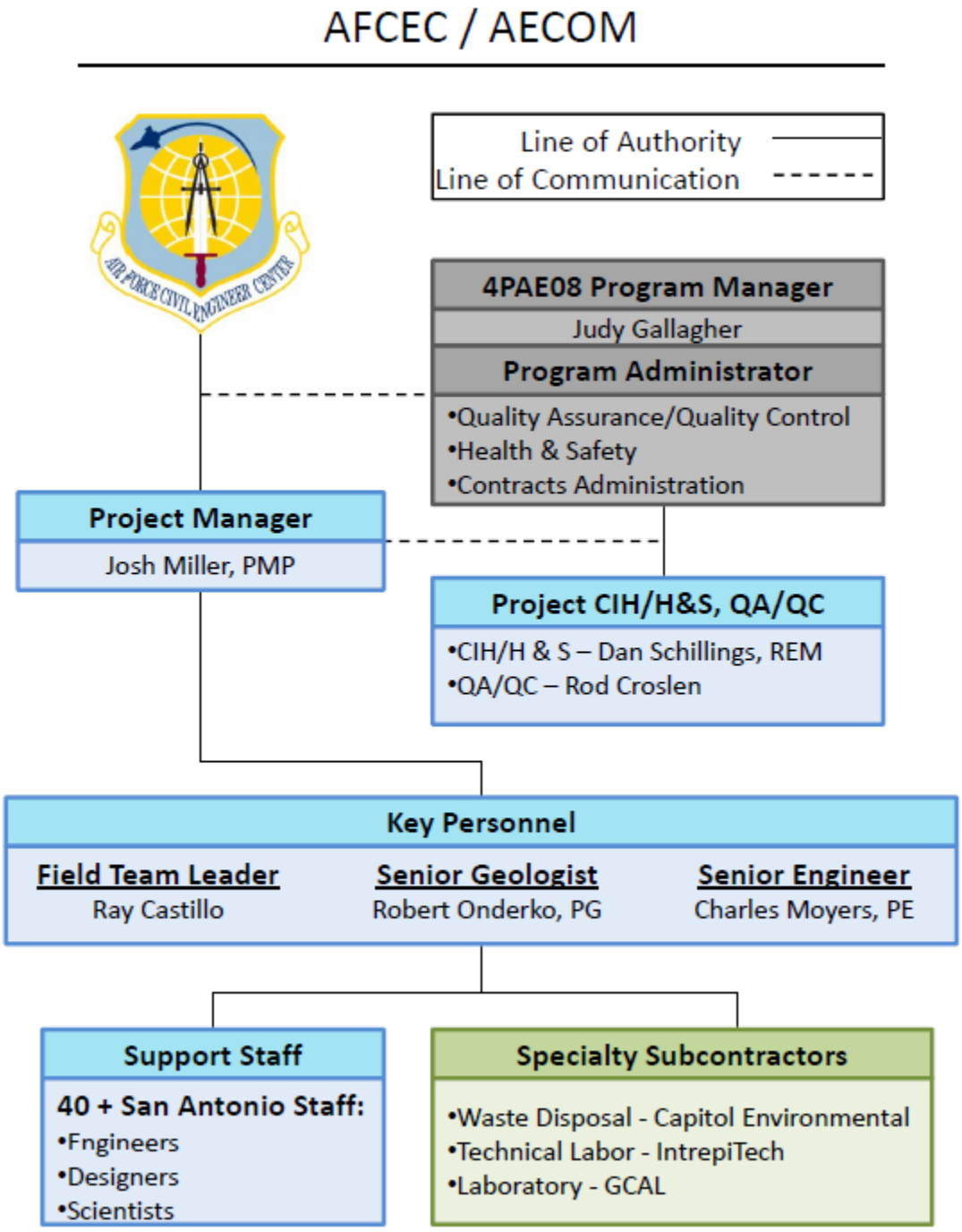
WORKSHEET #4: PROJECT PERSONNEL SIGN-OFF SHEET

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Kent Rohlof	AFCEC Project Manager/COR	(210) 395-8665		
Judy Gallagher	AECOM Program Manager	(703) 706-0555		
Rodney Croslen	AECOM QAO	(210) 253-7524		
Josh Miller	AECOM Project Manager	(210) 253-7517		
Raymond Castillo	AECOM Field Geologist/Field Team Leader	(210) 724-3118		
Chris Davis	AECOM Project Chemist	(510) 879-4534		
Dan Schillings	Health and Safety Officer	(210) 253-7567		
Charles Moyers, PE	New Mexico PE	(505) 889-4309		

Notes and Abbreviations:

AECOM AECOM Technical Services, Inc.
AFCEC Air Force Civil Engineer Center
COR Contracting Officer Representative
PE Professional Engineer
QAO Quality Assurance Officer
QAPP Quality Assurance Project Plan

WORKSHEET #5: PROJECT ORGANIZATIONAL CHART



WORKSHEET #6: COMMUNICATION PATHWAYS

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Significant modification to combined QAPP/Work Plan	QAO and Project Manager	Rodney Croslen Josh Miller	(210) 253-7524 (210) 253-7517	Modifications to the QAPP and/or Work Plan will be communicated to the AFCEC ASAP (within 48 hours) via e-mail and phone.
Change in sampling location or other sampling deviation; Weather related change in field sampling	Field Team Leader and Project Manager	Raymond Castillo Josh Miller	(210) 724-3118 (210) 253-7517	Field Team Leader immediately notifies AECOM Project Manager via phone or e-mail. AECOM Project Manager notifies the AFCEC COR as soon as possible (i.e., within 24 hours) via e-mail or phone.
Laboratory related issues	Project Chemist and Project Manager	Chris Davis Josh Miller	(510) 879-4534 (210) 253-7517	AECOM Project Chemist notifies AECOM Project Manager and QAO within 1 business day via e-mail or phone. The AFCEC notified as soon as possible (i.e., within 24 hours) for any significant issues via e-mail or phone.

Notes and Abbreviations:
AECOM AECOM Technical Services, Inc.
AFCEC Air Force Civil Engineer Center
ASAP as soon as possible
COR Contracting Officer Representative
QAO Quality Assurance Officer
QAPP Quality Assurance Project Plan

WORKSHEET #7: PERSONNEL RESPONSIBILITIES AND QUALIFICATION TABLE

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Josh Miller	Project Manager	AECOM	Overall Project Management	Résumé available upon request
Chris Davis	Project Chemist	AECOM	Interface with laboratory as needed; Oversees sample analysis and compiles analytical reports	Résumé available upon request
Raymond Castillo	Field Geologist/Field Team Leader	AECOM	Coordinate and oversee all field activities	Résumé available upon request
Rodney Croslen	Project QAO	AECOM	Overall QC	Résumé available upon request
Dan Schillings	H&S Officer	AECOM	Overall H&S	Résumé available upon request

Notes and Abbreviations:
AECOM AECOM Technical Services, Inc.
QAO Quality Assurance Officer
QC quality control
H&S health and safety

WORKSHEET #8: SPECIAL PERSONNEL TRAINING REQUIREMENTS TABLE

Specialized Training - Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
40 Hour OSHA HAZWOPER Training and 8 Hour Refresher	Varies	Varies	All field personnel	All field personnel	Available upon request
8 Hour OSHA Site Supervisor	Varies	Varies	Field Team Leader	All field personnel	Available upon request
First Aid/CPR	AECOM	Varies	At least one field team member	All field personnel	Available upon request
Electrical Safety	AECOM	Varies	All field personnel	All field personnel	Available upon request
Fall Protection	AECOM	Varies	All field personnel	All field personnel	Available upon request
Hazard Communication	AECOM	Varies	All field personnel	All field personnel	Available upon request
Yearly Physical	AECOM	Varies	All field personnel	All field personnel	Available upon request
Driver Awareness	AECOM	Varies	All field personnel	All field personnel	Available upon request
DOT Level 1	AECOM	Varies	At least one field team member	All field personnel	Available upon request

Notes and Abbreviations:

AECOM AECOM Technical Services, Inc.
CPR cardiopulmonary resuscitation
DOT Department of Transportation
HAZWOPER hazardous waste operations and emergency response
OSHA Occupational Safety and Health Administration

WORKSHEET #9: PROJECT SCOPING SESSION PARTICIPANTS SHEET

Project Name: RCRA Facility Closure Hazardous Waste Container Storage Unit Facility, Holloman AFB, New Mexico	**Site Name:** CSU Facility, Holloman AFB
TOCOR: Josh Miller	**Site Location:** Alamogordo, New Mexico
Date of Session: July 31, 2013	

Name	Title	Affiliation	Phone Number	E-mail Address
Ronald Scherer	Engineering and Environmental Services POC	DLA Installation Support Battle Creek, MI	269- 961-5911	Ron.Scherer@dla.mil
John Hamann	Hazardous Waste Manager	USAF ACC 49 CES/CEAN	575-572-6655	John.Hamann@holloman.af.mil
Greg Santiago	AFCEC Contracting Officer	772 ESS PKA	210-395-8052	gregory.santiago@us.af.mil
Kent Rohlof	AFCEC Project Manager/ COR	AFCEC/CFSN	210-395-8665	kent.rohlof@usace.af.mil
John Hill	AFCEC Alternate COR	AFCEC/CFSN	210-3695-8662	John.hill3@us.af.mil
Malini Lyman	AFCEC GEITA Support	AFCEC/CFSN	210-395-8661	malini.lyman.1.ctr@usace.af.mil
Mark Phillips	CSU Facility POC	DLA, Holloman AFB, NM	575-572-7860	Mark.Phillips@dla.mil
Rod Croslen	Project Director	AECOM	210-253-7524	Rodney.Croslen@aecom.com
Josh Miller	Project Manager	AECOM	210-253-7517	josh.miller@aecom.com
Robert Onderko	Project Geologist	AECOM	210-253-7530	robert.onderko@aecom.com
Richard Kaselow	Professional Engineer	AECOM	(505) 889-4109	richard.kaselow@aecom.com

Notes and Abbreviations:

AFB Air Force Base
AECOM AECOM Technical Services, Inc.
AFCEC Air Force Civil Engineer Center
COR Contracting Officer's Representative
CSU container storage unit
DLA Defense Logistics Agency
GEITA global engineering, integration, and technical assistance
POC point of contact
TOCOR Task Order Contracting Officer Representative

WORKSHEET #10: PROBLEM DEFINITION

Holloman AFB is located on approximately 59,827 acres of land about seven miles west of the city of Alamogordo in Otero County in south central New Mexico. The CSU facility is located on the east side of the base, approximately 1,400 feet inside the eastern base boundary on roughly 400,000 square feet of land designated for use by the DLA Disposition Service, a Holloman AFB tenant. The CSU Facility consists of an indoor covered building (Building 118), a staging area and an outdoor covered area.

Base activities necessitated the use of a variety of products to maintain and repair aircraft and aerospace ground equipment, as well as base structures and roads thus generating wastes classified as hazardous waste under RCRA due to exhibiting characteristics of ignitability, corrosivity, reactivity or toxicity, or conformance to the definition of listed waste under 40 Code of Federal Regulations Part 261 Subpart D. The CSU Facility operated under permit number NM6572124422-2 dated 24 February, 2004. The permit allowed for the storage of hazardous waste in as many as 788 55-gallon drums or equivalent (43,340 gallons), including Toxic Substances Control Act (TSCA) regulated materials, wastes, and equipment containing polychlorinated biphenyls (PCBs). Presently, the facility no longer accepts hazardous waste, and all stored hazardous waste containers and hazardous materials including PCB containing equipment, materials and wastes have been removed from all areas of the CSU Facility.

Decontamination and closure activities are planned under this project for the CSU Facility including the staging area, the outdoor covered area, and the indoor covered building in accordance with the approved Closure Plan for the CSU Facility.

The environmental questions being asked:

- What is the extent, if any, of PCB contamination within Bay 12 of the indoor covered storage facility (Building 118), where PCBs have been historically stored.
- What is the nature and extent, if any, of contamination in the soil surrounding the CSU Facility.

WORKSHEET #11: PROJECT QUALITY OBJECTIVE/SYSTEMATIC PLANNING PROCESS STATEMENTS

Who will use the data? The Data will be used by AFCEC, DLA, Holloman AFB and NMED.

What will the data be used for? The data will be used to determine the concentrations of contaminants, if present, in the affected media, waste liquids and material generated from closure activities.

What types of data are needed? (Target analytes, off-site laboratory techniques, sampling techniques) All wash and rinse water from the decontamination process (rinsate) will be collected, segregated and moved to polyethylene holding tanks by using portable sump pumps and associated equipment. The water from each holding tank will be sampled and characterized, then properly disposed of. A soil assessment of the area surrounding the CSU Facility will be performed using hand auger drilling method. Surface and subsurface soil samples will be collected from up to 19 locations surrounding the CSU Facility. Wipe samples for PCB contamination will be collected from Bay 11 and 12 of the indoor storage facility. The containment sump under the two Bays will also be sampled.

Samples will be sent for offsite analysis for:

- Rinsate IDW - volatiles, semi-volatiles, herbicides, RCRA 8 metals, pesticides, PCBs, ignitability, reactive cyanide, reactive sulfide, and pH.
- Soils - PCBs, volatiles, semi-volatiles, pesticides, mercury, and inductively coupled plasma mass spectrometry (ICP-MS) Target Analyte List metals.
- PCB Wipes - PCB analysis

Worksheets #12, #14, #19 and #20 of this QAPP present additional information that identifies the number of samples, field and laboratory parameters, analytical methods, recommended sample containers, matrices, holding times, and preservatives for these sampling activities.

How "good" does the data need to be in order to support the environmental decision? The data shall meet all QA/ quality control (QC) criteria as defined within this document.

How much data is needed? (Number of samples for each analytical group, matrix, and concentration) Worksheet #18 of this QAPP provides this information.

Where, when, and how should the data be collected/generated? Sampling procedures can be found in Worksheet #14. Samples, once collected, will be shipped to the Gulf Coast Analytical Laboratory in Baton Rouge, Louisiana for a 3 to 7 business day turnaround analysis.

Who will collect and generate the data? All samples will be collected by AECOM personnel. The Gulf Coast Analytical Laboratory in Baton Rouge will perform all analyses.

How will the data be reported? Data will be reported after appropriate analyses and interpretations. Raw data will be reported as necessary. AECOM will transmit data to AFCEC per the schedule provided in Worksheet #16.

How will the data be archived? Electronic copies will be backed up and stored on disk. Paper copies will be maintained as per the AFCEC contract requirements.

WORKSHEET #12: MEASUREMENT PERFORMANCE CRITERIA TABLE

This worksheet identifies the measurement performance criteria for QC samples collected at Holloman AFB. The type of QC samples, associated analytical groups, frequency, data quality indicators (DQIs), measurement performance criteria (MPC), and targeted assessment error assignment.

Programmatic Measurement Performance Criteria Table – Laboratory and field QC samples for fixed analytical lab

QC Sample	Analytical Group [a]	Minimum Frequency	DQIs	Measurement Performance Criteria	QC Sample Assesses Error for Sampling, Analytical or Both
Temperature Blank	All	1 per sample cooler requiring preservation to 4 ^{o}C	Accuracy /Bias	Temperature not to exceed >0 ^{o}C or ≤6 ^{o}C	Sampling & Analytical
Data Completeness Check	All	1 per laboratory	Data Completeness	85% Overall	Sampling & Analytical
Equipment/Rinsate Blanks	All	As required per sampling event	Bias/ Contamination	No target analytes >= 5X LOQ; with the exception of common field/laboratory contaminants (methylene chloride, acetone, toluene, 2-butanone-must not be >10X) otherwise qualified B	Sampling
Field Duplicate	All General Chemistry	10% of total samples planned for collection for each sampling technique utilized.	Precision	Values > LOQ, criteria 50% RPD, otherwise qualified J	Sampling & Analytical
MS	All General Chemistry	1 per 20 samples per media. If total samples are less than 20, 1 MS will still be collected (should be collected from a location expected to be relatively free from contamination)	Bias	For matrix evaluation, use QC acceptance criteria specified by DoD QSM[b], otherwise qualified J or UJ	Sampling & Analytical
MSD	All General Chemistry	1 per 20 samples per media. If total samples are less than 20, 1 MSD will still be collected.	Bias	For matrix evaluation, use QC acceptance criteria specified by DoD QSM, otherwise qualified J or UJ	Sampling & Analytical
ICV and CCV	All General Chemistry	ICV: Daily, before sample analysis CCV: After every 10 field samples and at the end of the analysis sequence	Accuracy	All analytes within 20% of expected value from the ICAL, otherwise qualified J or UJ	Sampling & Analytical

QC Sample	Analytical Group [a]	Minimum Frequency	DQIs	Measurement Performance Criteria	QC Sample Assesses Error for Sampling, Analytical or Both
Demonstrate acceptable analyst capability	All General Chemistry	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method	NA	QC acceptance criteria published by method-specified criteria.	Analytical
LCS containing all analytes required to be reported	All General Chemistry	One LCS and duplicate per analytical batch	Accuracy	QC acceptance criteria specified by DoD QSM, otherwise qualified J or UJ	Analytical
Method blank	All General Chemistry	One per analytical batch	Contamination	No target analytes >= 5X LOQ; with the exception of common field/laboratory contaminants (methylene chloride, acetone, toluene, 2-butanone-must not be >10X) otherwise qualified B	Sampling & Analytical
MDL study	All General Chemistry	At initial set-up and subsequently once per 12 month period; otherwise quarterly MDL verification checks shall be performed	Accuracy	See 40 CFR 136B. MDL verification checks must produce a signal at least 3 times the instrument noise level.	Sampling & Analytical
Minimum six-point ICAL	All General Chemistry	Initial calibration prior to sample analysis	NA	Option 1: RSD for each analyte 20% Option 2: linear least squares regression: r 0.995 Option 3: non-linear regression: (COD) r2 0.99 (6 points used for 2nd order, 7 for third order)	Analytical
Second source calibration verification used for CCV	All General Chemistry	After every 10 field samples and at the end of the analysis sequence	Accuracy	Value of second source for all analytes within 25% of expected value (initial source)	Analytical

Notes and Abbreviations:
[a] If information varies within an analytical group, separate by individual analyte.
Minimum frequency, DQI and measurement performance criteria apply to concentrated levels (low, mid and high).
All General Chemistry includes the following analysis for soils: SW8260, SW8270, TAL metals, SW8082, SW8081. Wipes samples analysis include SW8082.
QC samples and associated measurement performance criteria as provided in Worksheet #12 are applicable for all laboratory analyses intended for definitive and screening level data use.
[b] *DoD Quality Systems Manual (QSM) for Environmental Laboratories, Version 4.12* (DoD, October 2010)

^{o}C	degrees Celsius	LOQ	limit of quantitation
CCV	continuing calibration verification	MDL	method detection limit

CFR	Code of Federal Regulations	MS	matrix spike
COD	coefficient of determination	MSD	matrix spike duplicate
DoD	United States Department of Defense	NA	not applicable
DQI	data quality indicator	QC	quality control
ICAL	initial calibration for all analytes	QSM	Quality Systems Manual
ICV	initial calibration verification	RPD	relative percent difference
LCS	laboratory control sample	RSD	relative standard deviation

Equipment Rinsate Blanks

An equipment rinsate blank (i.e., "decontamination rinsate" or "equipment rinsate") sample consists of a sample of type II reagent grade water supplied by the laboratory source water poured over or through decontaminated field sampling equipment that is considered ready to collect or process an additional sample. Equipment rinsate blanks are to be collected from non-dedicated sampling equipment to assess the adequacy of the decontamination process. Prior to using the source water for equipment rinsate blanks, it is recommended that the water certification results be evaluated against the project-specific action levels and quantitation limits to ensure the water contains no analytes above these criteria.

To collect an equipment rinsate blank sample, pour the source water over and/or through the decontaminated sampling equipment. Collect this runoff water into the sample containers directly or with the use of a funnel, if necessary. The source water may be poured by use of an electric or hand submersible pump by tipping the jug of water upside down or by use of a stopcock and gravity. Results of equipment rinsate blank samples are used to evaluate whether equipment decontamination was effective.

At a minimum, equipment rinsate blank samples should be collected at a rate of one per each week of sampling. This rate may be adjusted depending on the nature of the investigation (site inspection, remedial investigation, remedial site evaluation, long-term monitoring) and the associated project quality objectives. The equipment rinsate blanks samples will be analyzed for the same parameters as the field samples that were collected using that piece of equipment. If analytes pertinent to the project are found in the equipment rinsate blanks, the frequency of equipment rinsate blank samples may be increased after decontamination procedures have been modified to further evaluate the effectiveness of the decontamination procedure. Detections in the equipment blank and their possible impacts to the investigation are evaluated on a project-specific basis.

When disposable or dedicated sampling equipment is utilized, equipment rinsate blank samples do not need to be collected.

Temperature Blank

A temperature blank is a container of water that is packed and shipped with the field samples requiring preservation by cooling to less than 6 degrees Celsius (°C) to the laboratory. Upon arrival at the laboratory, the laboratory measures the temperature of the blank. This temperature reading is used to represent the conditions of the field samples during shipment to the laboratory. This information is used by both the laboratory and by the independent data validator. If a temperature blank exceeds criteria of less than zero 0°C or greater than 6°C, the laboratory must notify the Project Manager or Project Chemist immediately for guidance. No temperature blank is necessary for waste samples since waste samples do not require ice for preservation.

Field Duplicates

A field duplicate is a generic term for two (or more) field samples taken at the same time in the same location. They are intended to represent the same population and are taken through all steps of the analytical preparation and analysis process in an identical manner and provide precision information for the data collection activity. Field duplicates for groundwater are generally considered to be co-locates.

Duplicates will be analyzed for the same analytical parameters as their associated parent sample. Field duplicates are generally collected at a frequency of 10 percent. Evaluation of field duplicate results is performed by calculation the relative percent difference (RPD) between the parent sample and its field duplicate for every analyte of interest and matrix. The acceptance criteria for analyte-specific RPDs are developed during the data quality objective (DQO) development process on a project-specific basis.

Analytical Method Blank

The analytical method blank is an analyte-free matrix which all reagents are added in the same volumes or proportions as used in sample processing and is carried through the complete sample preparation and analytical process. The purpose of this sample is to document contamination resulting from the analytical process. A method blank shall be included in every analytical batch.

The detection of analytes in a method blank must not exceed the limits of detection (LODs). Corrective action shall be performed to eliminate the source of contamination prior to proceeding with analysis. After the source of contamination has been eliminated, all samples in the preparation batch shall be re-prepared and re-analyzed. Analytical data are not corrected for the presence of analytes in blanks. When an analyte is detected in the method blank and in the associated samples and corrective actions are not performed or are ineffective, the appropriate validation qualifier shall be applied to the sample results.

Laboratory Control Spike/Laboratory Control Spike Duplicate (LCS/LCSD)

The LCSs are analyte-free water (for aqueous analyses) or reagents and glassware only (for soil analysis) spiked with all target analytes of interest for each analytical method. The LCS is analyzed to assess general method performance by the laboratory's ability to recover analytes from a control matrix. The spiking level must be greater than the lowest concentration standard used for calibration and less than or equal to the midpoint of the linear range calibrated. The LCS results are evaluated in conjunction with other related QC information to determine the acceptability of the data generated for the associated samples.

Whenever an analyte in a LCS is outside the acceptance limit, corrective action shall be performed. After the system problems have been resolved and system control has been reestablished, all samples in the analytical batch shall be reanalyzed for only the out-of-control analyte(s). When an analyte in a LCS exceeds the upper or lower control limit and no corrective action is performed or the corrective action was ineffective, the appropriate validation qualifier will be applied to all affected results.

Matrix Spikes/Matrix Spike Duplicates (MS/MSD)

The MS is used to access the performance of the method as applied to a particular matrix. MSs and MSDs are aliquots of samples spiked with known amounts of all target analytes. The spiking occurs in the laboratory, prior to sample preparation and analysis. The spiking level must be greater than the lowest concentration standard used for calibration and less than or equal to the midpoint of the linear range calibration

A minimum of one MS sample and one MSD sample shall be collected per 20 site samples per media collected. Sampling locations selected for the purpose of assigning a MS/MSD should be an area anticipated to be free from or have low concentrations of targeted analytes. Wells containing free product or having a history of high concentrations of targeted analytes should be avoided for MS/MSD.

Only project-specific samples shall be used for spiking. The MS/MSD is designated on the chain-of-custody (CoC). The MS/MSD is used to document the bias of a method due to sample matrix. These sample results are not be used to control the analytical process. The acceptance criteria for the MS and MSD is evaluated against the QC acceptance limits developed during the DQO development process. If performance criteria are not being met by the MS and MSD samples, the analytical procedures and methods must be re-evaluated for appropriateness and correctness. For example, clean-up procedures may be needed to remove matrix interferences.

Surrogate Spikes

Surrogates are organic compounds that are similar to the target analyte(s) in chemical structure and chemical behavior in the analytical process, but that are not normally found in environmental samples. The surrogate results are used to evaluate accuracy, method performance, and extraction efficiency. These surrogate compounds are spiked in environmental samples, control samples, and blank samples per the method requirements. The surrogate should be spiked at a concentration less than or equal to the midpoint of the linear range calibrated.

When the acceptance criteria of a surrogate recovery are not met, corrective action must be performed. Once the system problems have been resolved and system control has been reestablished, the sample is re-prepared and re-analyzed. If corrective actions are not performed or are ineffective, the appropriate validation qualifier shall be applied to the sample results.

Internal Standards

Internal standards (ISs) are known amounts of certain compounds added after preparation or extraction of a sample. These compounds are used in an IS calibration method to correct sample results affected by column injection losses, purging losses, or viscosity effects. ISs shall be added to environmental samples, control samples, and blanks in accordance with the method requirements.

When the IS results are outside of the acceptance limits, corrective actions shall be performed. After the system problems have been resolved and system control has been reestablished, all samples analyzed while the system was malfunctioning shall be reanalyzed. If corrective actions are not performed or are ineffective, the appropriate validation qualifier shall be applied to the sample results.

Retention Time Windows

Retention time windows are used in gas chromatography (GC) and high performance liquid chromatography (HPLC) analysis for qualitative identification of analytes. They are calculated from replicate analyses of a standard on multiple days. The procedure and calculation method are given in SW-846 Method 8000A.

Retention time windows are established to compensate for minor shifts in absolute retention times resulting from normal chromatographic variability. Absolute retention times are used for analyte identification in all GC and HPLC methods that do not employ IS calibration.

When the retention time is outside of the acceptance limits, new chromatographic columns are installed or significant changes are made to the operating conditions, new retention time windows must be re-established. After the system problems have been resolved and system control has been reestablished, reanalyze all samples analyzed since the last acceptable retention time check.

Data Quality Criteria

QC procedures are employed during chemical analysis to support and document the attainment of established method quality objectives. Whether these QC procedures support an assessment of general batch control or matrix-specific application, documentation includes calculating DQIs to verify data usability and contract compliance. DQIs were formerly referred to as the parameters of PARCCS (precision, accuracy, representativeness, comparability, completeness, and sensitivity). Acceptance criteria for PARCCS are developed during project-specific scoping sessions during the DQO development process. The basis for assessing each of these elements of data quality is discussed in the following subsections.

Precision

Precision is the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves. Precision is usually expressed as standard deviation, variance, percent difference, or range, in either absolute or relative terms. Precision data indicate how consistent and reproducible the field sampling or analytical procedures have been. Field duplicate precision is evaluated by calculating a RPD using the following equation:

$$RPD = |(D1-D2)/\{1/2(D1+D2)\}| \text{ X } 100$$

Where:

D1 = original sample concentration

D2 = duplicate sample concentration

If more than two field duplicate samples are collected from adjacent locations and analyzed, they are referred to as co-located field replicates. If two or more aliquots of the same sample are prepared and analyzed by the laboratory, these are referred to as laboratory replicates. Precision of replicate samples is evaluated by calculating the relative standard deviation (RSD) using the following equation:

$$\%RSD = \frac{\sqrt{\frac{\sum_{i=1}^{i=n} \left| D_i - \overline{D} \right|^2}{n}}}{\overline{D}}$$

Where:

D_i = the individual sample concentrations

D = the mean of n values

n = the total number of values

Possible causes of poor precision include sample heterogeneity, improper sample collection or handling, inconsistent sample preparation, and poor instrument stability.

Accuracy

Accuracy is the degree of agreement of a measurement, or average of measurements, with an accepted reference or "true" value, and is a measure of bias in the system. Accuracy of measurement data will be assessed and controlled through the use of LCSs and LCSDs, surrogate spikes and site-specific MSs and MSDs.

Results for LCS and surrogate spikes will be the primary indicators of accuracy. These results will be used to control accuracy within acceptable limits for definitive-level data. Field-designated MS/MSD samples will be employed for applicable methods to identify matrix-associated analytical influences or interferences that may affect the accuracy of the analytical data. As spiked samples are analyzed, spike recoveries will be calculated and compared to pre-established acceptance limits.

Accuracy/bias is

$$MS\ \%\ recovery = \frac{conc.\ of\ sample\ plus\ spike - conc.\ of\ unspiked\ sample}{value\ of\ spike\ added} x\,100$$

$$LCS\ target/surrogate\ \%\ recovery = \frac{measured\ concentration}{true\ (expected)\ concentration} x\,100$$

Trip blanks, field blanks, and equipment blanks monitor accuracy/bias by detecting any concentrations of analytes in water that was originally contaminant-free and comparing that to the field sample results.

Completeness

Completeness is a measure of the amount of adequate data obtained from the actual performance of measurement procedures compared to the amount expected to be obtained from error-free performance of the same measurement procedures under normal conditions. Completeness measures the extent to which the database resulting from a measurement effort fulfills objectives for the amount of data required. Completeness is defined as the valid data percentage of the total tests requested.

$$Completeness\ (\%) = \frac{number\ of\ valid\ analyses\ per\ analyte\ in\ a\ matrix}{number\ of\ requested\ analyses\ per\ analyte\ for\ that\ matrix} x\,100$$

Complete project data involves both satisfactory performance and documentation of field and laboratory procedures. Valid analyses are defined as those where the sample arrives at the laboratory intact, properly preserved, in sufficient quantity to perform the requested analyses, and accompanied by a completed CoC. Furthermore, the sample must be analyzed within the specified holding time and in such a manner that analytical QC acceptance criteria are met, with the following exception. Data qualified as estimated as a result of data validation are considered valid and counted towards completeness if still usable for the intended use of the data. Such data require evaluation to determine suitability for decision-making purposes. Rejected data are not valid data. Completeness for the entire project also involves completeness of field and laboratory documentation, whether all samples and analyses specified in the project-specific QAPP have been processed, and whether the procedures specified in the applicable laboratory Standard Operating Procedures (SOPs) have been followed (See Appendix A for Laboratory Analytical SOPs).

The completeness goal for a project as a whole is 85 percent. The completeness goal is for the entire duration of the project (e.g., there is not a goal of 85-percent completeness per sampling round). The completeness goal for the analytical laboratory portion for each project is 85 percent. Site-specific completeness goals may be necessary to support various environmental cleanup or No Further Action decisions. These goals will be included in the project-specific QAPPs. Failure to achieve the project completeness goal may necessitate re-sampling and reanalysis, or re-evaluation of DQOs.

Critical samples are samples that are used as the sole or primary source for making environmental decisions. These samples require a high level of data quality and completeness. Critical samples will have a completeness goal of 100 percent for each analyte of concern in each matrix, and the completeness goal will be evaluated based on each sampling round. Should recollection efforts be necessary to attain completeness objectives, appropriate project managers and regulatory parties will assess budgetary, site access, schedule, or other constraints, and their impact to the decision-making process.

Representativeness

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

The characteristics of representativeness are usually not quantifiable. Subjective factors to be considered in evaluating how representative a set of measurement data is of a property being measured include:

- Degree of homogeneity of the property or environmental matrices across a site;
- Consistency in applying field procedures;
- Degree of homogeneity of the property within a sample collected from one location at a site; and
- Available information on which a sampling plan is based.

To maximize representativeness of the data, sampling techniques, sample size, and sample locations are carefully chosen to yield samples representative of the particular location and time of sampling, and to produce samples that are collectively representative of the site as a whole. Properly installed monitoring wells verify that the groundwater being sampled originates from the aquifer of interest. Care must be taken to verify

proper stabilization of measured water parameters, clarity, and color before groundwater samples are collected. Precautions, such as not operating combustion engines near a well during sampling, must be taken to prevent the introduction of extraneous analytes into environmental samples.

Comparability

Comparability is the degree to which one data set can be compared to another data set measuring the same property. Comparability is assured through the use of established and approved sample collection techniques and analytical methods, consistency in the basis of analysis (volume, etc.), consistency in reporting units, and analysis of standard reference materials.

Data comparability will be achieved by using standard units of measure, e.g., mg/kg for inorganics and ug/kg for organics. The use of approved or standard methods to collect and analyze samples (in this case American Society of Testing Materials and U.S. EPA Methods), along with instruments calibrated against National Institute for Standards and Technology traceable standards will also help maintain comparability.

Comparability also depends on the other data quality characteristics. Only when data are judged to be representative of the environmental conditions, and when precision and accuracy are known, may data sets be compared with confidence.

Sensitivity

Sensitivity is the ability of an analytical method or instrument to discriminate between measurement responses representing different concentrations. This capability is established during the planning phase to meet project-specific objectives. It is important to be able to detect the target analytes at the levels of interest. Sensitivity requirements include the establishment of various limits, which are described in the project-specific QAPP, such as calibration requirements, instrument detection limits (IDLs), LODs, and project-specific LOQs. Both the IDLs and LODs are normally based on an interference-free matrix (i.e. reagent water), which do not take into account matrix effects and may not be achievable for all environmental samples.

The General Qualifiers are:

B	The analyte has a positive result for blank contamination
U (not detected)	The analyte was tested for, but was not detected above the method detection limit (MDL), and is considered non-detected (ND) at the reported value. This qualifier is added before any additional qualifiers for all ND results.
UJ	The analyte is ND but the result is an estimate due to QC failure or data quality limitations. UJ- indicates detection limit may be biased low.
J (estimated)	The analyte is positively identified but the reported concentration is an estimate due to QC failure or data quality limitations.
R (unusable)	The result is rejected due to QC failure or data quality limitations. The presence or absence of the analyte in the sample cannot be verified, or the reported result is so severely compromised as to be unusable.
M (estimated)	Matrix effect is suspected.

WORKSHEET #13: SECONDARY DATA CRITERIA AND LIMITATIONS TABLE

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator (Originating Organization, Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
NA	NA	NA	NA	NA

Notes and Abbreviations:
NA not applicable

WORKSHEET #14: SUMMARY OF PROJECT TASKS

Sampling Tasks: All samples will be sent to Gulf Coast Analytical Laboratory, Baton Rouge with a three to seven day turnaround time. The following is a list of SOPs that will be used while completing project sampling tasks (See Field Sampling Plan, Attachment B):

- SOP 1 - Sample Collection, Handling and Custody
- SOP 2 - IDW Management and Sampling
- SOP 3 - Collection of Soil Samples
- SOP 4 - Collection of PCB Wipe Samples
- SOP 5 - Packaging and Shipment of Environmental Samples

Analysis Tasks: Gulf Coast Analytical Laboratory, Baton Rouge will analyze for PCBs by method SW8082, semi-volatiles by method SW8270, volatiles by method SW8260, pesticides by method SW8081, and metals by method SW6020/7141 (See Appendix A for Laboratory Analytical SOPs).

QC Tasks: The following types of QC samples will be analyzed as necessary: field duplicates, MS/MSD, and rinsate blanks.

All samples will be sent to the laboratory in well-sealed containers, and packaged and labeled in accordance with Department of Transportation and International Air Transport Association requirements. A temperature blank will be placed in each shipping container and sufficient ice will be added to the samples to maintain a temperature of 4 ± 2°C, but not to the point of freezing. Custody seals will be used as appropriate in accordance with the packaging requirements. All applicable shipping regulations will be observed. The containers, preservation technique, and holding times for each analytical parameter are summarized in Worksheet #19.

Secondary Data: See Worksheet #13.

Data Management Tasks: Analytical data will be provided by the laboratory electronically and will be summarized in analytical data tables by AECOM. If manual entry of data is necessary, a secondary review of data entered into the tables will be performed for verification purposes. A trip report documenting the overall activities that occurred during field operations will be submitted to AFCEC. This may include, but is not limited to, CoC documentation, photographs, a site map, completed field forms and written field notes (i.e., logbook) taken during the sampling event.

- *Documentation and Records*: All field measurements and records for each sample collected will be documented in the field log book or sampling record sheet. Due to the evidentiary nature of samples collected, possession must be traceable from the time the samples are collected until their derived data is introduced as evidence in legal proceedings. To ensure that samples are secure from tampering, CoC documentation is utilized to provide a traceable record of sample custody (see AECOM's Work Plan, Section 4, for additional information). Field records will be maintained in the field logbooks. The type of information that will be entered into the logbook should include, but is not limited to the items listed below.
    - Site name
    - Site identification number, if applicable
    - Name and signature to whom the book was issued
    - Reference to the document (e.g., Work Plan, Field Sampling Plan, QAPP) describing the proposed field activities which are subsequently documented in the logbook

- Any deviation(s) from the USEPA-approved document (e.g., Work Plan, Field Sampling Plan, QAPP) and the rationale for the deviation(s)
- Dates and times of site entries and departures
- Names, organizations, addresses, and telephone numbers of persons on-site
- Types of sampling equipment (including filters, tools, syringes) and sampling method
- Any equipment failures and steps taken to repair/replace equipment
- Sketches of site conditions
- Description of activities
- Lists of photographs taken including time, date, location, picture number, name of the person taking the picture, and sketches of photo locations
- Records of all sample documentation
- Descriptions of all sampling activities including visual observations and physical measurements of samples, sample locations, data and time of sampling

- *Field Custody:* The sampling team members are responsible for the care and custody of the samples collected until they are properly transferred to the shipping company or laboratory. In addition, the sampling team members will ensure that samples are collected, maintained, and transferred in accordance with approved SOPs and CoC requirements as follows: Collect only the number of samples needed to represent the media being sampled. To the extent possible, determine the quantity, types of samples, and sample locations prior to the actual fieldwork. As few people as possible should handle samples. Sample labels will be completed for each sample, using waterproof ink. Custody will be maintained in the field by ensuring the samples are accompanied by the CoC documentation and are kept in a cooler that is within the line of sight or in a locked storage location from the time of collection until relinquished by signature and physical custody to the shipper.
- *Sample Numbering Scheme:* A descriptive, project-specific identification (ID) number to each sample will be assigned for data tracking and storage purposes. These ID numbers will be recorded on each sample container, field data sheet, and notebook maintained by field personnel. Sample designations and labeling are presented in SOP - 1, *Sample Collection, Handling and Custody* (See Field Sampling Plan, Attachment B).
- *QC samples will be identified using the following designations*:

  EB = equipment rinsate blank

  MS/MSD = will be designated in the comments column on the CoC

  D = duplicate

Assessment/Audit Tasks: This QAPP will be reviewed during the course of sampling to ensure consistency and to account for any changes in the plan that needs to be documented.

Data Review Tasks: Data will be reviewed and comparisons made with project objectives. Data will be placed into tables, charts, and graphs as necessary for data review and interpretations.

WORKSHEET #15: REPORTING LIMITS AND EVALUATION TABLES

ANALYTICAL REQUIREMENTS FOR SOLID SAMPLE EVALUATION:

Analyte	CAS Number	Residential NMED Soil Screening Levels[a] ug/kg	Limit of Quantitation (LOQ) µg/kg	Limit of Detection (LOD) µg/kg	Detection Limit (DL) µg/kg	Accuracy Control Limit (%R)	Precision Control Limit (Advisory %) RPD
Matrix: Soils **Analyical Group: SW8082 PCBs**							
Aroclor-1016	12674-11-2	1,000	33.3	16.7	13.3	40-140	30
Aroclor-1221	11104-28-2	1,000	33.3	16.7	13.3	NA	NA
Aroclor-1232	11141-16-5	1,000	33.3	16.7	13.3	NA	NA
Aroclor-1242	53469-21-9	1,000	33.3	16.7	13.3	NA	NA
Aroclor-1248	12672-29-6	1,000	33.3	16.7	13.3	NA	NA
Aroclor-1254	11097-69-1	1,000	33.3	16.7	13.3	NA	NA
Aroclor-1260	11096-82-5	1,000	33.3	16.7	13.3	60-130	30
Decachlorobiphenyl (Surrogate)	2051-24-3	NA	NA	NA	NA	60-125	NA

Analyte	CAS Number	TSCA PCB Cleanup Levels for Low Occupancy Areas[a] µg/kg	Limit of Quantitation (LOQ) µg/kg	Accuracy Control Limit (%R)	Precision Control Limit (Advisory %) RPD
Matrix: PCB Wipes **Analyical Group: SW8082 PCBs**					
Aroclor-1016	12674-11-2	25,000	30	40-140	30
Aroclor-1221	11104-28-2	25,000	30	NA	NA
Aroclor-1232	11141-16-5	25,000	30	NA	NA
Aroclor-1242	53469-21-9	25,000	30	NA	NA
Aroclor-1248	12672-29-6	25,000	30	NA	NA
Aroclor-1254	11097-69-1	25,000	30	NA	NA
Aroclor-1260	11096-82-5	25,000	30	60-130	30

Notes and Abbreviations:

[a]PCB-contaminated soil/sediments will be remediated to a default concentration of 1 mg/kg (1,000 µg/kg) total PCBs (defined as the sum of congeners, Aroclors or homologues, per most recent update on the NMED Hazardous Waste Bureau Documents web page: *Risk Assessment Guidance for Site Investigations and Remediation* (February 2012, updated June 2012) and *Appendix 4-F Action Levels and Cleanup Levels, Holloman Air Force Base, NMED Hazardous Waste Facility Permit No. NM6572124422 (February 2004).*

[b]NMED has established ground water cleanup levels for hazardous waste and/or hazardous constituents that incorporate both the New Mexico Water Quality Control Commission (WQCC) ground water standards for contaminants per 20.6.2.3103 New Mexico Administrative Code (NMAC) and EPA's National Primary Drinking Water Standards Maximum Contaminant Levels (MCLs). If both the WQCC ground water standard and an MCL have been established for an individual hazardous waste and/or constituents, then the lower of the two levels will be the cleanup level for that hazardous waste and/or constituents. The USEPA MCL of 0.5 µg/L for PCBs is presented as it is less than the WQCC standard of 1.0 µg/L.

µg/kg	microgram per kilogram
µg/L	microgram per liter
CAS	Chemical Abstracts Service
IDW	investigation derived waste
NA	not applicable
NMED	New Mexico Environment Department
PCB	polychlorinated biphenyl
RPD	relative percent difference

Analyte	CAS #	Residential NMED Soil Screening Levels[a] ug/kg	Limit of Quantitation (LOQ) µg/kg	Limit of Detection (LOD) µg/kg	Detection Limit (DL) µg/kg	Accuracy Control Limit (%R)	Precision Control Limit RPD
Matrix: Soil **Analyical Group: SW8270 Semi-volatiles**							
1,2,4,5-Tetrachlorobenzene	95-94-3	18,300	330	33.3	8.15	60-120	0-30
1,2,4-Trichlorobenzene	120-82-1	73,000	330	33.3	10.5	45-110	0-30
1,2-Dichlorobenzene	95-50-1	2,310,000	330	33.3	6.85	45-100	0-30
1,3-Dichlorobenzene	541-73-1	NA	330	33.3	13.4	40-100	0-30
1,4-Dichlorobenzene	106-46-7	31,700	330	33.3	8.82	35-105	0-30
2,3,4,6-Tetrachlorophenol	58-90-2	1,800,000[b]	330	33.3	10.3	60-120	0-30
2,4,5-Trichlorophenol	95-95-4	6,110,000	330	66.7	10.4	50-110	0-30
2,4,6-Trichlorophenol	88-06-2	61,100	330	167	11.6	45-110	0-30
2,4-Dichlorophenol	120-83-2	183,000	330	66.7	9.48	45-110	0-30
2,4-Dimethylphenol	105-67-9	1,220,000	330	330	6.52	30-105	0-30
2,4-Dinitrophenol	51-28-5	122,000	1650	330	22.5	15-130	0-30
2,4-Dinitrotoluene	121-14-2	15,700	330	66.7	6.72	50-115	0-30
2,6-Dichlorophenol	87-65-0	NA	330	33.3	4.22	60-120	0-30
2,6-Dinitrotoluene	606-20-2	61,100	330	33.3	12.3	50-110	0-30
2-Chloronaphthalene	91-58-7	6,300,000[b]	330	33.3	10.5	45-105	0-30
2-Chlorophenol	95-57-8	391,000	330	33.3	7.24	45-105	0-30
2-Methylnaphthalene	91-57-6	230,000[b]	330	33.3	4.76	45-105	0-30
2-Nitroaniline	88-74-4	610,000[b]	1650	66.7	4.19	45-120	0-30
2-Nitrophenol	88-75-5	NA	330	33.3	11.8	40-110	0-30
3,3'-Dichlorobenzidine	91-94-1	10,800	660	333	31.6	35-120	0-30
3-Nitroaniline	99-09-2	NA	1650	66.7	4.49	25-110	0-30
4,6-Dinitro-2-methylphenol	534-52-1	4,900[b]	1650	330	17.8	30-135	0-30
4-Bromophenyl phenyl ether	101-55-3	NA	330	33.3	10.5	45-115	0-30
4-Chloro-3-methylphenol	59-50-7	6,100,000[b]	330	33.3	7.42	45-115	0-30
4-Chloroaniline	106-47-8	24,000[b,c]	330	33.3	6.34	20-120	0-30
4-Chlorophenyl phenyl ether	7005-72-3	NA	330	33.3	7.34	45-110	0-30

Analyte	CAS #	Residential NMED Soil Screening Levels[a] ug/kg	Limit of Quantitation (LOQ) µg/kg	Limit of Detection (LOD) µg/kg	Detection Limit (DL) µg/kg	Accuracy Control Limit (%R)	Precision Control Limit RPD
4-Nitroaniline	100-01-6	240,000[b,c]	1650	167	4.25	35-115	0-30
4-Nitrophenol	100-02-7	NA	1650	167	21	15-140	0-30
Acenaphthene	83-32-9	3,440,000	330	33.3	10.1	45-110	0-30
Acenaphthylene	208-96-8	NA	330	33.3	6.75	45-105	0-30
Acetophenone	98-86-2	7,820,000	330	33.3	9.85	60-124	0-30
Anthracene	120-12-7	17,200,000	330	33.3	6.79	55-105	0-30
Atrazine	1912-24-9	21,000[b,c]	660	66.7	6.94	43-150	0-30
Benzo(a)anthracene	56-55-3	1,480	330	33.3	6.16	50-110	0-30
Benzo(a)pyrene	50-32-8	150	330	33.3	4.14	50-110	0-30
Benzo(b)fluoranthene	205-99-2	1,480	330	33.3	6.52	45-115	0-30
Benzo(g,h,i)perylene	191-24-2	NA	330	16.7	4.99	40-125	0-30
Benzo(k)fluoranthene	207-08-9	14,800	330	33.3	5.1	45-125	0-30
Benzaldehyde	100-52-7	7,800,000[b]	1650	167	32	25-127	0-30
Biphenyl	92-52-4	57,100	330	33.3	4.88	39-122	0-30
Bis(2-Chloroethoxy)methane	111-91-1	180,000[b]	330	33.3	5.76	45-110	0-30
Bis(2-Chloroethyl)ether	111-44-4	2,700	330	33.3	12.8	40-105	0-30
Bis(2-Chloroisopropyl)ether	108-60-1	91,500	330	33.3	7.23	20-115	0-30
Bis(2-Ethylhexyl)phthalate	117-81-7	347,000	330	33.3	4.68	45-125	0-30
Butyl benzyl phthalate	85-68-7	2,600,000[b,c]	330	16.7	6.59	50-125	0-30
Caprolactam	105-60-2	310,00,000[b]	330	667	14.6	34-120	0-30
Carbazole	86-74-8	NA	330	33.3	6.38	45-115	0-30
Chrysene	218-01-9	147,000	330	33.3	7.15	55-110	0-30
Di-n-butyl phthalate	84-74-2	6,110,000	330	16.7	6.38	55-110	0-30
Di-n-octyl phthalate	117-84-0	610,000[b]	330	16.7	4.37	40-130	0-30
Dibenz(a,h)anthracene	53-70-3	150	330	16.7	4.74	40-125	0-30
Dibenzofuran	132-64-9	78,000[b]	330	33.3	6.28	50-105	0-30
Diethyl phthalate	84-66-2	48,900,000	330	33.3	12.2	50-115	0-30
Dimethyl phthalate	131-11-3	611,000,000	330	16.7	5.14	50-110	0-30

Analyte	CAS #	Residential NMED Soil Screening Levels[a] ug/kg	Limit of Quantitation (LOQ) µg/kg	Limit of Detection (LOD) µg/kg	Detection Limit (DL) µg/kg	Accuracy Control Limit (%R)	Precision Control Limit RPD
Fluoranthene	206-44-0	2,290,000	330	16.7	5.37	55-115	0-30
Fluorene	86-73-7	2,290,000	330	33.3	5.95	50-110	0-30
Hexachlorobenzene	118-74-1	3,040	330	66.7	12.8	45-120	0-30
Hexachlorobutadiene	87-68-3	61,100	330	33.3	8.74	40-115	0-30
Hexachlorocyclopentadiene	77-47-4	367,000	330	167	70	23-121	0-30
Hexachloroethane	67-72-1	42,800	330	33.3	15.7	35-110	0-30
Indeno(1,2,3-cd)pyrene	193-39-5	1,480	330	33.3	7.95	40-120	0-30
Isophorone	78-59-1	5,120,000	330	33.3	5.87	45-110	0-30
Naphthalene	91-20-3	43,000	330	33.3	10.3	40-105	0-30
Nitrobenzene	98-95-3	53,500	330	33.3	17.2	45-120	0-30
Pentachlorophenol	87-86-5	8,940	1650	167	7.39	25-120	0-30
Phenanthrene	85-01-8	1,830,000	330	33.3	7.58	50-110	0-30
Phenol	108-95-2	18,300,000	330	33.3	9.1	40-100	0-30
Pyrene	129-00-0	1,720,000	330	33.3	4.63	45-125	0-30
m,p-Cresol (3,4-Dimethylpheonol)	1319-77-3MP	61,000[b]	330	167	12.4	40-105	0-30
n-Nitrosodi-n-propylamine	621-64-7	6,900[b,c]	330	33.3	14.4	40-115	0-30
n-Nitrosodiphenylamine	86-30-6	993,000	330	33.3	6.98	50-115	0-30
o-Cresol (2-Methylphenol)	95-48-7	3,100,000[b]	330	33.3	10.2	40-105	0-30
2,4,6-Tribromophenol (Surrogate)	118-79-6	NA	NA	NA	NA	35-125	NA
2-Fluorobiphenyl (Surrogate)	321-60-8	NA	NA	NA	NA	45-105	NA
2-Fluorophenol (Surrogate)	367-12-4	NA	NA	NA	NA	35-105	NA
Nitrobenzene-d5 (Surrogate)	4165-60-0	NA	NA	NA	NA	35-100	NA
Phenol-d5 (Surrogate)	4165-62-2	NA	NA	NA	NA	40-100	NA
Terphenyl-d14 (Surrogate)	1718-51-0	NA	NA	NA	NA	30-125	NA

Notes and Abbreviations:
[a]Residential Soil Screening Levels, per most recent update on the NMED Hazardous Waste Bureau Documents web page: *Risk Assessment Guidance for Site Investigations and Remediation* (February 2012, updated June 2012), used for all analytes for which NMED Screening Levels established.
[b]USEPA Residential Screening Level, May 2013, used when no NMED Residential Screening Level is established.
[c]Ten times the USEPA Residential Screening Level, May 2013, is used for compounds designated "c" (carcinogen effects) if no NMED Residential Screening Level is established, as specified in Appendix 4F of the Permit.

µg/kg - microgram per kilogram
NA - not applicable (no NMED or USEPA Residential Screening Levels established)
CAS - Chemical Abstracts Service
NMED - New Mexico Environment Department
RPD - relative percent difference

Analyte	CAS Number	Residential NMED Soil Screening Levels[a] ug/kg	Limit of Quantitation (LOQ) µg/kg	Limit of Detection (LOD) µg/kg	Detection Limit (DL) µg/kg	Accuracy Control Limit (%R)	Precision Control Limit RPD
Matrix: Soil **Analyical Group: SW8260 Volatiles**							
Acetone	67-64-1	66,600,000	25	2	0.296	20-160	0-30
Benzene	71-43-2	15,400	5	0.5	0.051	75-125	0-30
Bromochloromethane	74-97-5	160,000[b]	5	0.5	0.332	70-125	0-30
Bromodichloromethane	75-27-4	5,410	5	0.2	0.104	70-130	0-30
Bromoform	75-25-2	616,000	5	0.5	0.437	55-135	0-30
Bromomethane	74-83-9	16,500	5	2	0.486	30-160	0-30
2-Butanone	78-93-3	3,710,000	5	2	0.323	30-160	0-30
Carbon disulfide	75-15-0	1,530,000	5	0.5	0.187	45-160	0-30
Carbon tetrachloride	56-23-5	10,830	5	0.5	0.189	65-135	0-30
Chlorobenzene	108-90-7	376,000	5	0.5	0.129	75-125	0-30
Chloroethane	75-00-3	29,800,000	5	0.5	0.202	40-155	0-30
Chloroform	67-66-3	5,860	5	0.5	0.172	70-125	0-30
Chloromethane	74-87-3	275,000	5	2	0.193	50-130	0-30
Cyclohexane	110-82-7	7,000[b]	5	0.5	0.105	61-143	0-30
Dibromochloromethane	124-48-1	12,100	5	0.5	0.25	65-130	0-30
1,2-Dibromo-3-chloropropane	96-12-8	1,860	5	2	0.285	40-135	0-30
1,2-Dibromoethane (EDB)	106-93-4	590	5	2	0.206	70-125	0-30
1,2-Dichlorobenzene	95-50-1	2,310,000	5	0.5	0.166	75-120	0-30
1,3-Dichlorobenzene	541-73-1	NA	5	0.5	0.196	70-125	0-30
1,4-Dichlorobenzene	106-46-7	31,700	5	0.5	0.2	70-125	0-30
1,2-Dichloroethane	107-06-2	7,900	5	0.5	0.198	70-135	0-30
Dichlorodifluoromethane	75-71-8	168,000	5	0.5	0.224	35-135	0-30
1,1-Dichloroethane	75-34-3	64,500	5	0.5	0.096	75-125	0-30
1,1-Dichloroethene	75-35-4	449,000	5	0.5	0.227	65-135	0-30
1,2-Dichloroethene (total)	540-59-0	NA[c]	10	1	0.233	65-125	0-30
cis-1,2-Dichloroethene	156-59-2	156,000	5	0.5	0.114	65-125	0-30

Analyte	CAS Number	Residential NMED Soil Screening Levels[a] ug/kg	Limit of Quantitation (LOQ) µg/kg	Limit of Detection (LOD) µg/kg	Detection Limit (DL) µg/kg	Accuracy Control Limit (%R)	Precision Control Limit RPD
trans-1,2-Dichloroethene	156-60-5	270,000	5	0.5	0.119	65-135	0-30
1,2-Dichloropropane	78-87-5	15,200	5	0.5	0.291	70-120	0-30
trans-1,3-Dichloropropene	10061-02-6	33,700[a,d]	5	0.5	0.082	65-125	0-30
cis-1,3-Dichloropropene	10061-01-5	33,700[a,d]	5	0.5	0.129	70-125	0-30
Ethylbenzene	100-41-4	68,400	5	0.5	0.183	75-125	0-30
2-Hexanone (MBK)	591-78-6	5,820,000	5	2	0.295	45-145	0-30
Isopropylbenzene (Cumene)	98-82-8	2,430,000	5	0.5	0.105	75-130	0-30
Methyl Acetate	79-20-9	78,200,000	5	1	0.506	41-164	0-30
Methylcyclohexane	108-87-2	5,630,000	5	0.5	0.15	79-122	0-30
4-Methyl-2-pentanone (MIBK)	108-10-1	5,300[b]	5	0.5	0.154	45-145	0-30
Methylene chloride (Dichloromethane)	75-09-2	409,000	10	1	0.512	55-140	0-30
Methyl-tert-butyl ether	1634-04-4	901,000	5	0.5	0.061	50-135	0-30
Styrene	100-42-5	7,280,000	5	0.5	0.083	75-125	0-30
1,1,2,2-Tetrachloroethane	79-34-5	8,020	5	0.5	0.175	55-130	0-30
Tetrachloroethene	127-18-4	7,020	5	0.5	0.296	65-140	0-30
Toluene	108-88-3	5,270,000	5	0.5	0.107	70-125	0-30
1,2,3-Trichlorobenzene	87-61-6	49,000[b]	5	0.5	0.36	60-135	0-30
1,2,4-Trichlorobenzene	120-82-1	72,300	5	0.5	0.305	65-130	0-30
1,1,2-Trichloroethane	79-00-5	2,810	5	0.5	0.064	60-125	0-30
1,1,1-Trichloroethane	71-55-6	15,600,000	5	0.5	0.162	70-135	0-30
Trichloroethene	79-01-6	8,770	5	0.5	0.127	75-125	0-30
Trichlorofluoromethane	75-69-4	1,410,000	5	0.5	0.129	25-185	0-30
Trichlorotrifluoroethane	76-13-1	72,100,000	5	0.5	0.372	71-137	0-30
Vinyl chloride	75-01-4	730	5	0.5	0.194	60-125	0-30
m,p-Xylene	136777-61-2	775,000[e]	10	1	0.167	80-125	0-30
o-Xylene	95-47-6	898,000	5	0.5	0.08	75-125	0-30
Xylenes (total)	1330-20-7	814,000	15	1.5	0.247	75-125	0-30

Analyte	CAS Number	Residential NMED Soil Screening Levels[a] ug/kg	Limit of Quantitation (LOQ) µg/kg	Limit of Detection (LOD) µg/kg	Detection Limit (DL) µg/kg	Accuracy Control Limit (%R)	Precision Control Limit RPD
1,2-Dichloroethane-d4 (Surrogate)	17060-07-0	NA	NA	NA	NA	62-125	NA
4-Bromofluorobenzene (Surrogate)	460-00-4	NA	NA	NA	NA	85-120	NA
Dibromofluoromethane (Surrogate)	1868-53-7	NA	NA	NA	NA	65-130	NA
Toluene-d8 (Surrogate)	2037-26-5	NA	NA	NA	NA	85-115	NA

Notes and Abbreviations:
[a]Residential Soil Screening Levels, per most recent update on the NMED Hazardous Waste Bureau Documents web page: *Risk Assessment Guidance for Site Investigations and Remediation* (February 2012, updated June 2012), used for all analytes for which NMED Screening Levels established.
[b]USEPA Residential Screening Level, May 2013, used when no NMED Residential Screening Level is established. None of these volatile compounds are designated "c" (carcinogen effects).
[c]Refer to cis-1,2-Dichloroethene and trans-1,2-Dichloroethene)
[d]Residential screening level is for Total 1,3-Dichloropropene (cis-1,3-Dichloropropene plus trans-1,3-Dichloropropene)
[e]Residential screening level is m-xylene as NMED does not have screening level for m&p-xylene.
µg/kg - microgram per kilogram
CAS - Chemical Abstracts Service
RPD - relative percent difference
NA - not applicable (no NMED or USEPA Residential Screening Levels established)
NMED - New Mexico Environment Department

Analyte	CAS Number	Residential NMED Soil Screening Levels[a] ug/kg	Limit of Quantitation (LOQ) µg/kg	Limit of Detection (LOD) µg/kg	Detection Limit (DL) µg/kg	Accuracy Control Limit (%R)	Precision Control Limit (% RPD)
Matrix: Soil **Analyical Group: SW8081 Pesticides**							
Aldrin	309-00-2	280	1.67	1	0.83	45-140	30
alpha-BHC	319-84-6	770	1.67	1	0.83	60-125	30
beta-BHC	319-85-7	2,700	1.67	1	0.83	60-125	30
delta-BHC	319-86-8	NA	1.67	1	0.83	55-130	30
gamma-BHC (Lindane)	58-89-9	5,170	1.67	1	0.83	60-125	30
alpha-Chlordane	5103-71-9	16,200[d]	1.67	1	0.83	65-120	30
gamma-Chlordane	5103-74-2	16,200[d]	1.67	1	0.83	65-125	30
4,4'-Dichlorodiphenyl dichloroethane (4,4'-DDD)	72-54-8	20,300[e]	3.33	1	0.83	30-135	30
4,4'-Dichlorodiphenyl dichloroethylene (4,4'-DDE)	72-55-9	14,300[e]	3.33	1	0.83	70-125	30
4,4'-Dichlorodiphenyl trichloroethane (4,4'-DDT)	50-29-3	17,200[e]	3.33	1	0.83	45-140	30
Dieldrin	60-57-1	300	3.33	1	0.83	65-125	30
Endosulfan I	959-98-8	367,000[f]	1.67	1	0.83	15-135	30
Endosulfan II	33213-65-9	367,000[f]	3.33	1	0.83	35-140	30
Endosulfan sulfate	1031-07-8	NA	3.33	1	0.83	60-135	30
Endrin	72-20-8	18,300	3.33	1	0.83	60-135	30
Endrin aldehyde	7421-93-4	NA	3.33	1	0.83	35-145	30
Endrin ketone	53494-70-5	NA	3.33	1	0.83	65-135	30
Heptachlor	76-44-8	1,080	1.67	1	0.83	50-140	30
Heptachlor epoxide	1024-57-3	530[b,c]	1.67	1	0.83	65-130	30
Methoxychlor	72-43-5	310,000	1.67	1	0.83	55-145	30
Toxaphene	8001-35-2	4,420	8.33	4.17	5	NA	NA
Decachlorobiphenyl (Surrogate)	2051-24-3	NA	NA	NA	NA	55-130	NA
Tetrachloro-m-xylene (Surrogate)	877-09-8	NA	NA	NA	NA	70-125	NA

Notes and Abbreviations:
[a]Residential Soil Screening Levels, per most recent update on the NMED Hazardous Waste Bureau Documents web page: *Risk Assessment Guidance for Site Investigations and Remediation* (February 2012, updated June 2012), used for all analytes for which NMED Screening Levels established.
[b]USEPA Residential Screening Level, May 2013, used when no NMED Residential Screening Level is established.
[c]Ten times the USEPA Residential Screening Level, May 2013, is used for compounds designated "c" (carcinogen effects) if no NMED Residential Screening Level is established, as specified in Appendix 4F of the Permit.
[d]NMED Screening Level for total chlordane is presented as individual Screening Levels for alpha-chlordane and gamma-chlordane are not available.
[e]NMED Screening Levels for DDD, DDE, and DDT are presented for 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT, respectively, as NMED Screening Levels are not presented for the specific isomers 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT.
[f]NMED Screening Level for Endosulfan is presented as individual Screening Levels for Endosulfan-I and Endosulfan-II are not available.
µg/kg - microgram per kilogram
NA - not applicable (no NMED or USEPA Residential Screening Levels established)
RPD - relative percent difference
CAS - Chemical Abstracts Service
NMED - New Mexico Environment Department

Analyte	CAS Number	Residential NMED Soil Screening Levels[a] ug/kg	Limit of Quantitation (LOQ) mg/kg	Limit of Detection (LOD) mg/kg	Detection Limit (DL) mg/kg	Accuracy Control Limit (%R)	Precision Control Limit (% RPD)
Matrix: Soil **Analytical Group: SW6000/7000 Metals**							
Aluminum	7429-90-5	78,000,000	0.8	0.4	0.2	80-120	20
Antimony	7440-36-0	31,300	0.08	0.04	0.02	80-120	20
Arsenic	7440-38-2	3,900	0.04	0.02	0.01	80-120	20
Barium	7440-39-3	15,600,000	0.04	0.02	0.01	80-120	20
Beryllium	7440-41-7	156,000	0.04	0.02	0.01	80-120	20
Cadmium	7440-43-9	70,300	0.04	0.02	0.01	80-120	20
Calcium	7440-70-2	NA	20	10	5	80-120	20
Chromium (total)	7440-47-3	117,000,000[c]	0.04	0.02	0.01	80-120	20
Chromium VI	18540-29-9	2,970[d]	0.5	0.5	0.31	80-120	30
Cobalt	7440-48-4	23,000[b]	0.04	0.02	0.01	80-120	20
Copper	740-50-8	3,130,000	0.04	0.02	0.01	80-120	20
Iron	7439-89-6	54,800,000	4	2	1	80-120	20
Lead	7439-92-1	400,000	0.04	0.02	0.01	80-120	20
Magnesium	7439-95-4	NA	4	2	1	80-120	20
Manganese	7439-96-5	1,860,000	0.2	0.1	0.05	80-120	20
Mercury	7439-97-6	10,000[b]	0.01	0.01	0.0024	80-120	20
Nickel	7440-02-0	1,560,000	0.8	0.4	0.2	80-120	20
Potassium	9/7/7440	NA	4	2	1	80-120	20
Selenium	7782-49-2	391,000	0.04	0.02	0.01	80-120	20
Silver	7440-22-4	391,000	0.04	0.02	0.01	75-120	20
Sodium	7440-23-5	NA	4	2	1	80-120	20
Thallium	7440-28-0	780	0.04	0.02	0.01	80-120	20
Vanadium	7440-62-2	391,000	0.04	0.02	0.01	80-120	20
Zinc	7440-66-6	23,500,000	0.8	0.4	0.2	80-120	20

Notes and Abbreviations:
[a]Residential Soil Screening Levels, per most recent update on the NMED Hazardous Waste Bureau Documents web page: *Risk Assessment Guidance for Site Investigations and Remediation* (February 2012, updated June 2012), used for all analytes for which NMED Screening Levels established.
[b]USEPA Residential Screening Level, May 2013, used when no NMED Residential Screening Level is established. None of these analytes are designated "c" (carcinogen effects).
[c]NMED Screening Level for trivalent chromium is presented as no NMED Residential Screening Level or USEPA Screening Level is established for chromium (total). Trivalent chromium can be calculated as the difference between trivalent chromium and hexavalent chromium. If the total chromium result does not exceed the screening level for hexavalent chromium, the sample will be considered acceptable for both hexavalent chromium and trivalent chromium.

[d]NMED Screening Level for hexavalent chromium is presented. Hexavalent chromium analysis will only be required if the total chromium result exceeds the screening level for hexavalent chromium.
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
CAS - Chemical Abstracts Service
RPD - relative percent difference
NA - not applicable (no NMED or USEPA Residential Screening Levels established)
NMED - New Mexico Environment Department

ANALYTICAL REQUIREMENTS FOR AQUEOUS CLEAN CLOSURE AND WASTE DISPOSAL ON-SITE:

Analyte	CAS Number	Residential NMED Water Screening Levels[b] ug/L	Limit of Quantitation (LOQ) µg/L	Limit of Detection (LOD) µg/L	Detection Limit (DL) µg/L	Accuracy Control Limit (%R)	Precision Control Limit (Advisory %) RPD
Matrix: Rinsate Criteria for Closure and Base Sewer System Disposal **Analyical Group: SW8082 PCBs**							
Aroclor-1016	12674-11-2	0.5[b]	1.0	0.5	0.4	25-145	30
Aroclor-1221	11104-28-2	1.0	1.0	0.5	0.4	NA	NA
Aroclor-1232	11141-16-5	1.0	1.0	0.5	0.4	NA	NA
Aroclor-1242	53469-21-9	1.0	1.0	0.5	0.4	NA	NA
Aroclor-1248	12672-29-6	1.0	1.0	0.5	0.4	NA	NA
Aroclor-1254	11097-69-1	1.0	1.0	0.5	0.4	NA	NA
Aroclor-1260	11096-82-5	1.0	1.0	0.5	0.4	30-145	30
Decachlorobiphenyl (Surrogate)	2051-24-3	NA	NA	NA	NA		NA

Analyte	CAS #	Residential NMED Water Screening Levels[a] ug/L	Limit of Quantitation (LOQ) µg/L	Limit of Detection (LOD) µg/L	Detection Limit (DL) µg/L	Accuracy Control Limit (%R)	Precision Control Limit RPD
Matrix: Rinsate Criteria for Closure and Base Sewer System Disposal **Analyical Group: SW8270 Semi-volatiles**							
1,2,4,5-Tetrachlorobenzene	95-94-3	NA	20	0.5	0.407	67-120	30
1,2,4-Trichlorobenzene	120-82-1	NA	10	0.5	0.468	35-100	30
1,2-Dichlorobenzene	95-50-1	600[a]	10	0.5	0.421	35-100	30
1,3-Dichlorobenzene	541-73-1	NA	10	0.5	0.418	30-100	30
1,4-Dichlorobenzene	106-46-7	75[a]	10	1.2	0.49	30-100	30
2,3,4,6-Tetrachlorophenol	58-90-2	5.0[b]	20	0.5	0.171	36-120	30
2,4,5-Trichlorophenol	95-95-4	5.0[b]	10	0.5	0.269	50-110	30
2,4,6-Trichlorophenol	88-06-2	5.0[b]	10	0.5	0.324	50-115	30

Analyte	CAS #	Residential NMED Water Screening Levels[a] ug/L	Limit of Quantitation (LOQ) µg/L	Limit of Detection (LOD) µg/L	Detection Limit (DL) µg/L	Accuracy Control Limit (%R)	Precision Control Limit RPD
2,4-Dichlorophenol	120-83-2	5.0[b]	10	0.5	0.383	50-105	30
2,4-Dimethylphenol	105-67-9	5.0[b]	10	1.2	0.374	30-110	30
2,4-Dinitrophenol	51-28-5	5.0[b]	10	5	1.36	15-140	30
2,4-Dinitrotoluene	121-14-2	NA	10	0.5	0.283	50-120	30
2,6-Dichlorophenol	87-65-0	5.0[b]	20	0.5	0.444	59-120	30
2,6-Dinitrotoluene	606-20-2	NA	10	0.5	0.246	50-115	30
2-Chloronaphthalene	91-58-7	NA	10	0.5	0.391	50-105	30
2-Chlorophenol	95-57-8	5.0[b]	10	0.5	0.309	35-105	30
2-Methylnaphthalene	91-57-6	30[c]	10	0.5	0.469	45-105	30
2-Nitroaniline	88-74-4	NA	10	0.5	0.154	50-115	30
2-Nitrophenol	88-75-5	5.0[b]	10	0.5	0.457	40-115	30
3,3'-Dichlorobenzidine	91-94-1	NA	10	0.5	0.122	20-110	30
3-Nitroaniline	99-09-2	NA	10	0.5	0.304	20-125	30
4,6-Dinitro-2-methylphenol	534-52-1	5.0[b]	10	5	1.07	40-130	30
4-Bromophenyl phenyl ether	101-55-3	NA	10	0.5	0.451	50-115	30
4-Chloro-3-methylphenol	59-50-7	5.0[b]	10	0.5	0.332	45-110	30
4-Chloroaniline	106-47-8	NA	10	0.5	0.291	15-110	30
4-Chlorophenyl phenyl ether	7005-72-3	NA	10	0.5	0.398	50-110	30
4-Nitroaniline	100-01-6	NA	10	5	0.328	35-120	30
4-Nitrophenol	100-02-7	5.0[b]	10	5	1.17	10-120	30
Acenaphthene	83-32-9	NA	10	0.5	0.365	45-110	30
Acenaphthylene	208-96-8	NA	10	0.5	0.369	50-105	30
Acetophenone	98-86-2	NA	10	0.5	0.432	40-120	30
Anthracene	120-12-7	NA	10	0.5	0.215	55-110	30
Atrazine	1912-24-9	3.0[a]	50	10	0.332	39-148	30
Benzo(a)anthracene	56-55-3	NA	10	0.5	0.246	55-110	30
Benzo(a)pyrene	50-32-8	0.20[a]	10	0.5	0.17	55-110	30
Benzo(b)fluoranthene	205-99-2	NA	10	0.5	0.185	45-120	30

Analyte	CAS #	Residential NMED Water Screening Levels[a] ug/L	Limit of Quantitation (LOQ) µg/L	Limit of Detection (LOD) µg/L	Detection Limit (DL) µg/L	Accuracy Control Limit (%R)	Precision Control Limit RPD
Benzo(g,h,i)perylene	191-24-2	NA	10	0.5	0.198	40-120	30
Benzo(k)fluoranthene	207-08-9	NA	10	0.5	0.275	45-125	30
Benzaldehyde	100-52-7	NA	50	10	1.08	40-118	30
Biphenyl	92-52-4	NA	10	0.5	0.493	39-122	30
Bis(2-Chloroethoxy)methane	111-91-1	NA	10	0.5	0.405	45-105	30
Bis(2-Chloroethyl)ether	111-44-4	NA	10	0.5	0.422	35-110	30
Bis(2-Chloroisopropyl)ether	108-60-1	NA	10	0.5	0.406	25-130	30
Bis(2-Ethylhexyl)phthalate	117-81-7	6.0[a]	10	0.5	0.186	40-125	30
Butyl benzyl phthalate	85-68-7	NA	10	5	0.213	45-115	30
Caprolactam	105-60-2	NA	10	10	1.04	10-120	30
Carbazole	86-74-8	NA	10	0.5	0.264	50-115	30
Chrysene	218-01-9	NA	10	0.5	0.129	55-110	30
Di-n-butyl phthalate	84-74-2	NA	10	0.5	0.262	55-115	30
Di-n-octyl phthalate	117-84-0	NA	10	0.5	0.123	35-135	30
Dibenz(a,h)anthracene	53-70-3	NA	10	0.5	0.214	40-125	30
Dibenzofuran	132-64-9	NA	10	0.5	0.371	55-105	30
Diethyl phthalate	84-66-2	NA	10	0.5	0.262	40-120	30
Dimethyl phthalate	131-11-3	NA	10	0.5	0.336	25-125	30
Fluoranthene	206-44-0	NA	10	0.5	0.235	55-115	30
Fluorene	86-73-7	NA	10	0.5	0.358	50-110	30
Hexachlorobenzene	118-74-1	1.0[a]	10	1.2	0.499	50-110	30
Hexachlorobutadiene	87-68-3	NA	10	1.2	0.49	25-105	30
Hexachlorocyclopentadiene	77-47-4	50[a]	10	5	1.44	16-120	30
Hexachloroethane	67-72-1	NA	10	1.2	0.476	30-100	30
Indeno(1,2,3-cd)pyrene	193-39-5	NA	10	0.5	0.159	45-125	30
Isophorone	78-59-1	NA	10	0.5	0.368	50-110	30
Naphthalene	91-20-3	30[c]	10	0.5	0.466	40-100	30
Nitrobenzene	98-95-3	NA	10	0.5	0.381	45-110	30

Analyte	CAS #	Residential NMED Water Screening Levels[a] ug/L	Limit of Quantitation (LOQ) µg/L	Limit of Detection (LOD) µg/L	Detection Limit (DL) µg/L	Accuracy Control Limit (%R)	Precision Control Limit RPD
Pentachlorophenol	87-86-5	1.0[a]	10	0.5	0.288	40-115	30
Phenanthrene	85-01-8	NA	10	0.5	0.189	50-115	30
Phenol	108-95-2	5.0[b]	10	0.5	0.191	10-120	30
Pyrene	129-00-0	NA	10	0.5	0.406	50-130	30
m,p-Cresol (3,4-Dimethylpheonol)	1319-77-3MP	5.0[b]	10	0.5	0.177	30-110	30
n-Nitrosodi-n-propylamine	621-64-7	NA	10	0.5	0.417	35-130	30
n-Nitrosodiphenylamine	86-30-6	NA	10	0.5	0.335	50-110	30
o-Cresol (2-Methylphenol)	95-48-7	5.0[b]	10	0.5	0.253	40-110	30
2,4,6-Tribromophenol (Surrogate)	118-79-6	NA	NA	NA	NA	40-125	NA
2-Fluorobiphenyl (Surrogate)	321-60-8	NA	NA	NA	NA	50-110	NA
2-Fluorophenol (Surrogate)	367-12-4	NA	NA	NA	NA	20-110	NA
Nitrobenzene-d5 (Surrogate)	4165-60-0	NA	NA	NA	NA	40-110	NA
Phenol-d5 (Surrogate)	4165-62-2	NA	NA	NA	NA	10-115	NA
Terphenyl-d14 (Surrogate)	1718-51-0	NA	NA	NA	NA	50-135	NA

Notes and Abbreviations:

[a]NMED has established ground water cleanup levels for hazardous waste and/or hazardous constituents that incorporate both the New Mexico WQCC groundwater standards for contaminants per 20.6.2.3103 NMAC and EPA's National Primary Drinking Water Standards MCLs. If both the WQCC ground water standard and an MCL have been established for an individual hazardous waste and/or constituents, then the lower of the two levels will be the cleanup level for that hazardous waste and/or constituents. The USEPA MCL is presented as it is less than the WQCC groundwater standard or no WQCC groundwater standard is available. No WQCC groundwater standards are presented as the US EPA MCLs are lower.

[b]The WQCC groundwater Part B "Other Standards for Domestic Water Supply" standard for "Phenols" is presented as no MCL is available.

[c]The WQCC groundwater Part B "Other Standards for Domestic Water Supply" standard for "PAHs: total naphthalene plus monomethylnaphthalenes" is presented as no MCL is available.

CAS - Chemical Abstracts Service
NMED - New Mexico Environment Department
RPD - relative percent difference
NA - not applicable (no WQCC groundwater standard or USEPA MCL established)

Analyte	CAS Number	Residential NMED Water Screening Levels[a] ug/L	Limit of Quantitation (LOQ) µg/L	Limit of Detection (LOD) µg/L	Detection Limit (DL) µg/L	Accuracy Control Limit (%R)	Precision Control Limit RPD
Matrix: Rinsate Criteria for Closure and Base Sewer System Disposal **Analyical Group: SW8260 Volatiles**							
Acetone	67-64-1	NA	5	1	0.193	40-140	30
Benzene	71-43-2	5.0[a]	1	0.2	0.111	80-120	30
Bromochloromethane	74-97-5	NA	1	0.5	0.127	65-130	30
Bromodichloromethane	75-27-4	80[a,c]	1	0.2	0.083	75-120	30
Bromoform	75-25-2	80[a,c]	1	0.5	0.215	70-130	30
Bromomethane	74-83-9	NA	1	0.5	0.427	30-145	30
2-Butanone	78-93-3	NA	5	0.5	0.142	30-150	30
Carbon disulfide	75-15-0	NA	1	0.5	0.19	35-160	30
Carbon tetrachloride	56-23-5	5[a]	1	0.5	0.248	65-140	30
Chlorobenzene	108-90-7	100[a]	1	0.2	0.083	80-120	30
Chloroethane	75-00-3	NA	1	0.5	0.235	60-135	30
Chloroform	67-66-3	80[a,c]	1	0.2	0.155	65-135	30
Chloromethane	74-87-3	NA	1	0.2	0.144	40-125	30
Cyclohexane	110-82-7	NA	1	0.5	0.337	71-127	30
Dibromochloromethane	124-48-1	80[a,c]	1	0.2	0.054	60-135	30
1,2-Dibromo-3-chloropropane	96-12-8	0.20[a]	1	0.2	0.194	50-130	30
1,2-Dibromoethane (EDB)	106-93-4	0.050[a]	1	0.2	0.102	80-120	30
1,2-Dichlorobenzene	95-50-1	600[a]	1	0.2	0.135	70-120	30
1,3-Dichlorobenzene	541-73-1	NA	1	0.2	0.138	75-125	30
1,4-Dichlorobenzene	106-46-7	75[a]	1	0.2	0.083	75-125	30
1,2-Dichloroethane	107-06-2	5[a]	1	0.2	0.116	70-130	30
Dichlorodifluoromethane	75-71-8	NA	1	0.2	0.145	30-155	30
1,1-Dichloroethane	75-34-3	25[b]	1	0.2	0.171	70-135	30
1,1-Dichloroethene	75-35-4	5.0[b]	1	0.5	0.2	70-130	30
1,2-Dichloroethene (total)	540-59-0	NA[d]	2	0.4	0.18	60-140	30
cis-1,2-Dichloroethene	156-59-2	70[a]	1	0.2	0.103	70-125	30

Analyte	CAS Number	Residential NMED Water Screening Levels[a] ug/L	Limit of Quantitation (LOQ) µg/L	Limit of Detection (LOD) µg/L	Detection Limit (DL) µg/L	Accuracy Control Limit (%R)	Precision Control Limit RPD
trans-1,2-Dichloroethene	156-60-5	100[a]	1	0.2	0.077	60-140	30
1,2-Dichloropropane	78-87-5	5.0[a]	1	0.2	0.116	75-125	30
trans-1,3-Dichloropropene	10061-02-6	NA	1	0.2	0.128	55-140	30
cis-1,3-Dichloropropene	10061-01-5	NA	1	0.2	0.124	70-130	30
Ethylbenzene	100-41-4	700[a]	1	0.2	0.109	75-125	30
2-Hexanone (MBK)	591-78-6	NA	5	1	0.122	55-130	30
Isopropylbenzene (Cumene)	98-82-8	NA	1	0.2	0.13	75-125	30
Methyl Acetate	79-20-9	NA	5	2	0.159	55-134	30
Methylcyclohexane	108-87-2	NA	1	0.2	0.143	77-123	30
4-Methyl-2-pentanone (MIBK)	108-10-1	NA	5	0.5	0.12	60-135	30
Methylene chloride (Dichloromethane)	75-09-2	5.0[a]	5	0.5	0.149	55-140	30
Methyl-tert-butyl ether	1634-04-4	NA	1	0.2	0.078	65-125	30
Styrene	100-42-5	100[a]	1	0.2	0.089	65-135	30
1,1,2,2-Tetrachloroethane	79-34-5	10[b]	1	0.2	0.109	65-130	30
Tetrachloroethene	127-18-4	5.0[a]	1	0.5	0.193	45-150	30
Toluene	108-88-3	750[a]	1	0.2	0.122	75-120	30
1,2,3-Trichlorobenzene	87-61-6	NA	1	0.2	0.079	55-140	30
1,2,4-Trichlorobenzene	120-82-1	70[a]	1	0.2	0.105	65-135	30
1,1,1-Trichloroethane	71-55-6	60[b]	1	0.2	0.123	65-130	30
1,1,2-Trichloroethane	79-00-5	5.0[a]	1	0.2	0.159	75-125	30
Trichloroethene	79-01-6	5.0[a]	1	0.2	0.161	70-125	30
Trichlorofluoromethane	75-69-4	NA	1	0.2	0.157	60-145	30
Trichlorotrifluoroethane	76-13-1	NA	1	0.5	0.158	72-130	30
Vinyl chloride	75-01-4	1.0[b]	1	0.2	0.127	50-145	30
m,p-Xylene	136777-61-2	NA[e]	2	0.4	0.123	75-130	30
o-Xylene	95-47-6	NA[e]	1	0.2	0.055	80-120	30
Xylenes (total)	1330-20-7	620[b]	3	0.6	0.179	75-130	30

Analyte	CAS Number	Residential NMED Water Screening Levels[a] ug/L	Limit of Quantitation (LOQ) µg/L	Limit of Detection (LOD) µg/L	Detection Limit (DL) µg/L	Accuracy Control Limit (%R)	Precision Control Limit RPD
1,2-Dichloroethane-d4 (Surrogate)	17060-07-0	NA	NA	NA	NA	70-120	NA
4-Bromofluorobenzene (Surrogate)	460-00-4	NA	NA	NA	NA	75-120	NA
Dibromofluoromethane (Surrogate)	1868-53-7	NA	NA	NA	NA	85-115	NA
Toluene-d8 (Surrogate)	2037-26-5	NA	NA	NA	NA	85-120	NA

Notes and Abbreviations:

[a]NMED has established ground water cleanup levels for hazardous waste and/or hazardous constituents that incorporate both the New Mexico WQCC groundwater standards for contaminants per 20.6.2.3103 NMAC and EPA's National Primary Drinking Water Standards MCLs. If both the WQCC ground water standard and an MCL have been established for an individual hazardous waste and/or constituents, then the lower of the two levels will be the cleanup level for that hazardous waste and/or constituents. The USEPA MCL is presented as it is less than the WQCC groundwater standard or no WQCC groundwater standard is available.

[b]The WQCC groundwater standard is presented as it is less than the US EPA MCL or no MCL is available.

[c]The MCL for total trihalomethanes is presented.

[d]Refer to cis-1,2-Dichloroethene and trans-1,2-Dichloroethene

[e]Refer to total xylenes.

µg/L - microgram per kilogram

CAS - Chemical Abstracts Service

RPD - relative percent difference

NA - not applicable (no WQCC groundwater standard or USEPA MCL established)

NMED - New Mexico Environment Department

Analyte	CAS Number	Residential NMED Water Screening Levels ug/L	Limit of Quantitation (LOQ) µg/L	Limit of Detection (LOD) µg/L	Detection Limit (DL) µg/L	Accuracy Control Limit (%R)	Precision Control Limit (% RPD)
Matrix: Rinsate Criteria for Closure and Base Sewer System Disposal **Analyical Group: SW8081 Pesticides**							
Aldrin	309-00-2	NA	0.05	0.01	0.002	25-140	30
alpha-BHC	319-84-6	NA	0.025	0.01	0.002	60-130	30
beta-BHC	319-85-7	NA	0.05	0.01	0.002	65-125	30
delta-BHC	319-86-8	NA	0.05	0.01	0.002	45-135	30
gamma-BHC (Lindane)	58-89-9	0.20[a]	0.05	0.01	0.002	25-135	30
alpha-Chlordane	5103-71-9	NA	0.05	0.01	0.003	65-125	30
gamma-Chlordane	5103-74-2	NA	0.05	0.01	0.002	60-125	30
4,4'-Dichlorodiphenyl dichloroethane (4,4'-DDD)	72-54-8	NA	0.1	0.01	0.002	25-150	30
4,4'-Dichlorodiphenyl dichloroethylene (4,4'-DDE)	72-55-9	NA	0.1	0.01	0.002	35-140	30
4,4'-Dichlorodiphenyl trichloroethane (4,4'-DDT)	50-29-3	NA	0.1	0.01	0.003	45-140	30
Dieldrin	60-57-1	NA	0.1	0.01	0.002	60-130	30
Endosulfan I	959-98-8	NA	0.05	0.01	0.002	50-110	30
Endosulfan II	33213-65-9	NA	0.1	0.01	0.003	30-130	30
Endosulfan sulfate	1031-07-8	NA	0.1	0.01	0.003	55-135	30
Endrin	72-20-8	2.0[a]	0.1	0.01	0.002	55-135	30
Endrin aldehyde	7421-93-4	NA	0.1	0.01	0.004	55-135	30
Endrin ketone	53494-70-5	NA	0.1	0.01	0.002	75-125	30
Heptachlor	76-44-8	0.40[a]	0.05	0.01	0.004	40-130	30
Heptachlor epoxide	1024-57-3	0.20[a]	0.05	0.01	0.002	60-130	30
Methoxychlor	72-43-5	40[a]	0.05	0.01	0.003	55-150	30
Toxaphene	8001-35-2	3.0[a]	0.25	0.05	0.025	NA	NA
Decachlorobiphenyl (Surrogate)	2051-24-3	NA	NA	NA	NA	30-135	NA
Tetrachloro-m-xylene (Surrogate)	877-09-8	NA	NA	NA	NA	25-140	NA

Notes and Abbreviations:

[a]NMED has established ground water cleanup levels for hazardous waste and/or hazardous constituents that incorporate both the New Mexico WQCC groundwater standards for contaminants per 20.6.2.3103 NMAC and EPA's National Primary Drinking Water Standards MCLs. If both the WQCC ground water standard and an MCL have been established for an individual hazardous waste and/or constituents, then the lower of the two levels will be the cleanup level for that hazardous waste and/or constituents. The USEPA MCL is presented as no WQCC groundwater standard is available.

µg/L - microgram per liter
NA - not applicable (no WQCC groundwater standard or USEPA MCL established)
RPD - relative percent difference
CAS - Chemical Abstracts Service
NMED - New Mexico Environment Department

Analyte	CAS Number	Residential NMED Water Screening Levels ug/L	Limit of Quantitation (LOQ) ug/L	Limit of Detection (LOD) ug/L	Detection Limit (DL) ug/L	Accuracy Control Limit (%R)	Precision Control Limit (% RPD)
Matrix: Rinsate Criteria for Closure and Base Sewer System Disposal Analytical Group: SW6000/7000 Metals							
Aluminum	7429-90-5	NA	20	10	5	80-120	20
Antimony	7440-36-0	6.0[a]	2	1	0.5	80-120	20
Arsenic	7440-38-2	10[a]	1	0.5	0.25	80-120	20
Barium	7440-39-3	200[a]	1	0.5	0.25	80-120	20
Beryllium	7440-41-7	4.0[a]	1	0.5	0.25	80-120	20
Cadmium	7440-43-9	5a	1	0.5	0.25	80-120	20
Calcium	7440-70-2	NA	500	250	125	80-120	20
Chromium (total)	7440-47-3	50	1	0.5	0.25	80-120	20
Chromium VI	18540-29-9	NA	0.01	0.01	0.005	80-120	20
Cobalt	7440-48-4	NA	1	0.5	0.25	80-120	20
Copper	740-50-8	1,000[b]	1	0.5	0.25	80-120	20
Iron	7439-89-6	1,000[b]	100	50	25	80-120	20
Lead	7439-92-1	50[b]	1	0.5	0.25	80-120	20
Magnesium	7439-95-4	NA	100	50	25	80-120	20
Manganese	7439-96-5	200[b]	5	2.5	1.25	80-120	20
Mercury	7439-97-6	2.0[a,b]	TBD	TBD	TBD	80-120	20
Nickel	7440-02-0	NA	2	1	0.5	80-120	20
Potassium	9/7/7440	NA	100	50	25	80-120	20
Selenium	7782-49-2	50[a,b]	1	0.5	0.25	80-120	20
Silver	7440-22-4	50[b]	1	0.5	0.25	75-120	20
Sodium	7440-23-5	NA	100	50	25	80-120	20
Thallium	7440-28-0	2.0[a]	1	0.5	0.25	80-120	20
Vanadium	7440-62-2	NA	1	0.5	0.25	80-120	20
Zinc	7440-66-6	10,000[b]	20	10	5	80-120	20

Notes and Abbreviations:

[a]NMED has established ground water cleanup levels for hazardous waste and/or hazardous constituents that incorporate both the New Mexico WQCC groundwater standards for contaminants per 20.6.2.3103 NMAC and EPA's National Primary Drinking Water Standards MCLs. If both the WQCC ground water standard and an MCL have been established for an individual hazardous waste and/or constituents, then the lower of the two levels will be the cleanup level for that hazardous waste and/or constituents. The USEPA MCL is presented as it is less than the WQCC groundwater standard or no WQCC groundwater standard is available.

[b]The WQCC groundwater standard is presented as it is less than the US EPA MCL or no MCL is available.
µg/L - microgram per liter
CAS - Chemical Abstracts Service
RPD - relative percent difference
NA - not applicable (no WQCC groundwater standard or USEPA MCL established)
NMED - New Mexico Environment Department

ANALYTICAL REQUIREMENTS FOR AQUEOUS WASTE DISPOSAL OFF-SITE:

Compound Name	CAS No.	Regulatory Limit	MDL	PQL	Unit
Matrix: Rinsate Criteria for Off-Site Disposal **Analytical Group: EPA 1311/8260 Volatiles**					
1,1-Dichloroethene	75-35-4	700	0.2	1	ug/L
1,2-Dichloroethane	107-06-2	500	0.1161	1	ug/L
2-Butanone	78-93-3	200,000	0.1421	25	ug/L
Benzene	71-43-2	500	0.111	1	ug/L
Carbon tetrachloride	56-23-5	500	0.2479	1	ug/L
Chlorobenzene	108-90-7	100,000	0.0828	1	ug/L
Chloroform	67-66-3	6,000	0.155	1	ug/L
Tetrachloroethene	127-18-4	700	0.1926	1	ug/L
Trichloroethene	79-01-6	500	0.1614	1	ug/L
Vinyl chloride	75-01-4	200	0.1272	1	ug/L
Matrix: Rinsate Criteria for Off-Site Disposal **Analytical Group: EPA 1311/8081 Pesticides**					
Chlordane (Technical)	57-74-9	30	0.025	0.25	ug/L
Endrin	72-20-8	20	0.005	0.1	ug/L
Heptachlor	76-44-8	8.0	0.005	0.05	ug/L
Heptachlor epoxide	1024-57-3	8.0	0.005	0.05	ug/L
Methoxychlor	72-43-5	10,000	0.005	0.05	ug/L
Toxaphene	8001-35-2	500	0.025	0.25	ug/L
gamma-BHC (Lindane)	58-89-9	400	0.005	0.05	ug/L
Matrix: Rinsate Criteria for Off-Site Disposal **Analytical Group: EPA 1311/8270 Semi-volatiles**					
1,4-Dichlorobenzene	106-46-7	7,500	2.45	50	ug/L
2,4,5-Trichlorophenol	95-95-4	400,000	1.34	50	ug/L
2,4,6-Trichlorophenol	88-06-2	2,000	1.62	50	ug/L
2,4-Dinitrotoluene	121-14-2	130	1.41	10	ug/L
Cresols	1319-77-3	200,000	2.15	100	ug/L

Compound Name	CAS No.	Regulatory Limit	MDL	PQL	Unit
Hexachlorobenzene	118-74-1	130	2.5	10	ug/L
Hexachlorobutadiene	87-68-3	500	2.45	50	ug/L
Hexachloroethane	67-72-1	3,000	2.38	50	ug/L
Nitrobenzene	98-95-3	2,000	1.9	50	ug/L
Pentachlorophenol	87-86-5	100,000	1.44	50	ug/L
Pyridine	110-86-1	5,000	5.25	50	ug/L
m,p-Cresol	1319-77-3MP	200,000	0.883	50	ug/L
o-Cresol	95-48-7	200,000	1.26	50	ug/L
Matrix: Rinsate Criteria for Off-Site Disposal Analytical Group: EPA 1311/6000/7000 Metals					
Arsenic	7440-38-2	5.0	0.005	0.2	mg/L
Barium	7440-39-3	100	0.0025	1	mg/L
Cadmium	7440-43-9	1.0	0.00125	0.01	mg/L
Chromium	7440-47-3	5.0	0.0025	0.05	mg/L
Lead	7439-92-1	5.0	0.00375	0.1	mg/L
Mercury	7439-97-6	0.20	0.00007	0.002	mg/L
Selenium	7782-49-2	1.0	0.01	0.1	mg/L
Silver	7440-22-4	5.0	0.0025	0.05	mg/L
Matrix: Rinsate Criteria for Off-Site Disposal Analytical Group: EPA 1311/8151 Herbicides					
2,4'-Dichlorophenoxyacetic (2,4-D)	94-75-7	10,000	1	5	ug/L
2,4,5-TP (Silvex)	93-72-1	1,000	1	5	ug/L
Matrix: Rinsate Criteria for Off-Site Disposal Analytical Group: EPA 1010A - H6 Flashpoint					
Flashpoint	000000-01-3	NA	50	50	Deg F
Matrix: Rinsate Criteria for Off-Site Disposal Analytical Group: EPA 7.3.3.2, Rev 3/9012B - J5 Reactivity					
Reactivity Cyanide	57-12-5R	NA	NA	250	mg/kg

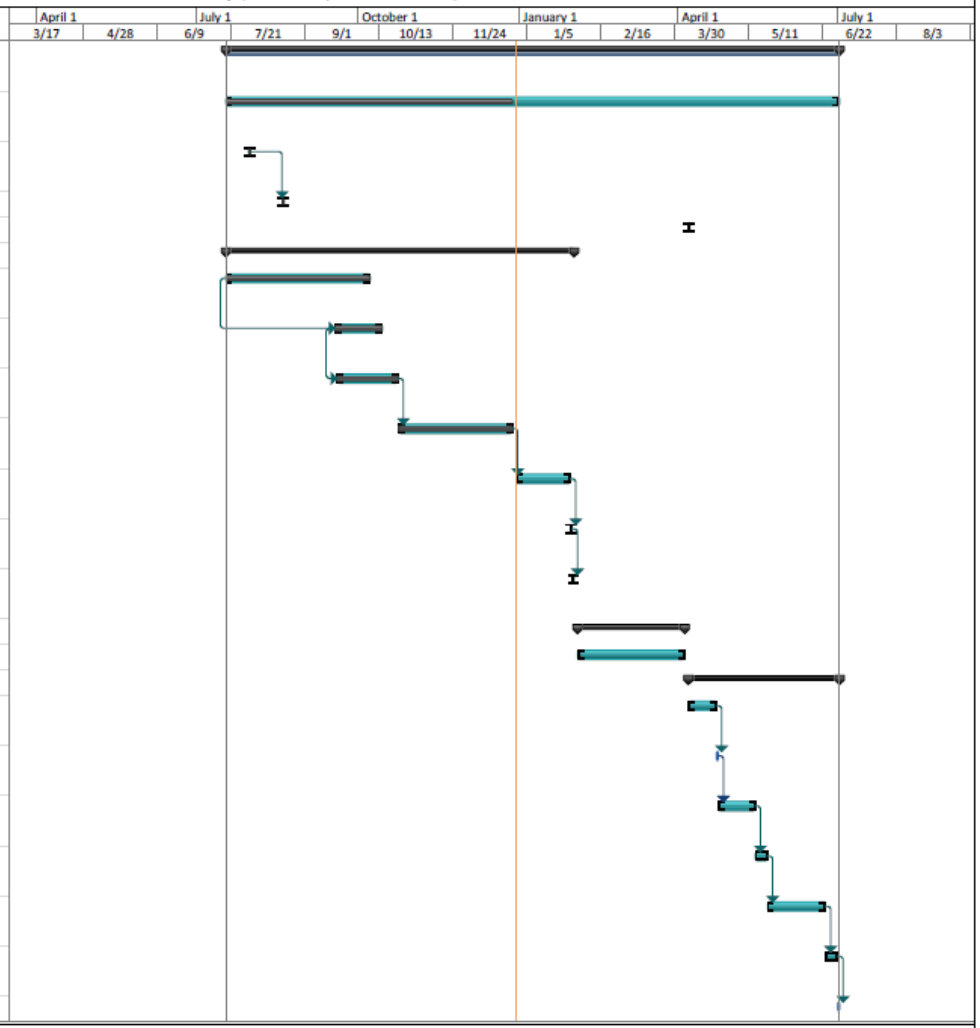
Compound Name	CAS No.	Regulatory Limit	MDL	PQL	Unit
Matrix: Rinsate Criteria for Off-Site Disposal **Analytical Group: EPA 7.3.4.2, Rev. 3/9034 - N2 Reactivity**					
Reactivity Sulfide	18496-25-8R	NA	80	80	mg/kg
Matrix: Rinsate Criteria for Off-Site Disposal **Analytical Group: EPA 9045D - F4 PH**					
pH	pH	NA	1	1	pH unit

Notes and Abbreviations:
µg/L - microgram per liter
CAS - Chemical Abstracts Service
MDL - method detection limit
NA - not applicable
NMED - New Mexico Environment Department
PQL - practical quantification limit
RL - reporting limit

WORKSHEET #16: PROJECT SCHEDULE TIMELINE

Contract No. FA8903-08-D-8770, Task Order 0281
RCRA Facility Closure Haz Waste CSU Facility (SWMU #75) - Holloman AFB, NM

ID	Task Name	Duration	Start	Finish	% Complete
1	**Project Management and Meetings**	**249 days**	**Thu 7/18/13**	**Tue 7/1/14**	**47%**
2	Project Management and Meetings	249 days	Thu 7/18/13	Tue 7/1/14	47%
3	Kick-Off Meeting (Telecon)	1 day	Wed 7/31/13	Wed 7/31/13	100%
4	Site Visit	1 day	Mon 8/19/13	Mon 8/19/13	100%
5	Results Meeting	1 day	Mon 4/7/14	Mon 4/7/14	0%
6	**Planning Documents**	**142 days**	**Thu 7/18/13**	**Fri 1/31/14**	**86%**
7	Prepare draft planning documents	58 days	Thu 7/18/13	Mon 10/7/13	100%
8	Submit draft planning documents	19 days	Wed 9/18/13	Mon 10/14/13	100%
9	AFCEC document review	25 days	Thu 9/19/13	Wed 10/23/13	100%
10	Prepare draft final documents	47 days	Thu 10/24/13	Fri 12/27/13	100%
11	Regulatory document review	23 days	Mon 12/30/13	Wed 1/29/14	0%
12	Prepare final planning documents	1 day	Thu 1/30/14	Thu 1/30/14	0%
13	Submit final planning documents	1 day	Fri 1/31/14	Fri 1/31/14	0%
14	**Field Activities**	**45 days**	**Mon 2/3/14**	**Fri 4/4/14**	**0%**
15	Field Activities	45 days	Mon 2/3/14	Fri 4/4/14	0%
16	**Technical Report**	**62 days**	**Mon 4/7/14**	**Tue 7/1/14**	**0%**
17	Prepare draft technical report	12 days	Mon 4/7/14	Tue 4/22/14	0%
18	Submit draft technical report	1 day	Wed 4/23/14	Wed 4/23/14	0%
19	AFCEC document review	15 days	Thu 4/24/14	Wed 5/14/14	0%
20	Prepare draft final documents	5 days	Thu 5/15/14	Wed 5/21/14	0%
21	Regulatory document review	23 days	Thu 5/22/14	Mon 6/23/14	0%
22	Prepare final technical report	5 days	Tue 6/24/14	Mon 6/30/14	0%
23	Submit technical report	1 day	Tue 7/1/14	Tue 7/1/14	0%



Project: 4PAE08 TO281_090913
Date: Mon 12/30/13

Task		Project Summary		Inactive Milestone		Manual Summary Rollup		Deadline	
Split		External Tasks		Inactive Summary		Manual Summary		Progress	
Milestone		External Milestone		Manual Task		Start-only			
Summary		Inactive Task		Duration-only		Finish-only			

WORKSHEET #17: SAMPLING DESIGN AND RATIONALE

Describe and provide a rationale for choosing the sampling approach: The primary objective of this project is to obtain clean closure of the CSU Facility at Holloman AFB, New Mexico. This will be accomplished by defining the nature and extent, if any, of contamination at the CSU Facility. Contamination of site media could have resulted from the movement or storage of waste within the CSU. The planned characterization of theoretical contamination at the CSU includes the following sampling methods:

- The collection and sampling of detergent wash and rinse water (i.e., rinsate) from each of a four phased decontamination process, in order establish whether the rinsate contains contamination, and if so, what is the nature and extent;
- Soil sampling around the Facility to determine if past storage activities within the Site have caused soil contamination, and if so, what is the nature and extent; and
- PCB wipe sampling from areas known to have historically stored PCB containers to determine the presence or absence of PCBs, and if present, what is the nature and extent.

WORKSHEET #18: SAMPLING LOCATIONS AND METHODS/SOP REQUIREMENTS TABLE

Matrix	Sampling Location/Depth	Concentration Level	Number of Samples	Sampling SOP Reference	Rationale for Sampling Location
PCB Wipe	Wipe samples for PCB contamination will be collected from the walls, floor, and sump surrounding Bay 11 and 12 of the indoor storage facility.	Low	6	SOP - 4, Collection of PCB Wipe Samples (See Field Sampling Plan Attachment B)	Samples will be taken at locations where PCB contamination is most likely expected to exist.
IDW Rinsate	The rinsate from the first three decontamination phases, and the fourth phase (segregated by four indoor quadrants, PCB storage area, and outdoor areas). will be segregated and moved to separate polyethylene tanks for sampling and analysis .	Low	7	SOP - 2, IDW Management and Sampling (See Field Sampling Plan Attachment B)	Rinsate will be sampled to determine proper disposal. The final rinse will be sampled to determine proper disposal, and for verification of clean closure.
Soil	Each soil sample collection shall consist of a spoon- or trowel-collected surface-level sample and a soil boring extending to a depth of three feet below ground surface. Each soil core will be composited from the surface in one foot intervals.	Low	19	SOP - 3, Collection of Soil Samples (See Field Sampling Plan Attachment B)	Samples will be taken evenly spaced around the Facility.

Notes and Abbreviations:
IDW investigation derived waste
PCB polychlorinated biphenyl
SOP Standard Operating Procedure

WORKSHEET #19: ANALYTICAL SOP REQUIREMENTS TABLE

Matrix	Analytical Group	Analytical and Preparation Method/ SOP Reference[a]	Container	Preservative	Maximum Holding Times[b]	
					Extraction	Analysis
Wipes	PCBs	SW-846 3550C/8082A EXT-002/GC-023	1- 4oz glass	Cool to 4 ± 2 ˚C	14 days	40 days
Soil	PCBs	SW-846 3550C/8082A EXT-002/GC-023	1- 4oz glass	Cool to 4 ± 2 ˚C	14 days	40 days
Soil	Volatiles	SW-846 5035A/8260B/ GCMSV-003	Terracore 3- 40 mL glass plus 2 oz jar	Cool to 4 ± 2 ˚C, methanol and sodium bisulfate	48 hours	14 days
Soil	Semi-volatiles	SW-846 3550C/8270D EXT-001/GCMSSV-004	1- 4oz glass	Cool to 4 ± 2 ˚C	14 days	40 days
Soil	Pesticides	SW-846 3550C/8081B EXT-002/GC-013	1- 4oz glass	Cool to 4 ± 2 ˚C	14 days	40 days
Soil	Mercury	SW-846 7471B MET-006, MET-008	1- 4oz glass	Cool to 4 ± 2 ˚C	NA	28 days
Soil	ICP-MS Metals	SW-846 3010A/6020A MET-004, MET-021	1- 4oz glass	None	NA	180 days

Notes and Abbreviations:
[a]See Appendix A for Laboratory Analytical SOPs.
[b]Holding time begins at time of collection.
^{o}C degrees Celsius
ICP-MS inductively coupled plasma mass spectrometry
mL milliliter
NA not applicable
oz ounce
PCB polychlorinated biphenyl
SOP Standard Operating Procedure

WORKSHEET #20: FIELD QUALITY CONTROL SAMPLE SUMMARY TABLE

Matrix	Analytical Group	Conc. Level	No. of Samples	No. of Equipment Rinsate Blanks	No. of Field Duplicates	No. of Trip Blanks	No. of MS/MSDs	Total No. of Samples to Lab
PCB Wipes	PCBs by SW8082	Low	5	1[a]	0	0	0	6
Soil	Volatiles by SW8260	Low	19	1	1	5	1/1	29
Soil	Semi-volatiles by SW8270	Low	19	1	1	0	1/1	23
Soil	TAL 24 Metals by SW6000/7000	Low	19	1	1	0	1/1	23
Soil	Pesticides by SW8081	Low	19	1	1	0	1/1	23
Soil	PCBs by SW8082	Low	19	1	1	0	1/1	23
Rinsate (MCLs)	PCBs by SW8082	Low	4	1	1	0	1/1	8
Rinsate (MCLs)	Volatiles by SW8260	Low	4	1	1	2	1/1	10
Rinsate (MCLs)	Semi-volatiles by SW8270	Low	4	1	1	0	1/1	8
Rinsate (MCLs)	TAL 24 Metals by SW6000/7000	Low	4	1	1	0	1/1	8
Rinsate (MCLs)	Pesticides by SW8081	Low	4	1	1	0	1/1	8
Rinsate (TCLP)	Volatiles by SW1311/ SW8260	Low	4	1[b]	0	0	0	4
Rinsate (TCLP)	Semi-volatiles by SW1311/SW8270	Low	4	0	0	0	0	4
Rinsate (TCLP)	RCRA 8 Metals by SW1311/SW6000/7000	Low	4	0	0	0	0	4
Rinsate (TCLP)	Flashpoint by 1010A	Low	4	0	0	0	0	4
Rinsate (TCLP)	Reactive Cyanide by SW846 Chapter 7	Low	4	0	0	0	0	4
Rinsate (TCLP)	Reactive Sulfide by SW846 Chapter 7	Low	4	0	0	0	0	4
Rinsate (TCLP)	Pesticides SW1311/SW8081	Low	4	0	0	0	0	4
Rinsate (TCLP)	Herbicides by SW1311/SW8151	Low	4	0	0	0	0	4
Rinsate (TCLP)	pH by SW9040/9045	Low	4	0	0	0	0	4

Notes and Abbreviations:
[a]An unopened and uncontaminated PCB wipe will be used as the equipment blank.
[b]A single wash water blank will be taken to act as a baseline for wash water. No duplicates are required for IDW.
Rinsate to be analyzed for NMWQC/MCL standards for on-site disposal determination.
Rinsate to be analyzed for TSCA/RCRA standards for off-site disposal determination if on-site disposal is not feasible.

Conc.	concentration	No.	number
IDW	investigation derived waste	PCB	polychlorinated biphenyl
MCL	maximum contaminant level	TAL	target analyte list
MS	matrix spike	TCLP	toxicity characteristic leaching procedure
MSD	matrix spike duplicate		

WORKSHEET #21: PROJECT SAMPLING SOP REFERENCE TABLE

SOP Title[a]	Originating Organization	Modified for Project Work? Yes/No	Comments
SOP 1 - Sample Collection, Handling and Custody SOP 2 - IDW Management and Sampling SOP 3 - Collection of Soil Samples SOP 4 - Collection of PCB Wipe Samples SOP 5 - Packaging and Shipping of Environmental Samples	AECOM	Yes	None

Notes and Abbreviations:
[a]SOPs are found in Attachment B of the Field Sampling Plan.
AECOM AECOM Technical Services, Inc.
SOP Standard Operating Procedure

WORKSHEET #22: FIELD EQUIPMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION TABLE

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Hand Auger	NA	NA	Daily Before Use	Visual Inspection	Daily Before Use	Manufacturer Specifics	Obtain New Hand Auger	Field Team Leader	Per Manufacturer's Manual
Concrete Wet Bore Drill	NA	NA	Daily Before Use	Visual Inspection	Daily Before Use	Manufacturer Specifics	Obtain New Concrete Wet Bore Drill	Field Team Leader	Per Manufacturer's Manual
Pressure Washer	NA	NA	Daily Before Use	Visual Inspection	Daily Before Use	Manufacturer Specifics	Obtain New Pressure Washer	Field Team Leader	Per Manufacturer's Manual

Notes and Abbreviations:
NA not applicable
SOP Standard Operating Procedure

WORKSHEET #23: ANALYTICAL SOP REFERENCE TABLE

SOP Reference[a]	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis (name and address)	Modified for Project Work? (Y/N)
Analytical and Preparation Method / SOP Reference						
EXT-002	SOP for PCB Extraction in Solid Samples, 4/11/13, Revision 18	Definitive	Solid	NA	GCAL 7979 GSRI Avenue Baton Rouge, LA 70820	N
GC-023	SOP for 8082A, 4/8/13, Revision 14	Definitive	Aqueous, Solid, Wipe PCB	GC/ECD Agilent 6890	GCAL 7979 GSRI Avenue Baton Rouge, LA 70820	N
GCMSV-003	SOP for the Analysis of Volatile Samples by 8260B, 12/12/11, Revision 23	Definitive	Solid, VOA	GC/MS Agilent 6890/5973 and Agilent 7890/5975	GCAL 7979 GSRI Avenue Baton Rouge, LA 70820	N
EXT-001	SOP for BNA Solids, Revision 19, 4/11/13	Definitive	Soil/SVOAs	NA	GCAL 7979 GSRI Avenue Baton Rouge, LA 70820	N
GCMSSV-004	SOP for the Analysis of Method 8270D, Revision 8, 1/25/13	Definitive	Soil/SVOAs	GC/MS Agilent 6890/5973 and Agilent 7890/5975	GCAL 7979 GSRI Avenue Baton Rouge, LA 70820	N
EXT-002	SOP for Pesticide/PCB Low Level Soil and Sediment Samples, Revision 18 04/11/13	Definitive	Soil	NA	GCAL 7979 GSRI Avenue Baton Rouge, LA 70820	N
GC-013	SOP for Pesticides – Method 8081B, Revision 15, 04/08/13	Definitive	Aqueous and Soil Extract	GC/ECD Agilent 6890	GCAL 7979 GSRI Avenue Baton Rouge, LA 70820	N
MET-004	SOP for 3050B Metals Digestion, 8/1/12, Revision 15	Definitive	Solids	NA	GCAL 7979 GSRI Avenue Baton Rouge, LA 70820	N
MET-021	SOP for the Analysis of Samples by ICP-MS, 8/24/12 Revision 3	Definitive	Metals digestates	Agilent 7700	GCAL 7979 GSRI Avenue Baton Rouge, LA 70820	N

SOP Reference[a]	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis (name and address)	Modified for Project Work? (Y/N)
MET-006	SOP for Sample Prep of Mercury, 5/19/10, Revision 19	Definitive	Solids	NA	GCAL 7979 GSRI Avenue Baton Rouge, LA 70820	N
MET-008	SOP for Hg Analysis, 10/26/12, Revision 18	Definitive	Mercury digestates	Perkin Elmer FIMS 400	GCAL 7979 GSRI Avenue Baton Rouge, LA 70820	N

Notes and Abbreviations:
[a]See Appendix A for Laboratory Analytical SOPs.
BNA base neutral acid
ECD electron capture detector
FIMS Flow Injection Mercury System
GC gas chromatograph
GCAL Gulf Coast Analytical
Hg Mercury
ICP-MS inductively coupled plasma mass spectrometer
NA not applicable
PCB polychlorinated biphenyl
SOP Standard Operating Procedure
VOA volatile organic analyte

WORKSHEET #24: ANALYTICAL INSTRUMENT CALIBRATION TABLE

Instrument	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Electron Capture Detector (ECD) - PCBs	Minimum five-point initial calibration for Aroclor 1016/1260, one point calibration of all additional Aroclors	100-1600ppb 1016/1260 400ppb	Initial calibration prior to sample analysis	RSD ≤20% for all compounds or linear or quadratic calibration r2 > 0.990	Repeat calibration if criterion is not met	Analyst, Supervisor	GC-023
ECD - PCBs	Second source calibration verification	400ppb	Once after each initial calibration	All analytes within ± 15% of expected value	Repeat initial calibration and reanalyze all samples analyzed since the last successful calibration verification	Analyst, Supervisor	GC-023
ECD - PCBs	Calibration verification (initial [ICV] and continuing [CCV])	400ppb	CCV after every 10 samples and at the end of the analytical sequence	%D or Drift < 20% for all analytes	Repeat initial calibration and reanalyze all samples analyzed since the last successful Calibration verification	Analyst, Supervisor	GC-023
ECD - PCBs	Confirmation of positive results (second column or second detector)	NA	All samples and QC	Detections agree within 40%	Report the higher concentration and include a narrative unless matrix interference is creating a high bias.	Analyst, Supervisor	GC-023
ECD - PCBs	LOD/LOQ verification	Various, see worksheet 15	Quarterly	LOD meets method qualitative requirements or is at least 3X higher than noise; LOQ is within LCS/LCSD criteria.	Perform instrument maintenance and repeat failed LOD or LOQ study passing two consecutive tests or perform new DL study.	Analyst, Supervisor	GC-023
GCMS - VOA	CCV	50 ug/L	CV daily, before sample analysis, and every 12 hours of analysis time	All targets ≤ 20%D	Repeat initial calibration and reanalyze all samples analyzed since the last successful calibration verification	Analyst, Supervisor	GCAL SOP GCMSV-003

Instrument	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GCMS - VOA	Minimum five-point initial calibration for all analytes (ICAL)	1 through 200 ug/L	Initial calibration prior to sample analysis	RSD ≤30 for RFs of the CCCs; Average %RSD ≤ 15% for all compounds, linear or quadratic curve fit with COD ≥ 0.99	Repeat calibration if criterion is not met	Analyst, Supervisor	GCAL SOP GCMSV-003
GCMS - VOA	Second source calibration verification	50 ug/L	Once after each initial calibration	All analytes within ± 20% of expected value	Remake standard, recalibrate if necessary.	Analyst, Supervisor	GCAL SOP GCMSV-003
GCMS -VOA	Evaluation of relative retention times (RRT)	NA	Prior to sample analysis	Set at mid-point of ICAL; +/- 30 seconds each CCV	CCV fails, perform column maintenance, inspect pumps, and leak checks	Analyst, Supervisor	GCAL SOP GCMSV-003
GCMS -VOA	Tuning	50 ng on column	Every 12-hours before calibration	SOP criteria for ion abundance.	Perform instrument maintenance	Analyst, Supervisor	GCAL SOP GCMSV-003
GCMS -VOA	LOD/LOQ verification	Various, see worksheet 15	Quarterly	LOD meets method qualitative requirements or is at least 3X higher than noise; LOQ is within LCS/LCSD criteria.	Perform instrument maintenance and repeat failed LOD or LOQ study passing two consecutive tests or perform new DL study.	Analyst, Supervisor	GCAL SOP GCMSV-003
GCMS - SVOA	CCV	50 ppm	CV daily, before sample analysis, and every 12 hours of analysis time	All targets ≤ 20%D	Repeat initial calibration and reanalyze all samples analyzed since the last successful Calibration verification	Analyst, Supervisor	GCAL SOP GCMSSV-004
GCMS - SVOA	Minimum five-point ICAL	0.2 through 200 ppm	Initial calibration prior to sample analysis	RSD ≤30 for RFs of the CCCs; Average %RSD ≤ 15% for all compounds, linear or quadratic curve fit with COD ≥ 0.99	Repeat calibration if criterion is not met	Analyst, Supervisor	GCAL SOP GCMSSV-004
GCMS - SVOA	Second source calibration verification	50 ppm	Once after each initial calibration	All analytes within ± 20% of expected value	Remake standard, recalibrate if necessary.	Analyst, Supervisor	GCAL SOP GCMSSV-004

Instrument	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GCMS - SVOA	Evaluation of RRT	NA	Prior to sample analysis	Set at mid-point of ICAL; +/- 30 seconds each CCV	CCV fails, perform column maintenance, inspect pumps, and leak checks	Analyst, Supervisor	GCAL SOP GCMSSV-004
GCMS - SVOA	Tuning	50ug/ml	Every 12-hours before calibration	SOP criteria for ion abundance, DDT breakdown less than 20%, Benzidine and Pentachlorophenol tailing factor less than 2.	Perform instrument maintenance	Analyst, Supervisor	GCAL SOP GCMSSV-004
GCMS - SVOA	LOD/LOQ verification	Various, see worksheet 15	Quarterly	LOD meets method qualitative requirements or is at least 3X higher than noise; LOQ is within LCS/LCSD criteria.	Perform instrument maintenance and repeat failed LOD or LOQ study passing two consecutive tests or perform new DL study.	Analyst, Supervisor	GCAL SOP GCMSSV-004
ECD – Pesticides	Breakdown check (Endrin/ DDT Method 8081B only)	80 ppb	Each day prior to analysis and every 12 hours.	Breakdown of Endrin and DDT not to exceed 15%	Instrument maintenance. Sample analysis can not proceed until breakdown criteria is achieved	Analyst, Supervisor	GC-013
ECD – Pesticides	ICV and CCV	60 ppb	CCV after every 10 samples and at the end of the analytical sequence	%D or Drift < 20% for all analytes	Repeat initial calibration and reanalyze all samples analyzed since the last successful calibration verification	Analyst, Supervisor	GC-013
ECD – Pesticides	Confirmation of positive results (second column or second detector)	NA	All samples and QC	Detections agree within 40%	Report the higher concentration and include a narrative unless matrix interference is creating a high bias.	Analyst, Supervisor	GC-013
ECD – Pesticides	Minimum five-point ICAL	5-100 ppb	Initial calibration prior to sample analysis	RSD <20% for all compounds or linear or quadratic calibration r2 > 0.990	Repeat calibration if criterion is not met	Analyst, Supervisor	GC-013

Instrument	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
ECD – Pesticides	Second source calibration verification	60 ppb	Once after each initial calibration	All analytes within ± 15% of expected value	Repeat initial calibration and reanalyze all samples analyzed since the last successful calibration verification	Analyst, Supervisor	GC-013
ECD – Pesticides	Retention time (RT) window width calculated for each analyte and surrogate	NA	After installing a new column, performing major maintenance or at initial set-up	Width is 3 X standard deviation of a minimum of three injections over a minimum of 72 hours, or default of 0.03 minutes whichever is greater.	NA	Analyst, Supervisor	GC-013
ECD – Pesticides	Retention time Window position establishment for each analyte and surrogate	NA	Set using mid-point of ICAL or at first CCV of the day if ICAL is not performed.	NA	NA	Analyst, Supervisor	GC-013
ECD – Pesticides	LOD/LOQ verification	Various, see worksheet 15	Quarterly	LOD meets method qualitative requirements or is at least 3X higher than noise; LOQ is within LCS/LCSD criteria.	Perform instrument maintenance and repeat failed LOD or LOQ study passing two consecutive tests or perform new DL study.	Analyst, Supervisor	GC-013
ICP-MS - Metals	Calibration blank	Once with each ICAL, after every 10 samples and at the end of an analytical sequence	Determined concentration ≤ LOD	Determine source of possible contamination, perform maintenance and recalibrate	Analyst, Supervisor	GCAL SOP MET-021	ICP-MS - Metals
ICP-MS - Metals	Continuing calibration verification	CCV after every 10 samples and at the end of the analytical sequence	All analytes within ± 10% of expected value	Repeat initial calibration and reanalyze all samples analyzed since the last successful calibration verification	Analyst, Supervisor	GCAL SOP MET-021	ICP-MS - Metals
ICP-MS - Metals	Initial calibration for all analytes (ICAL) ICP: minimum 3 standards	Daily initial calibration prior to sample analysis	correlation coefficient ≥0.995	Recalibrate and/or perform necessary equipment maintenance.	Analyst, Supervisor	GCAL SOP MET-021	ICP-MS - Metals

Instrument	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
ICP-MS - Metals	Linear Dynamic range/High level Check	Every 6 months and with major maintenance	90-110% recovery	Perform maintenance and/or reanalyze at lower concentration	Analyst, Supervisor	GCAL SOP MET-021	ICP-MS - Metals
ICP-MS - Metals	Low-level calibration check standard	Daily following calibration.	80-120% recovery	Recalibrate and/or perform necessary equipment maintenance.	Analyst, Supervisor	GCAL SOP MET-021	ICP-MS - Metals
ICP-MS - Metals	Second source ICV	Once after each initial calibration	All analytes within ± 10% of expected value	Repeat initial calibration and reanalyze all samples analyzed since the last successful calibration verification	Analyst, Supervisor	GCAL SOP MET-021	ICP-MS - Metals
CVAA - Mercury	Calibration Blank	Once with each ICAL, after every 10 samples and at the end of an analytical sequence.	Determined concentration ≤ LOD	Determine source of possible contamination, perform maintenance and recalibrate	Analyst, Supervisor	GCAL SOP MET-008	CVAA - Mercury
CVAA - Mercury	CCV	CCV after every 10 samples and at the end of the analytical sequence	All analytes within ± 10% of expected value	Repeat initial calibration and reanalyze all samples analyzed since the last successful calibration verification	Analyst, Supervisor	GCAL SOP MET-008	CVAA - Mercury
CVAA - Mercury	ICAL – Minimum 5 standards and blank	Daily initial calibration prior to sample analysis	Correlation coefficient ≥0.9995	Recalibrate and/or perform necessary equipment maintenance.	Analyst, Supervisor	GCAL SOP MET-008	CVAA - Mercury
CVAA - Mercury	ICV	Once after each initial calibration	All analytes within ± 10% of expected value	Repeat initial calibration and reanalyze all samples analyzed since the last successful calibration verification	Analyst, Supervisor	GCAL SOP MET-008	CVAA - Mercury

Notes and Abbreviations:

3X	three times
CCC	calibration check compound
CCV	calibration check verification
COD	coefficient of determination
CVAA	cold vapor atomic absorption
D	drift
DDT	dichlorodiphenyl trichloroethane
DL	detection limit
GC	gas chromatograph
GCAL	Gulf Coast Analytical Lab
GCMS	gas chromatograph mass spectroscopy
ICP	inductively coupled plasma mass spectroscopy
kg	kilogram
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LOD	limit of detection
LOQ	limit of quantitation
ml	milliliter
NA	not applicable
ng	nanogram
PCB	polychlorinated biphenyl
PPB	parts per billion
PPM	parts per million
QC	quality control
r2	coefficient of determination
RF	response factor
RSD	relative standard deviation
SOP	Standard Operating Procedure
SVOA	semi-volatile organic analyte
ug	microgram
VOA	volatile organic analyte

WORKSHEET #25: ANALYTICAL INSTRUMENT AND EQUIPMENT MAINTENANCE, TESTING, AND INSPECTION TABLE

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Gas Chromatograph/ Electron capture detector (GC/ECD)	Clean injection port and replace liner clip column Maintain pumps ECD wipe test	Pesticide	Monitor instrument performance via Continuing Calibration	Daily Wipe test annually	Calibration and QC criteria met	Change column Instrument maintenance	Analyst, Supervisor	GCAL SOP GC-13
GC/ Mass Spectrometer (MS)	Check for leaks, replace gas line filters, recondition or replace trap, replace column, clean injection port/liner	VOA	Monitor instrument performance via Continuing Calibration Verification	As needed	No maintenance is required as long as instrument QC meets DoD criteria	Replace connections, clean source, replace gas line filters, replace trap, replace GC column, clip column, replace injection port liner, clean injection port, replace Electron Multiplier	Analyst, Supervisor	GCAL SOP GCMSV-003
GC/MS	Check for leaks, replace gas line filters, replace column, clean injection port/liner	Semi-Volatiles	Monitor instrument performance via Continuing Calibration Verification	As needed	No maintenance is required as long as instrument QC meets DoD criteria	Replace connections, clean source, replace gas line filters, replace GC column, clip column, replace injection port liner, clean injection port, replace Electron Multiplier	Analyst, Supervisor	GCAL SOP GCMSSV-004
Inductively Coupled Plasma Mass Spectrometer (ICP-MS)	Change pump tubing, clean nebulizer, change torch, clean sample cone/skimmer cone	Metals	Monitor instrument performance via Continuing Calibration Verification and CCBlank	As needed	No maintenance is required as long as instrument QC meets DoD criteria	Change pump tubing, change torch and window, clean filters; recalibrate and reanalyze affected data	Analyst, Supervisor	GCAL SOP MET-021

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Cold Vapor AA	Check pump tubing, change sample tubing at least daily. Change reductant, carrier and waste tubing	Mercury	Monitor instrument performance via Continuing Calibration Verification and CCBlank	As needed	No maintenance is required as long as instrument QC meets DoD criteria	Change pump tubing, recalibrate and reanalyze affected data	Analyst, Supervisor	GCAL SOP-008

Notes and Abbreviations:

AA	atomic absorption
CCBlank	continuing calibration blank
DoD	United States Department of Defense
QC	quality control
SOP	Standard Operating Procedure
VOA	volatile organic analyte

WORKSHEET #26: SAMPLE HANDLING SYSTEM

To ensure sample authenticity and data defensibility, proper sample handing system procedures will be followed from the preparation time prior to sample collection (i.e., CoCs, label, and container preparation) to final sample disposal.

The Field Team Leader or designee will be responsible for completing the sample bottle label and CoC form, sample collection, sample packing, and coordination of sample shipment. The samples will be sent to the analytical laboratories via overnight delivery. The sample packing and shipping procedures are provided in *Packaging and Shipment of Environmental Samples SOP* included in the Field Sampling Plan.

The laboratory sample pickup staff and/or custodian will acknowledge the sample receipts upon arrival. The laboratory analytical technicians will prepare and analyze the field samples in accordance with the analytical SOPs. The field samples and all extracts/digestates will be stored at the laboratory for 30 days after a final report has been submitted to AECOM. The laboratory hazardous waste manager will be responsible for the final sample disposal upon notice from the AECOM project chemist.

Sample Collection, Packaging, and Shipment
Sample Collection (Personnel/Organization): Field Manager or designee/AECOM
Sample Packaging (Personnel/Organization): Field Manager or designee/AECOM
Coordination of Shipment (Personnel/Organization): Field Manager or designee/AECOM
Type of Shipment/Carrier: FedEx or other overnight delivery
Sample Receipt and Analysis
Sample Receipt (Personnel/Organization): Designated sample custodians/Gulf Coast Analytical Laboratories, LLC., Baton Rouge, LA
Sample Custody and Storage (Personnel/Organization): Designated sample custodians/ Gulf Coast Analytical Laboratories, LLC., Baton Rouge, LA
Sample Preparation (Personnel/Organization): Laboratory personnel/ Gulf Coast Analytical Laboratories, LLC., Baton Rouge, LA
Sample Determinative Analysis (Personnel/Organization): Gulf Coast Analytical Laboratories, LLC., Baton Rouge, LA
Sample Archiving
Field Sample Storage (No. of days from sample collection): 60 days
Sample Extract/Digestate Storage (No. of days from extraction/digestion): 30 days
Biological Sample Storage (No. of days from sample collection): NA
Sample Disposal
Personnel/Organization): Laboratory personnel/ Gulf Coast Analytical Laboratories, LLC., Baton Rouge, LA
Number of Days from Analysis: 60 days

WORKSHEET #27: SAMPLE CUSTODY REQUIREMENTS

See SOP - 1, Sample Collection, Handling and Custody located in Attachment B of the Field Sampling Plan.

WORKSHEET #28: QC SAMPLE TABLES

Matrix: Soil, Water, Wipes

Analytical Group: PCBs

Analytical Method/SOP Reference: SW-846 8082A/GC-023

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	DQI	Measurement Performance Criteria	QC Sample
Method Blank	One per preparatory batch	No analytes detected > ½ RL	No analytes detected > ½ RL. For common laboratory contaminants, no analytes detected > RL.	Group Analyst	Contamination	No analytes detected > ½ RL. For common laboratory contaminants, no analytes detected > RL	Method Blank
Surrogates	All field and QC samples	QC acceptance criteria as specified in Worksheet #15	Correct problem; reprep all failed samples for failed surrogates if sufficient sample is available.	Group Analyst	Accuracy	QC acceptance criteria as specified Worksheet #15	Surrogates
LCS	LCS per preparatory batch	QC acceptance criteria as specified in Worksheet #15	Correct problem; reanalyze all samples in the associated prep batch for failed analytes.	Group Analyst	Accuracy	QC acceptance criteria as specified in Worksheet #15	LCS
MS/MSD	MS/MSD per preparatory batch per matrix	Same criteria as LCS, RPD ≤30%; see Worksheet #15	Contact the client to determine if additional measures are required.	Group Analyst	Accuracy	QC acceptance criteria as specified in Worksheet #15	MS/MSD

Matrix: Solid

Analytical Group: Volatile Analysis

Analytical Method/SOP Reference: SW-846 8260B / GCAL SOP GCMSV-003

QC Sample	Frequency Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per preparatory batch	No analytes detected > ½ RL. For common laboratory contaminants, no analytes detected > RL.	Correct problem; reanalyze any sample associated with a blank that fails criteria, except when the sample analysis resulted in a non-detect.	Analyst, Supervisor, QA Manager	Bias Contamination	No analytes detected > ½ RL or > RL for common laboratory contaminants
Surrogates	All field and QC samples	QC acceptance criteria specified in Worksheet #15	Reanalyze and/or reprep if sufficient sample is available unless recoveries are high with no detection of analytes. If reprep and reanalysis confirms low recoveries, report and narrate.	Analyst, Supervisor, QA Manager	Accuracy Bias	Acceptance criteria specified in Worksheet #15
LCS	One LCS per preparatory batch	QC acceptance criteria specified in Worksheet #15	Reanalyze and/or reprep all associated samples unless recoveries are high with no detection of analytes.	Analyst, Supervisor, QA Manager	Accuracy Bias	Acceptance criteria specified in Worksheet #15
Internal Standards	In all field samples and standards	Retention time ± 30 seconds from retention time of the midpoint standard in the ICAL; Extracted Ion Current Profile (EICP) area within -50% to +100% of ICAL midpoint standard	Inspect Mass spectrometer or GC for malfunctions. Reanalyze all samples with IS failures. If reanalysis confirms matrix interference, report sample and narrate.	Analyst, Supervisor, QA Manager	Accuracy Bias	Retention time ± 30 seconds; EICP area within -50% to +100% of midpoint of ICAL
MS/MSD	One per preparatory batch per matrix	For matrix evaluation, use LCS recovery and RPD acceptance criteria specified in Worksheet #15	Contact the client to determine if additional measures are required.	Analyst, Supervisor, QA Manager	Accuracy Bias Precision	Acceptance criteria specified in Worksheet #15

Matrix: Solid

Analytical Group: Semi-Volatile Analysis

Analytical Method/SOP Reference: SW-846 8270D / GCAL SOP GCMSSV-004

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per preparatory batch	No analytes detected > ½ RL. For common laboratory contaminants, no analytes detected > RL.	Correct problem; reanalyze any sample associated with a blank that fails criteria, except when the sample analysis resulted in a non-detect.	Analyst, Supervisor, QA Manager	Bias Contamination	No analytes detected > ½ RL or > RL for common laboratory contaminants
Surrogates	All field and QC samples	QC acceptance criteria specified in Worksheet #15	Reanalyze and/or reprep if sufficient sample is available unless recoveries are high with no detection of analytes. If reprep and reanalysis confirms low recoveries, report and narrate.	Analyst, Supervisor, QA Manager	Accuracy Bias	Acceptance criteria specified in Worksheet #15
LCS	One LCS per preparatory batch	QC acceptance criteria specified in Worksheet #15	Reanalyze and/or reprep all associated samples unless recoveries are high with no detection of analytes.	Analyst, Supervisor, QA Manager	Accuracy Bias	Acceptance criteria specified in Worksheet #15
ISs	In all field samples and standards	Retention time ± 30 seconds from retention time of the midpoint standard in the ICAL; Extracted Ion Current Profile (EICP) area within -50% to +100% of ICAL midpoint standard	Inspect Mass spectrometer or GC for malfunctions. Reanalyze all samples with IS failures. If reanalysis confirms matrix interference, report sample and narrate.	Analyst, Supervisor, QA Manager	Accuracy Bias	Retention time ± 30 seconds; EICP area within -50% to +100% of midpoint of ICAL
MS/MSD	One per preparatory batch per matrix	For matrix evaluation, use LCS recovery and RPD acceptance criteria specified in Worksheet #15	Evaluate the data to determine if the failed criteria are due to sample matrix or laboratory error. Re-prep if sufficient sample is available when appropriate.	Analyst, Supervisor, QA Manager	Accuracy Bias	Acceptance criteria specified in Worksheet #15

Matrix: Groundwater and Solid Digestates

Analytical Group: Mercury

Analytical Method/SOP Reference: SW-846 7471B GCAL SOP MET-006 and MET-008

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per preparatory batch	No analytes detected > ½ RL.	Correct problem; reanalyze any sample associated with a blank that fails criteria, except when the sample analysis resulted in a non-detect.	Analyst, Supervisor, QA Manager	Bias Contamination	No analytes detected > ½ RL or > RL for common laboratory contaminants
LCS	One LCS per preparatory batch	See Worksheet 15 for control limits	Reanalyze and/or reprep all associated samples unless recoveries are high with no detection of analytes.	Analyst, Supervisor, QA Manager	Accuracy Bias	See Worksheet 15 for control limits
Sample Duplicate or MSD	One per preparatory batch	RPD ≤ 20%	Inspect sample to determine if matrix is contributing to precision failures.	Analyst, Supervisor, QA Manager	Precision	RPD ≤ 20%
MS	One per preparatory batch per matrix	For matrix evaluation, See Worksheet 15 for control limits	Inspect LCS recoveries. Evaluate data to determine if failure is due to matrix or lab error. Report with narrative as appropriate.	Analyst, Supervisor, QA Manager	Accuracy Bias	See Worksheet 15 for control limits

Matrix: Groundwater and Solid Digestates

Analytical Group: Metals

Analytical Method/SOP Reference: SW-846 3050B, 6020A / GCAL SOP MET-004, and MET-021

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per preparatory batch	No analytes detected > ½ RL. For common laboratory contaminants, no analytes detected > RL.	Correct problem; reanalyze any sample associated with a blank that fails criteria, except when the sample analysis resulted in a non-detect.	Analyst, Supervisor, QA Manager	Bias Contamination	No analytes detected > ½ RL or > RL for common laboratory contaminants
LCS	One LCS per preparatory batch	QC acceptance criteria specified by DoD QSM[a].	Reanalyze and/or reprep all associated samples unless recoveries are high with no detection of analytes.	Analyst, Supervisor, QA Manager	Accuracy Bias	Recoveries vary, in accordance with DoD QSM
Sample Duplicate or MSD	One per preparatory batch	RPD ≤ 20%	Contact the client to determine if additional measures are required.	Analyst, Supervisor, QA Manager	Precision	RPD ≤ 20%
MS	One per preparatory batch per matrix	For matrix evaluation, use LCS recovery acceptance criteria specified by DoD QSM.	Contact the client to determine if additional measures are required.	Analyst, Supervisor, QA Manager	Accuracy Bias	Recoveries vary, in accordance with DoD QSM.
ISs	In all field samples and standards	IS Intensity within 30-120% of intensity of the IS in the ICAL.	Reanalyze all samples with IS failures. If reanalysis confirms matrix interference, report sample and narrate.	Analyst, Supervisor, QA Manager	Accuracy Bias	IS Intensity within 30-120% of intensity of the IS in the ICAL.
ICP Dilution Test	One per preparatory batch	Five-fold dilution must agree within ± 10% of the original measurement for samples with concentrations > 50 x LOQ	Perform Post Digestion Spike	Analyst, Supervisor, QA Manager	Accuracy Bias	Five-fold dilution must agree within ± 10% of the original measurement for samples with concentrations > 50 x LOQ

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Post Digestion Spike	When dilution test fails or analyte concentration in all samples < 50 x LOD	Recovery 75-125%	Contact the client to determine if additional measures are required.	Analyst, Supervisor, QA Manager	Accuracy Bias	Recovery 75-125%

Notes and Abbreviations:
[a] *DoD Quality Systems Manual (QSM) for Environmental Laboratories, Version 4.12* (DoD, October 2010)
CA corrective action
DoD United States Department of Defense
DQI data quality indicator
GC gas chromatograph
ICAL initial calibration for all analytes
ICP inductively coupled plasma
IS internal standard
LCS laboratory control sample
LOD limit of detection
LOQ limit of quantitation
MS matrix spike
MSD matrix spike duplicate
PCB polychlorinated biphenyl
QA quality assurance
QC quality control
QSM Quality Systems Manual
RL reporting limit
RPD relative percent difference
SOP Standard Operating Procedure

WORKSHEET #29: PROJECT DOCUMENTS AND RECORDS TABLE

Document	Where Maintained
Sample Collection Documents and Records	
Field Logbook	AECOM San Antonio Office
Groundwater Sampling Logs	AECOM San Antonio Office
CoC Forms	AECOM San Antonio Office
On-site Analysis Documents and Records	
Visual Observation Assessment Log	AECOM San Antonio Office
Off-site Analysis Documents and Records	
Air Bills	AECOM San Antonio Office
Laboratory Data Reports	AECOM San Antonio Office
Laboratory EDD	AECOM San Antonio Office
Laboratory Instrument Calibration Logs	AECOM San Antonio Office
Laboratory Sample Preparation Logs	AECOM San Antonio Office
Laboratory Run Logs	AECOM San Antonio Office
Laboratory Sample Disposal Records	AECOM San Antonio Office
On-Site Field Screening Data	AECOM San Antonio Office
Data Assessment Documents and Records	
Laboratory System Audit Report	AECOM San Antonio Office
Laboratory Performance Audit Reports	AECOM San Antonio Office
Field System Audit Reports	AECOM San Antonio Office
Field Performance Audit Reports	AECOM San Antonio Office
Validation Reports (Review and Performance)	AECOM San Antonio Office
Assessment Findings and Corrective Action Responses	AECOM San Antonio Office
Other Documents and Records	
Well Development Logs	AECOM San Antonio Office
Equipment Calibration Logs	AECOM San Antonio Office
Waste Manifests	AECOM San Antonio Office
Site Photographs	AECOM San Antonio Office
Personnel Qualifications	AECOM San Antonio Office
Survey Locations Data	AECOM San Antonio Office
Health and Safety Sign-in Sheets	AECOM San Antonio Office
Health and Safety Plan Acknowledgement	AECOM San Antonio Office

Long-Term Storage/Location of Project Documents and Records (Listed Above)

As specified in the *DoD Quality Systems Manual (QSM) for Environmental Laboratories, Version 4.12* (DoD, October 2010), all analytical documents and records shall be retained by the laboratory for a minimum of five years from generation of the last entry in the records. All information necessary for the historical reconstruction of data must be maintained by the laboratory. Records that are stored only on electronic media must be supported by the hardware and software necessary for their retrieval.

All analytical data will be stored on CD/DVD as portable document format files and archived in the San Antonio AECOM office. All other data generated in the field and reports generated for the project will be stored in both hardcopies and computer readable data files by AECOM in the San Antonio, Texas office for a minimum of five years.

WORKSHEET #30: ANALYTICAL SERVICES TABLE

Matrix	Analytical Group	Sampling Locations/ ID Number	Analytical Method	Data Package Turnaround Time[a]	Laboratory/Organization (name and address, contact person, and telephone number)
Wipes	PCBs	See Worksheet#18	SW8082	14 days	Gulf Coast Analytical Laboratories 7979 GSRI Rd. Baton Rouge, LA 70820 Sean Hardin 225.769.4900
Soil	Volatiles	See Worksheet#18	SW8260	14 days	Gulf Coast Analytical Laboratories 7979 GSRI Rd. Baton Rouge, LA 70820 Sean Hardin 225.769.4900
Soil	Semi-volatiles	See Worksheet#18	SW8270	14 days	Gulf Coast Analytical Laboratories 7979 GSRI Rd. Baton Rouge, LA 70820 Sean Hardin 225.769.4900
Soil	Metals	See Worksheet#18	SW6000/7000	14 days	Gulf Coast Analytical Laboratories 7979 GSRI Rd. Baton Rouge, LA 70820 Sean Hardin 225.769.4900
Soil	PCBs	See Worksheet#18	SW8082	14 days	Gulf Coast Analytical Laboratories 7979 GSRI Rd. Baton Rouge, LA 70820 Sean Hardin 225.769.4900
Soil	Pesticides	See Worksheet#18	SW8081	14 days	Gulf Coast Analytical Laboratories 7979 GSRI Rd. Baton Rouge, LA 70820 Sean Hardin 225.769.4900
IDW Rinsate	Volatiles	See Worksheet#18	SW1311/8260	14 days	Gulf Coast Analytical Laboratories 7979 GSRI Rd. Baton Rouge, LA 70820 Sean Hardin 225.769.4900

Matrix	Analytical Group	Sampling Locations/ ID Number	Analytical Method	Data Package Turnaround Time[a]	Laboratory/Organization (name and address, contact person, and telephone number)
IDW Rinsate	Semi-volatiles	See Worksheet#18	SW1311/8270	14 days	Gulf Coast Analytical Laboratories 7979 GSRI Rd. Baton Rouge, LA 70820 Sean Hardin 225.769.4900
IDW Rinsate	Metals	See Worksheet#18	SW1311/SW6000/ 7000	14 days	Gulf Coast Analytical Laboratories 7979 GSRI Rd. Baton Rouge, LA 70820 Sean Hardin 225.769.4900
IDW Rinsate	PCBs	See Worksheet#18	8082	14 days	Gulf Coast Analytical Laboratories 7979 GSRI Rd. Baton Rouge, LA 70820 Sean Hardin 225.769.4900
IDW Rinsate	Corrosivity	See Worksheet#18	9041	14 days	Gulf Coast Analytical Laboratories 7979 GSRI Rd. Baton Rouge, LA 70820 Sean Hardin 225.769.4900
IDW Rinsate	Ignitability	See Worksheet#18	SW1020	14 days	Gulf Coast Analytical Laboratories 7979 GSRI Rd. Baton Rouge, LA 70820 Sean Hardin 225.769.4900
IDW Rinsate	Reactivity	See Worksheet#18	SW846 Chapter 7	14 days	Gulf Coast Analytical Laboratories 7979 GSRI Rd. Baton Rouge, LA 70820 Sean Hardin 225.769.4900
IDW Rinsate	Pesticides	See Worksheet#18	SW1311/SW8081	14 days	Gulf Coast Analytical Laboratories 7979 GSRI Rd. Baton Rouge, LA 70820 Sean Hardin 225.769.4900
IDW Rinsate	Herbicides	See Worksheet#18	SW1311/SW8151	14 days	Gulf Coast Analytical Laboratories 7979 GSRI Rd. Baton Rouge, LA 70820 Sean Hardin 225.769.4900

Matrix	Analytical Group	Sampling Locations/ ID Number	Analytical Method	Data Package Turnaround Time[a]	Laboratory/Organization (name and address, contact person, and telephone number)
IDW Rinsate	pH	See Worksheet#18	SW9040/9045	14 days	Gulf Coast Analytical Laboratories 7979 GSRI Rd. Baton Rouge, LA 70820 Sean Hardin 225.769.4900

Notes and Abbreviations:
[a]Earlier turnaround times may be requested from the lab by AECOM.
ID identification
IDW investigation derived waste
PCB polychlorinated biphenyl

WORKSHEET #31: PLANNED PROJECT ASSESSMENTS TABLE

This worksheet outlines the project assessments that are planned during the execution of the field investigation at Holloman AFB. The table below provides the types and frequencies of each planned assessment and identifies the organizations and personnel responsible for identifying, initiating and confirming that corrective actions, if required, are effectively implemented. Laboratories performing work for AECOM must be accredited under the Department of Defense Environmental Laboratory Accreditation Program for the general chemistry requirements. A desk audit will be performed to review laboratory operation and ensure the technical procedures and documentation are in place and operating to provide data that fulfill the field investigation objectives and to ensure corrective actions, if any have been implemented. This desk audit will be done by 100% data validation/review of the data against the laboratory SOPs (See Appendix A for Laboratory Analytical SOPs).

Descriptions of each of the planned projects assessments are described in below.

Table 31-1: Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment	Person(s) Responsible for Responding to Assessment Findings	Person(s) Responsible for Identifying and Implementing CA	Person(s) Responsible for Monitoring Effectiveness of CA
Review of field notes/field procedures	Daily	Internal	AECOM	Raymond Castillo /AECOM Field Manager	Raymond Castillo/AECOM Geologist	Raymond Castillo /AECOM Field Geologist	Josh Miller (AECOM/ Project PM) or his designee
Laboratory data assessment	100% of SDGs received from the laboratories	External	AECOM	Chris Davis/ AECOM Project Chemist	Chris Davis/AECOM Sean Harding/GCAL	Chris Davis/ AECOM Project Chemist	Chris Davis/ AECOM Project Chemist

Notes and Abbreviations:

AECOM AECOM Technical Services, Inc.
CA corrective action
GCAL Gulf Coast Analytical Lab
PM Project Manager
SDG sample delivery group

WORKSHEET #32: ASSESSMENT FINDINGS AND CORRECTIVE ACTION RESPONSES TABLE

Corrective actions will be required if the audits (see Worksheet #31) identify noncompliance problems with the laboratories, field procedures, or the data. Depending on the severity of the finding, a follow-up audit may be performed to verify that the corrective action has successfully been implemented.

Corrective actions for laboratory issues identified as a result of audits will require the following actions:

- Document the nonconformance issues on a laboratory nonconformance form.
- Record the cause of the nonconformance.
- Document the corrective actions taken.
- Verify the corrective actions taken were sufficient to address the concern.

Procedures for handling assessment findings and corrective actions are summarized in the table below.

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (name, title, organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (name, title, organization)	Timeframe for Response
Review of field notes/field procedures	Verbal communication/ logbook record	Josh Miller/ AECOM PM	24 hours after review	Letter or e-mail	Josh Miller/AECOM PM	24 hours after notification
Laboratory performance assessment	Written Audit Report incorporated into Data Quality Evaluation Report	Sean Hardin/ GCAL	24 hours after audit	Letter or e-mail	Josh Miller/AECOM PM Chris Davis/AECOM Project Chemist	24 hours after notification

Notes and Abbreviations:

AECOM AECOM Technical Services, Inc.
GCAL Gulf Coast Analytical Lab
PM Project Manager

WORKSHEET #33: QA MANAGEMENT REPORTS TABLE

This worksheet identifies the planned QA Management Reports used to ensure that managers and stakeholders are updated on project status and results of planned project assessments. These QA reports are designed to address management issues such as deviations from the approved QAPP; results of data review activities in terms of amount of usable data generated; required corrective actions and effectiveness of corrective action implementation; limitations on the use of measurement data generated; and data usability assessments in terms of PRARCCS.

Table 33-1: Quality Assurance Management Reports Table

Type of Report	Frequency	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation	Report Recipient(s)
Combined Laboratory Performance and Data Review Report	As required	30 days after receipt of data	Chris Davis/AECOM	Josh Miller/AECOM PM
Data Validation Report	Once for each SDG	21 days after receipt of data	Chris Davis/AECOM	Josh Miller/AECOM PM

Notes and Abbreviations:

AECOM AECOM Technical Services, Inc.
PM Project Manager
SDG sample delivery group

WORKSHEET #34: VERIFICATION (STEP I) PROCESS TABLE

To ensure that scientifically sound data of known and documented quality are used in making environmental decisions, the following three-step data review will be performed: Step I (verification) will confirm that all sampling and analytical requirements have been met. Step II (validation) will assess whether the sampling and analytical processes comply with the contract-specific and the QAPP-specific requirements. Step III (usability assessment) will determine whether the resulting data are suitable as a basis for the decision being made. Worksheets #34, #35, #36, and #37 describe the processes to be followed for the above three steps, respectively.

This worksheet establishes the procedures that will be followed to verify project data including, but are not limited to, sampling documents and analytical data package.

Verification Input	Description	Frequency	Internal/External	Responsible (name, organization)
Review of Field SOPs[1]	Determines whether field SOPs are performed in accordance with this WP and prescribed SOPs.	Once	Internal	Josh Miller/AECOM Project Manager
Review of Field Notes	Field notes will be reviewed internally at the end of each working day and placed in the project file.	Daily	Internal	Josh Miller/AECOM Project Manager
Review of field instrument calibration sheets	Determines whether field instruments are calibrated and used in accordance with manufacturers' requirements.	Per manufacturer's recommendation	Internal	Josh Miller/AECOM Project Manager Raymond Castillo/AECOM Field Team Leader
Review of CoC Forms	CoC forms and shipping documentation will be reviewed internally upon their completion and verified against the packed sample coolers they represent. The shipper's signature on the CoC will be initialed by the reviewer, a copy of the CoC retained in the project file, and the original and remaining copies taped inside the cooler for shipment.	Daily	Internal	Raymond Castillo/AECOM Field Team Leader
Analytical Data Package	Laboratory data packages will be verified internally by the laboratory performing the work for completeness and technical accuracy prior to submittal. Received data packages will be validated internally by the AECOM project chemist or designee.	Once per SDG	Internal /External	Sean Hardin/ GCAL Chris Davis/AECOM Project Chemist

Verification Input	Description	Frequency	Internal/External	Responsible (name, organization)
Review of fixed laboratory instrument calibration sheets and laboratory analysis procedures[2]	Determine whether laboratory instruments are used in accordance with manufactures' requirements and determine whether the laboratory analysis is performed in accordance with the procedures described in the laboratory-specific SOPs.	Once	Internal/ External	Sean Hardin/ GCAL Chris Davis/AECOM Project Chemist
Laboratory Data Assessment	Determines whether electronic and hard copy data upon receipt are comparable and contain the proper reporting format. The assessment will consist of reviewing both types of data to verify that data were delivered in proper fields and that all required fields are populated correctly.	Once per SDG	Internal/ External	Sean Hardin/ GCAL Chris Davis/AECOM Project Chemist
SOP Deviation (if any)	Document and assess the impact on the data from any deviations of the analytical or field SOPs[a/b].	As needed	Internal	Josh Miller/AECOM Project Manager Chris Davis/AECOM Project Chemist

Notes and Abbreviations:

[a] See Attachment A of the Field Sampling Plan for sampling SOPs.

[b] See Appendix A for Laboratory Analytical SOPs.

AECOM AECOM Technical Services, Inc.
CoC chain-of-custody
GCAL Gulf Coast Analytical Lab
SDG sample delivery group
SOP Standard Operating Procedure
WP Work Plan

WORKSHEET #35: VALIDATION (STEPS IIA AND IIB) PROCESS TABLE

Step II (validation) will confirm whether the requirements for a specific intended use are fulfilled. The purpose of data validation is to assess the performance associated with the analysis in order to determine the quality of the data. Step IIa will verify whether the sampling and analytical data comply with the applicable methods, procedures, and contracts. Step IIb will compare the sampling and analytical data with the measurement performance criteria specified in Worksheet #12.

Step IIa/IIb[a]	Validation Input	Description	Person(s) Responsible for Validation
IIa	Field SOPs[b]	Verify that the sampling SOPs were followed.	Raymond Castillo/ AECOM Field Team Leader Chris Davis/AECOM Project Chemist
IIa	Analytical SOPs[c]	Verify that the analytical SOPs were followed.	Sean Hardin/ GCAL Chris Davis/AECOM Project Chemist
IIa	Method QC Results	Verify that the required QC samples were run and met required limits.	Sean Hardin/ GCAL Chris Davis/AECOM Project Chemist
IIa/IIb	Data Validation	Validate 100 percent of the data to confirm QA.	Chris Davis/AECOM Project Chemist
IIa/IIb	Data Usability Evaluation	Evaluate data based on PARCCS for project objectives.	Chris Davis/AECOM Project Chemist
IIb	Field Documentation	Verify accuracy and completeness of field notes.	Raymond Castillo/ AECOM Field Team Leader
IIb	Field QC Sample Results	Verify that the required field QC samples were run and met required limits.	Sean Hardin/ GCAL Chris Davis/AECOM Project Chemist
IIb	Quantification Limits	Verify that the sample results met the project quantification limit specified in the QAPP.	Chris Davis/AECOM Project Chemist

Notes and Abbreviations:

[a]IIa = Compliance with methods, procedures, and contracts (see Table 10, page 117, *UFP-QAPP Manual*, V.1)

IIb = Comparison with measurement performance criteria in the QAPP (see Table 11, page 118, *UFP-QAPP Manual*, V.1)

[b] See Attachment A of the Field Sampling Plan for sampling SOPs.

[c] See Appendix A for Laboratory Analytical SOPs.

AECOM AECOM Technical Services, Inc.
GCAL Gulf Coast Analytical Lab
PARCCS precision, accuracy, representativeness, comparability, completeness, and sensitivity
QAPP Quality Assurance Project Plan
QA/QC quality assurance/quality control
SDG sample delivery group
SOP Standard Operating Procedure

WORKSHEET #36: SAMPLING AND ANALYSIS VALIDATION (STEPS IIA AND IIB) SUMMARY TABLE

Step IIa[a]	Matrix	Analytical Group	Validation Criterion	Responsible (Name, Organization)
IIa	Wipes	PCBs	Full Validation Procedure for PCBs by GC EPA Method SW8082, using DoD QSM[b] and EPA National Functional Guidelines for Data Review	Chris Davis/ AECOM
IIa	Solid	Volatiles	Full Validation Procedure for Volatiles by GC/MS EPA Method SW8260, using DoD QSM and EPA National Functional Guidelines for Data Review	Chris Davis/ AECOM
IIa	Solid	Semi-volatiles	Full Validation Procedure for Semi-volatiles by GC/MS EPA Method 8270, using DoD QSM and EPA National Functional Guidelines for Data Review	Chris Davis/ AECOM
IIa	Solid	Metals	Full Validation Procedure for Metals by ICP-MS EPA Method 6020/7471, using DoD QSM and EPA National Functional Guidelines for Data Review	Chris Davis/ AECOM
IIa	Solid	PCBs	Full Validation Procedure for PCBs by GC EPA Method SW8082, using DoD QSM and EPA National Functional Guidelines for Data Review	Chris Davis/ AECOM
IIa	Solid	Pesticides	Full Validation Procedure for Pesticides by GC EPA Method 8081 using QSM and EPA National Functional Guidelines for Data Review	Chris Davis/ AECOM

Notes and Abbreviations:

[a]IIa = Compliance with methods, procedures, and contracts (see Table 10, page 117, *UFP-QAPP Manual*, V.1)

[b] *DoD Quality Systems Manual (QSM) for Environmental Laboratories, Version 4.12* (DoD, October 2010)

DoD	Department of Defense
EPA	Environmental Protection Agency
GC	gas chromatography
ICP	inductively coupled plasma mass spectroscopy
PCB	polychlorinated biphenyl
QSM	Quality Systems Manual
UFP-QAPP	Uniform Federal Policy-Quality Assurance Project Plan

WORKSHEET #37: DATA USABILITY ASSESSMENT

This worksheet provides procedures, methods, and activities to determine whether data are of the right type, quality, and quantity to support environmental decision-making for the project.

Table 37-1: Considerations for Usability Assessment

Item	Assessment Activity	Responsibility
Data Deliverables and Work Plan	Ensure that all necessary information was provided, including but not limited to, QC sample results and data validation results.	Chris Davis/ AECOM
Sampling Locations, Deviation	Determine whether alterations to sampling locations continue to satisfy the project quality objectives.	Josh Miller/ AECOM
CoC, Deviation	Establish that any problems with documentation or custody procedures do not prevent the data from being used for the intended purpose.	Chris Davis/ AECOM
Holding Times, Deviation	Determine the acceptability of data where holding times were exceeded.	Chris Davis/ AECOM
SOPs[a/b] and Methods, Deviations	Evaluate the impact of deviations from analytical and field SOPs and specified methods on data quality.	Chris Davis/ AECOM
QC Samples	Evaluate the implications of unacceptable QC sample results on the data usability for the associated samples. For example, consider the effects of observed blank contamination.	Chris Davis/ AECOM
Matrix	Evaluate matrix effects (interference or bias).	Chris Davis/ AECOM
Meteorological Data and Site Conditions	Evaluate the possible effects of meteorological (e.g., wind, rain, temperature) and site conditions on sample results. Review field reports to identify whether any unusual conditions were present and how the sampling plan was executed.	Raymond Castillo/ AECOM Field Team Leader
Precision	Evaluate analytical precision measurements. Precision measures the reproducibility of a measurement and is defined as the degree of mutual agreement among independent measurements as the result of repeated application of the same process under similar conditions.	Chris Davis/ AECOM
Accuracy	Evaluation of how close the analytical result is to the true value of the analyte in a sample. Accuracy is a statistical measurement of correctness. It includes components of random error (variability due to imprecision) and systemic error. It therefore reflects the total error associated with a measurement.	Chris Davis/ AECOM
Comparability	Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Sample data should be comparable with other measurement data for similar samples and sample conditions. This goal is achieved by using standard techniques to collect and analyze representative samples and reporting analytical results in appropriate units	Chris Davis/ AECOM

Item	Assessment Activity	Responsibility
Representativeness	Determine the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is achieved through use of the standard sampling, field, and analytical procedures.	Chris Davis/ AECOM
Completeness	Evaluate the impact of missing information. Ensure that enough information was obtained for the data to be usable (completeness as defined in DQOs documented in this Work Plan).	Chris Davis/ AECOM
Critical Samples	Establish that critical samples and critical target analytes, as defined in the Work Plan, were collected and analyzed. Determine whether the results meet criteria specified in the Work Plan.	Josh Miller/ AECOM
Data Restrictions	Describe the exact process for handling data that do not meet DQOs (i.e., when measurement performance criteria are not met). Depending on how those data will be used, specify the restrictions on use of those data for environmental decision-making.	Chris Davis/ AECOM
Usability Decision	Determine whether the data can be used to make a specific decision considering the implications of all deviations and corrective actions.	Josh Miller/ AECOM
Usability Report	Discuss and compare overall PARCCS for each matrix, analytical group, and concentration level. Describe limitations on the use of project data if criteria for DQIs are not met.	Chris Davis/ AECOM

Notes and Abbreviations:
[a] See Attachment A of the Field Sampling Plan for sampling SOPs.
[b] See Appendix A for Laboratory Analytical SOPs.
AECOM AECOM Technical Services, Inc.
CoC chain-of-custody
DQI data quality indicator
DQO data quality objective
PARCCS precision, accuracy/bias, representativeness, comparability, completeness, and sensitivity
QC quality control
SOP Standard Operating Procedure

Summary of the Usability Assessment Process and Procedures

A usability assessment to determine how well the data collected on this project support the project objectives and decisions to be made will be performed by a project team (e.g., the Task Order Manager, Project Manager [PM], QA Manager, Hydrogeologist, Geochemist, field staff, and Project Chemist) from AECOM.

All definitive-level analytical data will be sent to AECOM for data validation. AECOM will determine the usability of the analytical data and will identify any limitations on the use of the data. Only definitive-level data that has undergone verification and validation will be used for risk assessments; definitive-level and screening-level data will be used for study decisions, based on identified limitations on the use of the data. All raw data and electronic copies screening-level data will be retained by AECOM in the event data reconstruction/validation is deemed necessary.

The analytical results of the sampling will be compared to the DQOs presented on Worksheets #12 and #28 to determine whether the MPC were met. Upon completion of the verification and validation processes noted on Worksheet #34 and Worksheet #35, the DQIs will be evaluated for each analytical group. Based on the results of this examination, conclusions regarding the validity and usability of data for each analytical group will be drawn. A Data Quality Evaluation Report will be prepared by the Data Validator and provided to the PM within 21 days of receipt from the laboratory. Overall measurement error (sampling plus analytical) will be assessed as noted below.

Evaluative Procedures Used to Assess Overall Measurement

Error Associated With the Project

Measurement error will be evaluated by reviewing sampling design, sampling locations, and sample collection methods. AECOM will evaluate QC samples (see Worksheet #20) to assess the overall measurement error associated with the project.

Personnel Responsible for Performing the Usability Assessment

- Chris Davis, the AECOM Project Chemist will be responsible for performing the analytical data usability assessment.
- Chris Davis will also perform a usability assessment of the validated data and screening-level data. This usability assessment will include (1) review of accepted or rejected data, (2) review of data qualifiers, (3) review of laboratory surrogate recoveries, (4) review of LCSs, and (5) consultation with the analytical laboratory.
- Josh Miller, the AECOM PM, will use the results of both usability assessments to determine whether the data generated during the investigation can be used to answer the principle study questions.

Documentation to be Generated During Usability Assessment and How Results will be Presented

AECOM will generate validated data packages to be presented in the Report. The usability assessment will generate a letter report describing the means and methods of the usability assessment and the results. All data sets will be evaluated using PARCCS criteria developed during the site-specific DQO development process and summarized below.

Precision and Accuracy. Precision and accuracy are evaluated using DQIs, such as MS/MSDs, LCSs, and surrogates. Precision and accuracy of the data set are considered acceptable after integration of qualification of estimated (i.e., estimated [J] and non-detected estimated [U]) results.

Representativeness. All samples for each method and matrix are evaluated for holding time compliance. All samples are associated with a method blank in each individual sample delivery group. Representativeness of the project data is considered acceptable after qualification for blank contamination.

Comparability. In general, data comparability is evaluated through the collection and analysis of field duplicates and field blanks. The laboratory will use standard analytical methods for their analyses. The analytical results will be reported in correct standard units. Holding times, sample preservation, and sample integrity will be within QC criteria.

Completeness. The overall completeness will be determined by the total number of analytes reported versus the number of sample results rejected in percent. The completeness percentage based on rejected data should meet the 90% goal.

Uncertainty Discussion of Reporting Limits. The magnitude of the laboratory reporting limits might have an effect on the results of any environmental investigation. For instance, if a chemical is present in an environmental medium at concentrations below the highest reporting limit and below the screening criteria, then that chemical should be eliminated from consideration as a constituent of potential concern (COPC). However, it is also possible that a chemical is present below the reporting limit and above the screening criteria; therefore, the assumption that the chemical is not present would potentially result in an underestimation of the potential impact of contamination. As a result, the chemical should not be eliminated from the COPC list and may require further evaluation.

APPENDIX A: Laboratory Analytical Standard Operating Procedures

STANDARD OPERATING PROCEDURE FOR

ULTRASONIC EXTRACTION FOR BASE/NEUTRAL AND ACID COMPOUNDS (BNA)

SW-846 3550C

Approved by: _____ Date: 04/12/13
R. Jason Olivier, Organic Lab Manager

Approved by: _____ Date: 04/12/13
Allison Naquin, Director of Quality and Technical Services

Approved by: _____ Date: 04/12/13
Shelley Bourgeois, Quality Assurance Manager

This is a controlled document. When printed it becomes uncontrolled. The controlled source is stored on GCAL Intranet.

1.0 SCOPE AND APPLICATION

1.1 This procedure is designed for the preparation of solid samples for the analysis of extractable base, neutral, and acid organic compounds.

2.0 APPLICABLE MATRIX OR MATRICES

2.1 Soil

3.0 SUMMARY OF TEST METHOD

3.1 A measured volume of sample, approximately 30 g, or a reduced volume based on sample matrix, is serially extracted with 1:1 methylene chloride/acetone using ultrasonic extraction.

3.2 The extract is dried, concentrated, and bottled for analysis of BNAs by GC/MS.

4.0 DEFINITIONS

4.1 Refer to SOP GEN-016

5.0 PERSONNEL QUALIFICATIONS AND RESPONSIBILITIES

5.1 The analyst performing this test procedure must have completed the required safety and technical orientation, ethics training, on-the-job training, and an initial demonstration of capability (IDOC).

5.2 The analyst must have completed a demonstration of capabilities (DOC) as described in SOP GEN-007. The demonstration of capabilities must be completed annually.

6.0 INTERFERENCES

6.1 Solvents, reagents, glassware and other sample extraction apparatus may yield interferences to sample analysis. All these must be demonstrated to be free from interferences under the conditions of analysis by analyzing method blanks.

6.2 Interferences co-extracted from the samples will vary considerably from source to source. If analysis of an extracted sample is prevented due to interferences, further cleanup of the sample extract may be necessary.

6.3 Phthalate esters contaminate many types of products commonly found in the laboratory. Plastics, in particular, must be avoided because phthalates are commonly used as plasticizers and are easily extracted from plastic materials. Serious phthalate contamination may result at any time if consistent quality control is not practiced.

6.4 Soap residue, which results in a basic pH on glassware surfaces, may cause degradation of certain analytes. Organochlorine pesticides, phthalate esters and phenols may react under basic conditions. This problem is especially pronounced with glassware that may be difficult to rinse (e.g., K-D flask). These items should be hand-rinsed very carefully to avoid this problem.

7.0 SAFETY

7.1 Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards and all associated protective wear and spill clean-up procedures PRIOR TO the use of any chemical. Employees must be familiar with the applicable material safety data sheets (MSDS). Chemical labels on the containers or packages contain important information on the safe handling, fire hazard and health hazards associated with the chemical.

7.2 Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. Exposure to these materials must be reduced to the lowest level possible. Therefore, work should be performed in well ventilated areas in a fume hood.

7.3 The appropriate personal protective equipment (PPE) must be worn when working in the laboratory. For this procedure the required PPE is a lab coat, eye covering (safety glasses or goggles) and gloves; the PPE shall be worn when handling samples and/or chemicals.

7.4 Contact lenses are not to be worn in the laboratory.

7.5 Food or drink may not be present when actively processing or handling samples.

8.0 EQUIPMENT AND SUPPLIES

8.1 Glass beakers – 250 mL

8.2 Kuderna-Danish (K-D) apparatus

- 8.2.1 Receiver, 10 mL graduated
- 8.2.2 Evaporation Flask, 500 mL - attached to the receiver with a blue clamp
- 8.2.3 3-Ball Snyder Column, pre-rinsed three times with methylene chloride

8.3 2-Ball Snyder Column, pre-rinsed three times with methylene chloride

8.4 Hot plate

8.5 Spatula, stainless steel or wooden stirrer.

8.6 1 mL pipette (verified daily before use) or 1 mL gas tight syringe

8.7 Funnels, glass or Teflon

8.8 Filter Paper – Whatman 41 18.5 cm or equivalent.

8.9 Boiling chips, Teflon or equivalent

8.10 Sonicator- Fisher Scientific Ultrasonic Dismembrator equipped with ¾ inch disruptor horn.

8.11 Pasteur pipets

8.12 Water bath – Organomation S-Evap-KD Solvent Evaporator, or equivalent, heated with concentric ring cover and capable of temperature control (± 5°C). The bath must be used in a hood.

8.13 Analytical balance – capable of weighing to 0.1g and calibrated daily when in use

8.14 Vials – 2 mL auto-sampler vials with Teflon lined crimp caps

8.15 Volumetric Flasks – 1.0 mL, 5.0 mL, 10.0 mL

8.16 Nitrogen Blow-Down Unit

9.0 REAGENTS AND STANDARDS

9.1 Reagents – all organic reagent and solvent grades must be of Pesticide quality and meet method requirements. A copy of the accompanying certificate of analysis (CoA) must be kept on file. Reagents are to be stored according to manufacturer's instruction and will expire on the date specified by the manufacturer. When the manufacturer fails to provide an expiration date, the expiration date will be 12 months from the date opened or sooner if the reagents show signs of deterioration such as change in color, clumping, separation, etc. If tests or appearance indicates the reagent has decomposed or is contaminated, dispose of the reagent and notify the QA Department and/or supervisor.
Label all reagents with reagent ID, lot number, date received, date opened and expiration date. Label all prepared solutions as required by SOP GEN-006.

9.1.1 Deionized water

9.1.2 Sodium sulfate (ACS) – granular, anhydrous, heated to approximately 400 °C for a minimum of 4 hours in a shallow tray, cooled and stored in a glass containers with Teflon lined caps. Record in the Sodium Sulfate Logbook and assign a lot number. Label all glass containers of sodium sulfate with the batch number, the date baked, expiration date and the initials of the preparer.

9.1.3 Methylene chloride

9.1.4 Acetone

9.1.5 1:1 Methylene chloride/Acetone – purchased premixed.

9.2 Standards – all standards used must be pure material or from prepared certified solutions. A copy of the accompanying certificate of analysis (CoA) must be kept on file. Stock standards are to be stored according to manufacturer's instruction and will expire on the date specified by the manufacturer. Label all working standards with date prepared, concentration, standard ID number, expiration date and the initials of individual preparing the standard. Record all standard preparations in the Standard Preparation Logbook. Label prepared standards as described in SOP GEN-006.

9.2.1 Surrogate Stock Standards (commercially prepared) – store refrigerated at ≤ 6 °C in amber glass bottle until use. Expires according to the manufacturer's expiration date or 6 months after preparation whichever is sooner or if comparisons with quality control check samples indicate a problem.

9.2.1.1 Base/Neutral Surrogate Mix (5000 µg/mL)

9.2.1.2 Acid Surrogate Mix (10,000 µg/mL)

9.2.2 Surrogate Working Solution Mix (50/100 µg/mL) – add 10.0 mL of Base/Neutral Surrogate Mix solution and 10.0 mL of Acid Surrogate Mix solution to a 1000 mL volumetric flask and bring to volume with acetone. Record in the Standards Preparation Logbook. Transfer into an amber glass bottle with Teflon lined cap, label with the standard name, standard ID, date prepared and expiration date. The solution will expire 6 months

from the date of preparation or manufacturer's expiration date whichever occurs first. Store refrigerated at ≤ 6 °C until use.

9.2.3 625 Stock Spiking Solution (commercially prepared, multi-analyte mix, 100 µg/mL) – store refrigerated at ≤ 6 °C in amber glass bottle until use. Expires according to the manufacturer's expiration date or 6 months after preparation whichever is sooner or if comparisons with quality control check samples indicate a problem.

9.2.4 Base Neutral Stock Spiking Solution (commercially prepared, multi-analyte mix, 5000 µg/mL) – store refrigerated at ≤ 6 °C in sealed ampules until use. Expires according to the manufacturer's expiration date or 6 months after preparation whichever is sooner or if comparisons with quality control check samples indicate a problem.

9.2.5 Acid Stock Spiking Solution (commercially prepared, multi-analyte mix, 7500 µg/mL) – store refrigerated at ≤ 6 °C in sealed ampules until use. Expires according to the manufacturer's expiration date or 6 months after preparation whichever is sooner or if comparisons with quality control check samples indicate a problem.

9.2.6 8270 Working Spiking Solution (100 µg/mL) – add 4.0 mL of Base/Neutral spiking solution and 2.68 mL of Acid spiking solution to a 200 mL volumetric flask and bring to volume with acetone. Record in the Standards Preparation Logbook. Transfer into an amber glass bottle with Teflon lined cap, label with the standard name, standard ID, date prepared and expiration date. The solution will expire 6 months from the date of preparation or manufacturer's expiration date whichever occurs first. Store refrigerated at ≤ 6 °C until use.

9.2.7 APP9 Stock Spiking Solution (commercially custom prepared, multi-analyte mix, 400µg/mL) – store refrigerated at ≤ 6 °C in amber glass bottle until use. Expires according to the manufacturer's expiration date or 6 months after preparation whichever is sooner or if comparisons with quality control check samples indicate a problem.

9.2.8 APP9 Working Spiking Solution (100 µg/mL) – add 5.0 mL of APP9 stock spiking solution to a 20 mL volumetric flask and bring to volume with acetone. Record in the Standards Preparation Logbook. Transfer into an amber glass bottle with Teflon lined cap, label with the standard name, standard ID, date prepared and expiration date. The solution will expire 6 months from the date of preparation or manufacturer's expiration date whichever occurs first. Store refrigerated at ≤ 6 °C until use.

9.2.9 Commercially prepared standards at the desired concentration or diluted with the appropriate solvent may have to be purchased based on the project or client specified analyte list. These standards will expire according to the manufacturer's expiration date or 6 months after preparation whichever is sooner or if comparisons with quality control

check samples indicate a problem. Store standards according to manufacturer's instructions.

10.0 SAMPLE COLLECTION, SHIPMENT, AND STORAGE

10.1 Samples are received at the laboratory by common carrier or hand delivered. Sample receipt policies are described in SOP SAD-001.

10.2 A chain-of-custody must accompany all samples and must document the date and the time of sample collection and the preservation method used. Internal chain of custody procedures are described in SOP SAD-002.

10.3 Samples are stored at the laboratory using conditions required by 40CFR 136 or reference method.

10.4 Samples are stored at the laboratory in a secure location until disposal.

11.0 PRESERVATION AND HOLD TIME

11.1 Required preservation – Cool to 0-6° C, but not frozen

11.2 Maximum holding time – 14 days from collection to extraction and 40 days from extraction to analysis

12.0 QUALITY CONTROL

12.1 One method blank, LCS, LCSD, MS, and MSD shall be prepared per batch, a maximum of twenty samples.

12.2 If insufficient sample is available for a MS and/or MSD then document this on the Extraction Preparation Form.

12.3 QC samples are prepared in the exact manner of the samples using the Procedure in Section 14.0.

13.0 CALIBRATION AND STANDARDIZATION

13.1 Analytical balances will be calibrated each day in use and the calibration recorded in the logbook associated with that analytical balance.

13.2 Auto-Pipettes will be calibrated each quarter and verified each day of use. Quarterly calibrations of auto-pipettes are recorded in the Non-Standard Labware Logbook and daily calibration verifications for auto- pipettes are recorded in the Daily Mechanical Pipet Calibration logbook associated with each pipette.

14.0 PROCEDURE

14.1 Rinse all 250 mL beakers with methylene chloride three times. Dispose of the rinsate in the appropriate solvent waste container.

14.2 Rinse a K-D apparatus three times with methylene chloride. Dispose of the rinsate in the appropriate solvent waste container.

14.3 Label each beaker and K-D apparatus with the last six (6) digits of the sample ID to be extracted. Fill in the Extraction Preparation Form information as each item is completed.

14.4 With each extraction batch, a method blank, LCS, LCSD and MS/MSD are included. If insufficient sample is available for a MS and/or MSD, document on the Extraction Preparation Form.

14.5 Weigh a 30 g aliquot of sodium sulfate into a methylene chloride rinsed beaker labeled Blank; repeat for the LCS and LCSD. Record the weight on the Extraction Preparation Form.

14.6 Homogenize sample by pouring the contents of the sample container onto a piece of butcher paper and chop and mix with a spatula. Remove any material such as sticks, leaves, or rocks. Weigh 30 g of homogenized sample to the nearest 0.1 g into the beaker. Record weight on the Extraction Preparation Form.

14.7 Add approximately 30 g of sodium sulfate to each sample and mix well. The sample should have a free flowing sandy texture at this point. If not, add Sodium Sulfate until the sample is free flowing.

14.8 Add 1.0 mL of the surrogate standard spiking solution to each beaker. Spike the LCS/LCSD and the MS/MSD beakers with 1.0 mL of the required 8270 or 625 spiking solution. If Appendix IX compounds are required, add 1.0 mL of the APP9 spiking solution. Note: if multiple spiking solutions are required, the LCS/LCSD and MS/MSD are prepared separately with the associated standards. Mix well. All extraction prep batches require a spike witness that is a peer technician, analyst or someone from supervisory or management level. Only employees that have received spike witness training can act as a spike witness. In the event that an employee is working outside of normal business hours and no qualified spike witness is available, then it is solely the individual technician's responsibility to verify all appropriate spikes and surrogates have been added. In this event, no spike witness will be indicated on the Extraction Preparation Form.

14.9 Immediately add approximately 100 mL of 1:1 methylene chloride/acetone. The solvent level should be about 2 inches above the sample in the beaker.

14.10 The sonicator is tested daily prior to use by pressing the test button on the front panel. If the sonicator is operating correctly the instrument returns to ready mode and is ready for use. If an error message is given, notify supervisor and do not sonicate samples using this sonicator.

14.11 Sonicate each sample and QC samples for 3 minutes by placing the probe of the sonicator about ½ inch below the surface of the solvent but above the sediment.

14.12 Decant and filter extracts through a funnel lined with folded filter paper into a labeled K-D apparatus.

14.13 Repeat the extraction two more times with two additional 100 mL portions of 1:1 methylene chloride/acetone. Combine the solvent from each extraction into the labeled K-D.

14.14 On the final sonication transfer the entire contents of the beaker into the funnel and rinse with methylene chloride.

14.15 Add one or two Teflon boiling chips to the labeled K-D apparatus. Rinse the 3 ball Snyder column with methylene chloride. Attach the Snyder column to the evaporation flask. Place the labeled K-D apparatus on the water bath. Adjust the

vertical position of the apparatus and the water temperature as required to complete the concentration in 10 to 15 minutes. At the proper rate of distillation the balls of the column will chatter but the column will not flood with condensed solvent. When the apparent volume of liquid reaches approximately 5 mL, remove the labeled K-D apparatus from the water bath and allow it to drain and cool for at least 10 minutes. Remove the Snyder column and labeled K-D from the receiver. Label the receiver with the last 6 digits of the sample number.

14.16 Rinse a two-ball micro-Snyder column with methylene chloride. Add another clean, boiling chip to the receiver and attach the two-ball micro-Snyder column. Place the labeled receiver apparatus on a hot water bath (water bath below boiling) so that the concentrator tube is partially immersed in the hot water. Adjust the vertical position of the apparatus and the water temperature as required to complete the concentration in 5 to 10 minutes. At the proper rate of distillation, the balls of the column will actively chatter but the chambers will not flood with condensed solvent. When the apparent volume of liquid reaches approximately 0.5 mL, remove the apparatus from the water bath and allow it to drain for at least 10 minutes while cooling. Remove the Snyder column.

14.17 Alternately, the extracts can be concentrated on the nitrogen blow-down unit. Place the labeled receiver on the concentration unit and allow a gentle flow of nitrogen to concentrate the extract to approximately 0.5 mL.

14.18 Adjust the final volume to 1.0 mL with methylene chloride in a 1.0 mL Class “A” volumetric tube. Transfer the extract to an auto-sampler vial, cap with a Teflon lined cap, and label with the sample number and test procedure.

14.19 Sign the Extraction Preparation Form. Deliver a copy of the Extraction Preparation Form and the extracts to the GCMS Semi-volatiles laboratory. If an analyst is not available to receive the samples, place in the appropriate refrigerator with the Extraction Preparation Form.

14.20 Extracts are analyzed using SOPs GCMSSV-001 or GCMSSV-004.

15.0 CALCULATIONS

15.1 Not applicable.

16.0 REPORTING LIMIT

16.1 Not applicable. The reporting limit will be established by the analytical procedure.

17.0 METHOD PERFORMANCE

17.1 Refer to the determinative methods for performance data.

18.0 POLLUTION PREVENTION

18.1 Pollution prevention encompasses any technique that reduces or eliminates the quantity or toxicity of waste at the point of generation.

18.2 Refer to QAPP Section 10.2

19.0 DATA ASSESSMENT AND ACCEPTANCE CRITERIA

19.1 Refer to the determinative methods and SOPs GCMSSV-001 and GCMSSV-004 for data assessment and acceptance criteria.

20.0 CORRECTIVE ACTIONS FOR OUT-OF-CONTROL DATA

20.1 Refer to GEN-018 for instructions on corrective actions. Corrective actions must be completed when the items below are noted:

20.1.1 Whenever a sample holding time is missed due to lab error (not applicable if samples were received with less than one day of holding time remaining or if for any reason analysis could not proceed while waiting for instructions from a client).

20.1.2 If a sample has been reported incorrectly for any reason.

21.0 WASTE MANAGEMENT

21.1 All unused samples or sample extracts are discarded according to the Hazardous Waste Disposal SOP, GEN-009.

22.0 REFERENCES

22.1 SW-846 3550C

22.2 SW-846 3500C

23.0 METHOD MODIFICATIONS

23.1 Procedure step 14.7 – Sodium sulfate is added to the sample prior to addition of surrogate and spike solutions.

23.2 Procedure step 14.9 -The extraction solvent is added to the sample to be approximately 2 inches above the sediment in the beaker. Exactly 100 mL is not measured as stated in the method.

24.0 TABLES, DIAGRAMS, AND FLOWCHARTS

24.1 Document review and revision history

24.2 Prep sheets are available on GCAL's Intranet under "Prep Menu"

Note: Actions older than 5 years may be removed from this record.

Document Review and Revision History

Approval Date	Revision No.	Record of Activity	Author
		Previous version	
04/11/13	19	New Format. Added several sections for compliance with TNI requirements for SOPs; revised Section 7.0 Safety for clarity; revised Section 9.0 to reflect standard preparation in acetone rather than methanol; revised Section 14.0 to include the nitrogen blow-down unit, and 2 mL vials.	R. Jason Olivier Scott Bailey Shelley Bourgeois

STANDARD OPERATING PROCEDURE FOR

ULTRASONIC EXTRACTION FOR PESTICIDES AND PCBs

SW-846 3550C

Approved by: _____ Date: 04/12/13
R. Jason Olivier, Organic Lab Manager

Approved by: _____ Date: 04/12/13
Allison Naquin, Director of Quality and Technical Services

Approved by: _____ Date: 04/12/13
Shelley Bourgeois, Quality Assurance Manager

This is a controlled document. When printed it becomes uncontrolled. The controlled source is stored on GCAL Intranet.

1.0 SCOPE AND APPLICATION

1.1 This procedure is designed for the preparation of solid samples for the analysis of Organochlorine Pesticides and PCBs

2.0 APPLICABLE MATRIX OR MATRICES

2.1 Soil

3.0 SUMMARY OF TEST METHOD

3.1 A measured volume of sample, approximately 30 g, or a reduced volume based on sample matrix, is serially extracted with 1:1 methylene chloride/acetone using ultrasonic extraction.

3.2 The methylene chloride extract is dried, exchanged to hexane, concentrated, and bottled for analysis of Pesticides and/or PCBs by GC.

4.0 DEFINITIONS

4.1 Refer to SOP GEN-016

5.0 PERSONNEL QUALIFICATIONS AND RESPONSIBILITIES

5.1 The analyst performing this test procedure must have completed the required safety and technical orientation, ethics training, on-the-job training, and an initial demonstration of capability (IDOC).

5.2 The analyst must have completed a demonstration of capabilities (DOC) as described in SOP GEN-007. The demonstration of capabilities must be completed annually.

6.0 INTERFERENCES

6.1 Solvents, reagents, glassware and other sample extraction apparatus may yield interferences to sample analysis. All these must be demonstrated to be free from interferences under the conditions of analysis by analyzing method blanks.

6.2 Interferences co-extracted from the samples will vary considerably from source to source. If analysis of an extracted sample is prevented due to interferences, further cleanup of the sample extract may be necessary.

6.3 Phthalate esters contaminate many types of products commonly found in the laboratory. Plastics, in particular, must be avoided because phthalates are commonly used as plasticizers and are easily extracted from plastic materials. Serious phthalate contamination may result at any time if consistent quality control is not practiced.

6.4 Soap residue, which results in a basic pH on glassware surfaces, may cause degradation of certain analytes. Organochlorine pesticides, phthalate esters and phenols may react under basic conditions. This problem is especially pronounced with glassware that may be difficult to rinse (e.g., K-D flask). These items should be hand-rinsed very carefully to avoid this problem.

7.0 SAFETY

7.1 Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards and all associated protective wear and spill clean-up procedures PRIOR TO the use of any chemical. Employees must be familiar with the applicable material safety data sheets (MSDS). Chemical labels on the containers or packages contain important information on the safe handling, fire hazard and health hazards associated with the chemical.

7.2 Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. Exposure to these materials must be reduced to the lowest level possible. Therefore, work should be performed in well ventilated areas in a fume hood.

7.3 The appropriate personal protective equipment (PPE) must be worn when working in the laboratory. For this procedure the required PPE is a lab coat, eye covering (safety glasses or goggles) and gloves; the PPE shall be worn when handling samples and/or chemicals.

7.4 Contact lenses are not to be worn in the laboratory.

7.5 Food or drink may not be present when actively processing or handling samples.

8.0 EQUIPMENT AND SUPPLIES

8.1 Glass beakers – 250 mL

8.2 Kuderna-Danish (K-D) apparatus

- 8.2.1 Receiver, 10 mL graduated
- 8.2.2 Evaporation Flask, 500 mL - attached to the receiver with a blue clamp
- 8.2.3 3-Ball Snyder Column, pre-rinsed three times with methylene chloride

8.3 2-Ball Snyder Column, pre-rinsed three times with methylene chloride

8.4 Hot plate

8.5 Spatula, stainless steel or wooden stirrer.

8.6 1 mL pipette (verified daily before use) or 1 mL gas tight syringe

8.7 Funnels, glass or Teflon

8.8 Filter Paper – Whatman 41 18.5 cm or equivalent.

8.9 Boiling chips, Teflon or equivalent

8.10 Sonicator- Fisher Scientific Ultrasonic Dismembrator equipped with ¾ inch disruptor horn.

8.11 Pasteur pipets

8.12 Water bath – Organomation S-Evap-KD Solvent Evaporator, or equivalent, heated with concentric ring cover and capable of temperature control (± 5°C). The bath must be used in a hood.

8.13 Analytical balance – capable of weighing to 0.1g and calibrated daily when in use

8.14 Vials – 2 mL auto-sampler vials with Teflon lined crimp caps

8.15 Volumetric Flasks – 1.0 mL, 5.0 mL, 10.0 mL

8.16 Vials – 2 mL auto-sampler vials with Teflon lined crimp caps and 20 mL vials with Teflon lined screw caps

8.17 44 mL VOA vials
8.18 Nitrogen Blow-Down Unit

9.0 REAGENTS AND STANDARDS

9.1 Reagents – all organic reagent and solvent grades must be of Pesticide quality and meet method requirements. A copy of the accompanying certificate of analysis (CoA) must be kept on file. Reagents are to be stored according to manufacturer's instruction and will expire on the date specified by the manufacturer. When the manufacturer fails to provide an expiration date, the expiration date will be 12 months from the date opened or sooner if the reagents show signs of deterioration such as change in color, clumping, separation, etc. If tests or appearance indicates the reagent has decomposed or is contaminated, dispose of the reagent and notify the QA Department and/or supervisor.
Label all reagents with reagent ID, lot number, date received, date opened and expiration date. Label all prepared solutions as required by SOP GEN-006.

9.1.1 Deionized water
9.1.2 Sodium sulfate (ACS) – granular, anhydrous, heated to approximately 400 °C for a minimum of 4 hours in a shallow tray, cooled and stored in a glass containers with Teflon lined caps. Record in the Sodium Sulfate Logbook and assign a lot number. Label all glass containers of sodium sulfate with the batch number, the date baked, expiration date and the initials of the preparer.
9.1.3 Methylene chloride
9.1.4 Acetone
9.1.5 1:1 Methylene chloride/Acetone – purchased premixed
9.1.6 Hexane

9.2 Standards – all standards used must be pure material or from prepared certified solutions. A copy of the accompanying certificate of analysis (CoA) must be kept on file. Stock standards are to be stored according to manufacturer's instruction and will expire on the date specified by the manufacturer. Label all working standards with date prepared, concentration, standard ID number, expiration date and the initials of individual preparing the standard. Record all standard preparations in the Standard Preparation Logbook. Label prepared standards as described in SOP GEN-006.

9.2.1 Surrogate Stock Standards (commercially prepared, Tetrachloro-m-xylene and Decachlorobiphenyl, 200 µg/mL each) – store refrigerated at ≤ 6 °C in sealed ampules until use. Expires according to the manufacturer's expiration date or 6 months after preparation whichever is sooner or if comparisons with quality control check samples indicate a problem.
9.2.2 Surrogate Working Solution Mix (0.5 µg/mL) – add 2.5 mL of stock Pesticide/PCB Surrogate Mix to a 1000 mL volumetric flask and bring to volume with acetone. Record in the Standards Preparation Logbook. Transfer into an amber glass bottle with Teflon lined cap, label with the

standard name, standard ID, date prepared and expiration date. The solution will expire 6 months from the date of preparation or manufacturer's expiration date whichever occurs first. Store refrigerated at ≤ 6 °C until use.

9.2.3 608 Stock Spiking Solution (commercially prepared, multi-analyte mix, 1000 µg/mL) – store refrigerated at ≤ 6 °C in amber glass bottle until use. Expires according to the manufacturer's expiration date or 6 months after preparation whichever is sooner or if comparisons with quality control check samples indicate a problem.

9.2.4 608 Working Spiking Solution (0.5 µg/mL) – add 250 µL of stock pesticide spiking solution to a 500 mL volumetric flask and bring to volume with acetone. Record in the Standards Preparation Logbook. Transfer into an amber glass bottle with Teflon lined cap, label with the standard name, standard ID, date prepared and expiration date. The solution will expire 6 months from the date of preparation or manufacturer's expiration date whichever occurs first. Store refrigerated at ≤ 6 °C until use.

9.2.5 PCB Stock Spiking Solutions (commercially prepared individual spiking solutions of 5000 µg/mL of Aroclor-1016 and 5000 µg/mL of Aroclor-1260) – store refrigerated at ≤ 6 °C in amber glass bottle until use. Expires according to the manufacturer's expiration date or 6 months after preparation whichever is sooner or if comparisons with quality control check samples indicate a problem.

9.2.6 PCB Working Spiking Solution (4 µg/mL) – add 800 µL of each stock PCB spiking solution to a 1000 mL volumetric flask and bring to volume with acetone. Record in the Standards Preparation Logbook. Transfer into an amber glass bottle with Teflon lined cap, label with the standard name, standard ID, date prepared and expiration date. The solution will expire 6 months from the date of preparation or manufacturer's expiration date whichever occurs first. Store refrigerated at ≤ 6 °C until use.

9.2.7 Commercially prepared standards at the desired concentration or diluted with the appropriate solvent may have to be purchased based on the project or client specified analyte list. These standards will expire according to the manufacturer's expiration date or 6 months after preparation whichever is sooner or if comparisons with quality control check samples indicate a problem. Store standards according to manufacturer's instructions.

10.0 SAMPLE COLLECTION, SHIPMENT, AND STORAGE

10.1 Samples are received at the laboratory by common carrier or hand delivered. Sample receipt policies are described in SOP SAD-001.

10.2 A chain-of-custody must accompany all samples and must document the date and the time of sample collection and the preservation method used. Internal chain of custody procedures are described in SOP SAD-002.

10.3 Samples are stored at the laboratory using conditions required by 40CFR 136 or reference method.

10.4 Samples are stored at the laboratory in a secure location until disposal.

11.0 PRESERVATION AND HOLD TIME

11.1 Required preservation – Cool to 0-6° C, but not frozen

11.2 Maximum holding time – 14 days from collection to extraction and 40 days from extraction to analysis for Pesticides; 1 year from collection to extraction and 1 year from extraction to analysis for PCBs.

12.0 QUALITY CONTROL

12.1 One method blank, LCS, LCSD, MS, and MSD shall be prepared per batch, a maximum of twenty samples.

12.2 If insufficient sample is available for a MS and/or MSD then document this on the Extraction Preparation Form.

12.3 QC samples are prepared in the exact manner of the samples using the Procedure in Section 14.0.

13.0 CALIBRATION AND STANDARDIZATION

13.1 Analytical balances will be calibrated each day in use and the calibration recorded in the logbook associated with that analytical balance.

13.2 Auto-Pipettes will be calibrated each quarter and verified each day of use. Quarterly calibrations of auto-pipettes are recorded in the Non-Standard Labware Logbook and daily calibration verifications for auto- pipettes are recorded in the Daily Mechanical Pipet Calibration logbook associated with each pipette.

14.0 PROCEDURE

14.1 Rinse all 250 mL beakers with methylene chloride three times. Dispose of the rinsate in the appropriate solvent waste container.

14.2 Rinse a K-D apparatus three times with methylene chloride. Dispose of the rinsate in the appropriate solvent waste container.

14.3 Label each beaker and K-D apparatus with the last six (6) digits of the sample ID to be extracted. Fill in the Extraction Preparation Form information as each item is completed.

14.4 With each extraction batch, a method blank, LCS, LCSD and MS/MSD are included. If insufficient sample is available for a MS and/or MSD, document on the Extraction Preparation Form.

14.5 Weigh a 30 g aliquot of sodium sulfate into a methylene chloride rinsed beaker labeled Blank; repeat for the LCS and LCSD. Record the weight on the Extraction Preparation Form.

14.6 Homogenize sample by pouring the contents of the sample container onto a piece of butcher paper and chop and mix with a spatula. Remove any material such as sticks, leaves, or rocks. Weigh 30 g of homogenized sample to the nearest 0.1 g into the beaker. Record weight on the Extraction Preparation Form.

14.7 Add approximately 30 g of sodium sulfate to each sample and mix well. The sample should have a free flowing sandy texture at this point. If not, add Sodium Sulfate until the sample is free flowing.

14.8 Add 1.0 mL of the surrogate standard spiking solution to each beaker. Spike the LCS/LCSD and the MS/MSD beakers with 1.0 mL of the Pesticide or PCB spiking solutions for samples requiring 8081/8082 analysis. Note: if both pesticides and PCBs are required, the LCS/LCSD and MS/MSD are prepared separately with the associated standards. Mix well. All extraction prep batches require a spike witness that is a peer technician, analyst or someone from supervisory or management level. Only employees that have received spike witness training can act as a spike witness. In the event that an employee is working outside of normal business hours and no qualified spike witness is available, then it is solely the individual technician's responsibility to verify all appropriate spikes and surrogates have been added. In this event, no spike witness will be indicated on the Extraction Preparation Form.

14.9 Immediately add approximately 100 mL of 1:1 methylene chloride/acetone. The solvent level should be about 2 inches above the sample in the beaker.

14.10 The sonicator is tested daily prior to use by pressing the test button on the front panel. If the sonicator is operating correctly the instrument returns to ready mode and is ready for use. If an error message is given, notify supervisor and do not sonicate samples using this sonicator.

14.11 Sonicate each sample and QC samples for 3 minutes by placing the probe of the sonicator about ½ inch below the surface of the solvent but above the sediment.

14.12 Decant and filter extracts through a funnel lined with folded filter paper into a labeled K-D apparatus.

14.13 Repeat the extraction two more times with two additional 100 mL portions of 1:1 methylene chloride/acetone. Combine the solvent from each extraction into the labeled K-D.

14.14 On the final sonication transfer the entire contents of the beaker into the funnel and rinse with methylene chloride.

14.15 Add one or two Teflon boiling chips to the labeled K-D apparatus. Rinse the 3 ball Snyder column with methylene chloride. Attach the Snyder column to the evaporation flask. Place the labeled K-D apparatus on the water bath. Adjust the vertical position of the apparatus and the water temperature as required to complete the concentration in 10 to 15 minutes. At the proper rate of distillation the balls of the column will chatter but the column will not flood with condensed solvent. When the apparent volume of liquid reaches approximately 5 mL, add approximately 44 mL of Pesticide-grade hexane through the Snyder column.

14.16 Continue the distillation described in Procedure 14.15. When the apparent volume of liquid reaches approximately 2 mL, remove the labeled K-D apparatus from the water bath and allow it to drain and cool for at least 10 minutes. Remove the Snyder column and labeled K-D from the receiver. Label the receiver with the last 6 digits of the sample number.

14.17 If additional concentration is required, rinse a two-ball micro-Snyder column with hexane. Add another clean, boiling chip to the receiver and attach the two-ball micro-Snyder column. Place the labeled receiver apparatus on a hot water bath (water bath below boiling) so that the concentrator tube is partially immersed in the hot water. Adjust the vertical position of the apparatus and the water temperature as required to complete the concentration in 5 to 10 minutes. At the proper rate of distillation, the balls of the column will actively chatter but the chambers will not flood with condensed solvent. When the apparent volume of liquid reaches approximately 2 mL, remove the apparatus from the water bath and allow it to drain for at least 10 minutes while cooling. Remove the Snyder column.

14.18 Alternately, the extracts can be concentrated on the nitrogen blow-down unit. Place the labeled receiver on the concentration unit and allow a gentle flow of nitrogen to concentrate the extract to approximately 2 mL.

14.19 Adjust the final volume to 10.0 mL with hexane in a 10.0 mL volumetric flask. Transfer approximately 1 mL of each extract to an auto-sampler vial, cap with a Teflon lined cap, and label with the sample number and test procedure. Store the remaining extract in a 20 mL vial in the extractions sample cooler.

14.20 Sign the Extraction Preparation Form. Deliver a copy of the Extraction Preparation Form and the extracts to the GC Semi-volatiles laboratory. If an analyst is not available to receive the samples, place in the appropriate refrigerator with the Extraction Preparation Form.

14.21 Extracts are analyzed using SOPs GC-013 or GC-023.

15.0 CALCULATIONS

15.1 Not applicable.

16.0 REPORTING LIMIT

16.1 Not applicable. The reporting limit will be established by the analytical procedure.

17.0 METHOD PERFORMANCE

17.1 Refer to the determinative methods for performance data.

18.0 POLLUTION PREVENTION

18.1 Pollution prevention encompasses any technique that reduces or eliminates the quantity or toxicity of waste at the point of generation.

18.2 Refer to QAPP Section 10.2

19.0 DATA ASSESSMENT AND ACCEPTANCE CRITERIA

19.1 Refer to the determinative methods and SOPs GC-013 or GC-023 for data assessment and acceptance criteria.

20.0 CORRECTIVE ACTIONS FOR OUT-OF-CONTROL DATA

20.1 Refer to GEN-018 for instructions on corrective actions. Corrective actions must be completed when the items below are noted:

20.1.1 Whenever a sample holding time is missed due to lab error (not applicable if samples were received with less than one day of holding time remaining or if for any reason analysis could not proceed while waiting for instructions from a client).

20.1.2 If a sample has been reported incorrectly for any reason.

21.0 WASTE MANAGEMENT

21.1 All unused samples or sample extracts are discarded according to the Hazardous Waste Disposal SOP, GEN-009.

22.0 REFERENCES

22.1 SW-846 3550C

22.2 SW-846 3500C

23.0 METHOD MODIFICATIONS

23.1 Procedure step 14.7 – Sodium sulfate is added to the sample prior to addition of surrogate and spike solutions.

23.2 Procedure step 14.9 -The extraction solvent is added to the sample to be approximately 2 inches above the sediment in the beaker. Exactly 100 mL is not measured as stated in the method.

24.0 TABLES, DIAGRAMS, AND FLOWCHARTS

24.1 Document review and revision history

24.2 Prep sheets are available on GCAL's Intranet under "Prep Menu"

Note: Actions older than 5 years may be removed from this record.

Document Review and Revision History

Approval Date	Revision No.	Record of Activity	Author
		Previous version	
04/11/13	19	New Format. Added several sections for compliance with TNI requirements for SOPs; revised Section 7.0 Safety for clarity; revised Section 9.0 to reflect standard preparation in acetone rather than methanol; revised Section 14.0 to include the nitrogen blow-down unit, and 2 mL vials.	R. Jason Olivier Scott Bailey Shelley Bourgeois

GULF COAST ANALTYICAL LABORATORIES
STANDARD OPERATING PROCEDURE
GC – PESTICIDES
SW-846 8081B

PROCEDURE: GC-013
PAGES: 13
EFFECTIVE DATE: 04/08/13
SUPERCEDES DATE: 12/14/11
APPROVED BY:
QA/QC APPROVED:

SCOPE AND APPLICATION This method provides gas chromatographic procedures for the detection of ppb levels of certain Organochlorine pesticides. Prior to the use of this method, appropriate extraction techniques must be used. The extraction is described in EXT-002 for solid samples and EXT-010 for aqueous samples. An aliquot of the sample extract is injected into a GC equipped with an ECD detector.

MATRIX Water and Solid

REFERENCE SW-846 Method 8081B, 8000B, 8000C

PRESERVATIVE Cool to 0-6° C, but not frozen; protect from light

HOLDING TIME
Water – From collection to extraction – 7 days
From extraction to analysis – 40 days
Solid – From collection to extraction – 14 days
From extraction to analysis – 40 days

DEFINITIONS Refer to SOP GEN-016

SAFETY Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards and all associated personal protective equipment and spill clean-up procedures PRIOR to the use of any chemical. In all cases, the applicable Material Safety Data Sheet (MSDS) and the supervisor or safety officer should be consulted. The bottle labels also provide important information that must be noted. Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. In particular, approved gloves, safety glasses, and labcoats must be worn. In addition to other measures prescribed by the division, solvents must be handled in ventilated hoods.

The electron capture detectors employed in this method must have a wipe test performed twice a year. In accordance with the federally mandated, state administered programs, the wipes are checked for degradation of the radionuclide foil by a contracted nuclear counting firm. Evidence of these tests are kept in file in the laboratory.

INTERFERENCES Solvents, reagents, glassware, and other sample artifacts may interfere with sample analysis. Interferences are monitored by the analysis of a method blank performed with each batch.

INSTRUMENTATION Gas Chromatograph should be suitable for

split/splitless injection. The system is equipped with an electron capture detector. The instruments used are Agilent Technology 6890N GC/uECD (micro ECD).

The data system must be capable of time stamping, all data produced, with the correct date and time. The data system employed is Target.

COLUMNS

Recommended Columns are
XLB or similar phase 30m X 0.32mm ID
35MS or similar phase 30m X 0.32mm ID

REAGENTS

Hexane-pesticide grade. Store away from sources of Phthalates.

STANDARDS

1. Purchasing Standards: All standards shall be purchased from a certified vendor. The ICV shall be from a secondary source.

2. The 8081 stock standard is a certified standard containing all single component analytes at varying concentrations for calibration. Add 625uL and dilute to 50mL with Hexane to make the working standard.

3. The Toxaphene stock standard is purchased certified to contain 5000ug/mL. A working standard of 5000ug/L is prepared by spiking 50uL of the stock standard and diluting to 50mL in Hexane.

4. The Technical Chlordane stock standard is purchased certified to contain 1000 ug/mL. A working standard of 400 ug/L is prepared by spiking 20 uL of the stock standard and diluting to 50mL in Hexane. A higher concentration spike is made when a five point Chlordane calibration is necessary.

5. Surrogate stock standard is purchased certified and contains Decachlorobiphenyl and Tetrachloro-m-xylene at 400ug/mL. Dilute 25uL of stock standard to 50mL in Hexane to make a 200ug/L solution. All prepared QC and samples are already spiked, and no additional surrogates are added. The analytical lab must spike all calibration standards.

6. ICV Standard: Stock standard solution containing all single component analytes of interest prepared from a source independent of the calibration standards. Dilute 3uL to 50mL with hexane to make a 60ug/L solution for the single component compounds. An ICV standard for Toxaphene and Chlordane is prepared when the analytes are requested.

7. Degradation (DEG) stock standard containing 4,4'-DDT and Endrin at 200ug/mL. A working standard of 80ug/L is prepared by spiking 20uL of the stock standard and diluting to 50mL in Hexane.

8. Standard Storage: Stock Standards can be stored

for up to one year. All other working standards can be kept for up to 6 months or until stock standard it was made from expires, whichever is sooner. Standards must be replaced sooner if suspected of degrading or concentrating. All standards shall be kept at 4°C when not in use. Store standards in amber glass with PTFE-lined caps and protect from light.

Preparing Calibration Standards:

1. The calibration standards are prepared by diluting stock solutions into 6 working levels. The following chart indicates the compounds and concentrations.

Table 1 Concentrations (µg/L)

	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	LEVEL 6
ALPHA-BHC	2.5	5	20	60	80	100
GAMMA-BHC	2.5	5	20	60	80	100
4,4'-DDT	5.0	10	40	120	160	200
4,4'-DDD	5.0	10	40	120	160	200
DIELDRIN	5.0	10	40	120	160	200
ENDOSULFAN I	2.5	5	20	60	80	100
ENDRIN	5.0	10	40	120	160	200
HEPTACHLOR	2.5	5	20	60	80	100
METHOXYCHLOR	25	50	200	600	800	1000
ALDRIN	2.5	5	20	60	80	100
BETA-BHC	2.5	5	20	60	80	100
DELTA-BHC	2.5	5	20	60	80	100
a-CHLORDANE	2.5	5	20	60	80	100
g-CHLORDANE	2.5	5	20	60	80	100
4,4'-DDE	10	10	40	120	160	200
ENDOSULFAN II	5.0	10	40	120	160	200
ENDOSULFAN SULFATE	5.0	10	40	120	160	200
ENDRIN ALDEHYDE	5.0	10	40	120	160	200
ENDRIN KETONE	5.0	10	40	120	160	200
HEPTACHLOR EPOXIDE	2.5	5	20	60	80	100
TOXAPHENE*	-	-	-	-	-	5000
TECHNICAL CHLORDANE*	-	-	-	-	-	400

2. *Multi-component compounds require a single calibration standard.

RETENTION TIME STUDY

1. For all analytes and surrogates a retention time study is performed over approximately 72 hours whenever a new column is installed, after major maintenance, or during initial set-up. The standard deviation (SD) is calculated based on this study using at least three determinations, measured to 0.001 minutes. The width of the retention time window is three times the SD for each of the analytes. Alternatively, if the calculated SD is less than 0.01 minutes, a default window of ± 0.03 minutes shall be employed.

2. The daily retention time window for the analyte is equal to the retention time of the analyte in the first CCV of the day, ± 3 times the standard deviation calculated from the retention time study or ± 0.03 minutes when the default is employed. If an ICAL is analyzed in the batch, use the level 4 standard in Table 1 to set the daily retention time window for the analytical batch.

DEGRADATION STANDARD

1. A degradation check standard must be analyzed each day prior to analyzing samples and once every 12-hours the instrument continues to analyze samples. Inject 1 uL of the 80ppb DEG working standard.

2. The degradation standard contains 4,4'-DDT and Endrin and is used to determine their breakdown components. 4,4'-DDT breaks down to 4,4'-DDD and DDE, Endrin breaks down to Endrin Aldehyde and Endrin Ketone.

3. The breakdown standard insures the instrument is maintained properly and will not cause breakdown of DDT and Endrin.

4. The degradation of either 4,4-DDT or Endrin cannot exceed 15% individually.

   Breakdown DDT =

   $$\frac{Ac + Ad}{At + Ac + Ad} \times 100$$

   At = Peak Area of DDT
   Ac = Peak Area of DDE
   Ad = Peak Area of DDD

   Breakdown of Endrin =

   $$\frac{Aa + Ak}{Ac + Aa + Ak} \times 100$$

   Ac = Peak Area of Endrin
   Aa = Peak Area of Endrin Aldehyde
   Ak = Peak Area of Endrin Ketone

5. If the degradation standard fails to meet this

criteria take appropriate corrective action (clean injector, replace insert, septa, ferrules, trim column, re-prep. standard, clean syringe, etc.). The degradation standard must meet criteria prior to analyzing samples.

INITIAL CALIBRATION

The initial calibration consists of a series of standards analyzed at the concentration noted in Table 1. An initial calibration curve for each single component target analyte must be analyzed and evaluated before any peak for that analyte can be quantitated. For multi-component analytes, Technical Chlordane and Toxaphene, a single point is analyzed for the ICAL.

1. The calibration range is defined as the on-column concentration range between the lowest level standard and the highest level standard. Because six calibration standards are used, the analyst has the option of eliminating one of the points using the criteria below. Within the following requirements the analyst may select the points that improve linearity, obtain the calibration range needed for a specific project, or maintain the default calibration range (5.0 – 100 ug/mL). Typically, alpha-BHC is the only compound reported in the Level 1 standard. For DOD projects and other projects that do not require lower detection limits, levels 2 through 6 are used on a regular basis and alpha-BHC is left on in level 1 at all times for RECAP projects.

   a) At least five contiguous points must be used.
   b) Calibration acceptance criteria must be met as described below.
   c) The lowest calibration point must support the lowest reporting limit needed in the associated samples.
   d) The concentration of the spiked QC (LCS) sample must fall within the calibration range.

2. Replacing points in the middle of a curve is not allowed unless the analyst can document a technical issue at the time of analysis or spiking of the standard. The new point must be analyzed in the same analytical batch. If the problem appears to be associated with a single standard, that one standard may be reanalyzed. Replacing the standard may be necessary in some cases.

3. The calibration curve is now ready for analysis.

4. The acceptance criteria for initial calibration <u>must</u> be satisfied before analysis of samples begin. Select projects may have additional or more stringent criteria that must be achieved for the applicable samples. See SOP GEN-019.

5. Additionally one of the following options must be met. Always attempt to meet calibration criteria using the average response factor. If the average response factor does not pass, options B and C are evaluated, but do not need to be evaluated in the order listed

(if historical results indicate that quadratic fits are appropriate for a particular analyte, that option may be selected without evaluating linear). The calibration options and requirements are as follows:

A. Average Response Factor Calibration. For each of the standards, calculate the response factor of each compound. Calculate the average of a minimum of five response factors and the standard deviation across the selected five response factors. Use the average RF and the standard deviation to calculate the percent relative standard deviation (%RSD). All equations can be found in the Calculation section. When the five (or more) response factors of the standards demonstrate less than 20% RSD for all analytes, linearity through the origin can be assumed. If the RSD for any analyte is greater than 20%, the analyst may wish to review the results for those analytes to ensure that the problem is not associated with just one of the initial calibration standards.

B. For those compounds that the RSD exceeds 20%, a linear regression equation that is not forced through the origin may be used. The coefficient of determination must be at least 0.990 for the curve to be acceptable. As part of the evaluation, check the y-intercept (b) and any negative factors (b or M). Negative factors may result in false negatives and positives. Large shifts in the y-intercept from zero will impact the data. If the intercept is greater than half the reporting limit, this option shall not be used. Check the required reporting limit and any impacts on the data. False positives are not reported.

C. A quadratic curve fit may be used if the coefficient of determination $r^2 \geq 0.990$. A minimum of a six-point calibration is used if this option is chosen and the curve shall not be forced through zero. As part of the evaluation, check the y-intercept (b) and any negative factors (b or M). Negative factors may result in false negatives and positives. Large shifts in the y-intercept from zero will impact the data. If the intercept is greater than half the reporting limit, this option shall not be used. Check the required reporting limit and any impacts on the data. False positives are not reported. For South Carolina projects, quadratic curve fits are not allowed.

6. Determine the response factor for a multicomponent compound by calculating the average area count of the four major peaks. For Technical Chlordane and Toxaphene, the analyst should choose four peaks from the pattern for use in quantitation. These peaks should be chosen as discrete peaks and ones that have a sufficient response in the pattern. These same four peaks will be used for quantitation of all samples.

INITIAL CALIBRATION VERIFICATION

Immediately following the initial calibration procedure or before sample analysis, the analyst shall perform initial calibration verification (ICV). This will consist of a solution containing all single component target analytes prepared from a standard that is independent from the initial calibration.

The ICV must be analyzed following the initial calibration. The ICV recovery must be 85-115%. Specific project criteria may apply that must be achieved for the associated samples. See SOP GEN-019.

If any target analyte recovery is outside the control limits, corrective action must be taken. This may include instrument maintenance, re-analysis of the ICV or initial calibration, or re-preparation of the standards involved. If holding time or agreed project due dates will not be met because of ICV failure, the client must be contacted and approve of proceeding with the analysis. Note all failures in the case narrative.

CONTINUING CALIBRATION VERIFICATION STANDARDS

1. The calibration verification standard (CCV) is the mid-level standard of the six-point calibration (Level 4 in Table 1). The CCVs are analyzed to verify that the calibration curve and retention time windows are still valid.

2. The CCV is analyzed at the beginning of each 12-hour shift. The shift begins with the injection of the CCV and ends after the completion of analysis of the last standard <u>injected</u> within 12 hours of the beginning of shift. A calibration verification standard must also be injected every 10 samples and at the end of the analytical sequence.

3. The criterion for the CCV is that all target analytes must be ± 20 percent difference (%D) from the initial calibration. For each CCV, each compound must fall within the retention time window.

4. If the CCV fails to meet these criteria, repeat the injection of the standard. If the standard continues to fail, take appropriate corrective action (inspection of GC, re-prep the standard, etc.) If these criteria cannot be met, a new calibration curve shall be prepared.

5. If the CCV analyzed <u>after</u> a group of samples has a response for an analyte >20% and the analyte was <u>not</u> detected in any of the previous samples during the analytical shift, then the samples do not need to be re-analyzed. If an analyte was <u>not</u> detected in the sample and the standard response is more than 20% <u>below</u> the initial calibration response, then re-injection is necessary. For DOD projects, a QC

exception will be requested from the client before using this option.

SAMPLE ANALYSIS

1. Up to 10 samples (not including MB, LCS/LCSD) can be analyzed after the calibration verification standard.

2. All samples are evaluated on a primary column then a secondary column if an analyte above detection limit was detected. The secondary column confirms the presence of that analyte.

3. If the analyte falls within the retention time window on both the primary and secondary analysis, then calculate the concentration present. The higher value of the two analyses is reported. (The lower value maybe reported if required by the project.) If the difference between the two results, calculated as an RPD, is greater than 40%, narrate the sample results. The results are flagged in the report. For DOD projects, the analyst should use project specific requirements for reporting if available. Otherwise, report the result from the primary column and flag results where the confirmation result is greater than 40% RPD.

SAMPLE RE-EXTRACTION

Samples are to be re-extracted due to failed QC or due to the surrogate results. When a MB, LCS, or LCSD fails to meet criteria, the entire batch is sent to extractions for re-extraction. If the MS, MSD, or surrogates fail criteria, only the affected samples are sent to extractions. Particular samples may be re-extracted if the sample results do not match historical values, if a sample and a duplicate do not match, or if physical differences are noted in samples. If samples are re-extracted outside of method specified holding times, both analyses are reported. To request sample/batch re-extraction, do the following:

1. If the extract has been analyzed, process the file and load to LIMS.
2. Enter the code “RP” into the analysis code; this will schedule new sample prep.
3. Complete the Re-extraction Request and Tracking Form (attached) and submit a copy to extraction supervisor.
4. When new extracts are brought to the lab and analyzed, complete the original Re-extraction Request and Tracking Form and report the data appropriately.
5. If additional sample is not available to re-prep, check with project manager to determine appropriate action to report the available data.
6. If two sets of data will be reported, see login to obtain a re-extracted sample number.

CALCULATIONS

1. $\text{MS \% REC} = \frac{\text{MS Concentration-Sample Concentration}}{} \times 100$

spike added

2. MSD % REC = $\frac{\text{MSD Concentration-Sample Concentration}}{\text{spike added}} \times 100$

3. % RPD = $\frac{\text{MS-MSD}}{(\text{MS+MSD})/2} \times 100$

LCS/LCSD results are substituted to calculate %RPD between LCS and LCSD. Results are calculated using the concentration (not percent recovery).

4. Response Factor = A_s/C_s

As = Peak Area of analyte or surrogate
Cs = Concentration of the analyte or surrogate

5. Surrogate/LCS Recovery = $\frac{\text{Concentration Found}}{\text{Concentration Added}} \times 100$

6. Concentration using RF:

Concentration (µg/L) = $\frac{(A_s)(D)(V_t)}{(RF)(V_s)}$

Concentration (µg/kg) = $\frac{(A_s)(D)(V_t)}{(RF)(W_s)}$

A_s = Area of peak for the analyte in sample
D = Dilution factor
RF = Mean Response factor from initial calibration
W_s = Weight of sample extracted in g
V_t = Total volume of concentrated extract in µL
V_s = Volume of aqueous sample extracted in mL

7. Concentration using linear curve fit:

Concentration (µg/L) = $[m(A_S)+b]D$

Concentration (mg/kg) = $[m(A_S)+b]D(5/W_S)$

m = Inverse of slope
A_s = Area of peak for the analyte in sample
b = Intercept of the y-axis
D = Dilution factor
W_s = Weight of sample extracted

8. Concentration using a quadratic curve fit:

Concentration (mg/L) = $[b + a(A_S) + a_2(A_S)^2]D(5/V_S)$

Concentration (mg/kg) = $[b + a(A_S) + a_2(A_S)^2]D(5/W_S)$

9. % Difference = $[(RF_I - RF_C) / RF_I\} \times 100$

RF_I = Average response factor from initial calibration
RF_C = Response factor from current verification check standard

10. % Drift = $\frac{\text{Calculated Conc. – Theoretical Conc.}}{} * 100$

Theoretical Conc.

11. % RSD = (SD/X) X 100

RSD = Relative Standard Deviation
X = mean of initial RF's for a compound
SD = Standard Deviation of average RF's for a compound

QUALITY CONTROL

METHOD BLANK

1. The method blank (extraction blank) is analyzed to demonstrate the extraction procedure did not introduce contamination.

2. No target analytes should be detected in the method blank above ½ the reporting limit. If any target analytes are detected, data may not be reported and samples must be re-extracted and re-analyzed unless the following apply:

   A. If a target analyte is detected above ½ the reporting limit, data may be reported if the concentration is not greater than 5% of the measured concentration in associated samples. Include a narrative with the data.
   B. If a target analyte is detected in the method blank but there are no hits in the samples, the data may be reported with a narrative.
   C. Additional project criteria may apply. See SOP GEN-019.

SURROGATES

1. The surrogate is used to verify that each sample was properly extracted. A surrogate is a non-target compound that is chemically similar to the analytes. The surrogates used are Decachlorobiphenyl (DCB) and 2,4,5,6-Tetrachloro-m-xylene (TCMX).

2. If a surrogate recovery fails below the lower control limit, re-extract and re-analyze the sample. If the surrogate is outside QC limits in the re-extract sample, then indicate in the case narrative and state that the recovery was outside the control limits due to sample matrix. If re-extraction cannot be performed due to insufficient sample, report the data with a narrative.

3. If the surrogate recovery is above the control limits and the sample results are less than the reporting limit, the data may be reported with a narrative.

Surrogate	Rec. Limits % Water	Rec. Limits % Soil
TCMX	49-137%	58-140
DCB	30-139%	55-139

4. Project specific limits may apply and may be

more stringent; project limits are listed in the LIMS. See SOP GEN-019.

LABORATORY CONTROL STANDARD (LCS/LCSD)

1. A LCS and LCSD (if required) are included in each batch to demonstrate the system is in control. Routinely the LCS/LCSD will be spiked with a full list of the single component analytes.

2. All recoveries should be within the control limits listed in Table 2 below. If the full list of target analytes is spiked, a small percentage of sporadic failures will be allowed. See Table 3 for the number of allowable failures. The failures are noted in the case narrative. If a recovery is above the upper control limit and the sample results are below the reporting limit, the data may be reported with a narrative. For South Carolina projects, LCS/LCSD recoveries must be 70-130% to report data. For South Carolina, no sporadic marginal failures are allowed.

Table 2: LCS Control Limits 8081B

Compound	% Recovery Water	RPD Water	% Recovery Solid	RPD Solid
alpha-BHC	70-131	40	57-145	40
Gamma-BHC	70-130	40	58-137	40
4,4-DDT	58-130	40	46-137	40
4,4-DDD	67-135	40	58-142	40
Dieldrin	70-134	40	61-142	40
Endosulfan I	30-130	40	30-130	40
Endrin	67-136	40	60-143	40
Heptachlor	65-130	40	61-149	40
Methoxychlor	56-135	40	44-142	40
Aldrin	59-130	40	63-141	40
beta-BHC	70-130	40	56-145	40
delta-BHC	70-132	40	59-146	40
alpha-Chlordane	70-141	40	62-151	40
gamma-Chlordane	63-130	40	54-133	40
4,4-DDE	66-130	40	59-140	40
Endosulfan II	41-130	40	43-130	40
Endosulfan sulfate	65-139	40	57-147	40

Endrin aldehyde	61-130	40	52-130	40
Endrin ketone	68-138	40	56-148	40
Heptachlor epoxide	69-130	40	61-137	40

3. If a recovery is below the lower control limit, the batch must be re-extracted and re-analyzed. If a re-extraction is not possible due to insufficient sample volume, report the data with a narrative. If precision fails but all spikes are within QC limits, note this in the case narrative.

TABLE 3: Number of Allowable Failures

Number of Analytes	Failures Allowed
0-11	0
11-30	1

4. Project specific recovery and precision limits may apply and may be more stringent; project limits are listed in the LIMS. See SOP GEN-019.

MATRIX SPIKES (MS/MSD)

1. The purpose of the MS/MSD is to assess the performance of the method for a particular sample matrix. The recoveries for each spike compound should be within the control limits specified in Table 2.

2. Whenever the MS and/or MSD recoveries are outside the control limits, review data to verify that a lab error has not occurred (wrong spike amount, not spiked) before automatically identifying a failure as matrix interference.

3. If recoveries for the MS and/or MSD are outside the control limits and the recoveries are similar, the data is reportable with a narrative stating the LCS recoveries were acceptable. The failure is attributed to sample matrix.

4. If precision and spike recoveries are outside of control limits, re-extract the parent, MS, and MSD. If the failure is repeated, check that the samples are homogenous. Narrate the sample results including corrective action and sample appearance if applicable. If precision fails but all spikes are within QC limits, note this in the case narrative.

5. Native sample concentrations may be high in comparison to the spiking concentration and therefore an accurate recovery cannot be calculated. Document this in the case narrative.

6. Spikes may be diluted out in the analysis

process. Document this in the case narrative.

7. Project specific recovery and precision limits may apply and may be more stringent; project limits are listed in the LIMS. See SOP GEN-019.

REPORTING LIMIT

Table 4 lists default-reporting limits for Pesticides. Reporting limits may be lowered by altering the prep and, when allowable, calibrating lower. The reporting limit should be no lower than 2X the verified MDL. Some projects may have different criteria for setting reporting limits. Check SOP GEN-019 and with the project manager.

Table 4 Reporting Limits

COMPOUND	WATER (ug/L)	SOLID (ug/kg)
alpha-BHC	0.05	2
beta-BHC	0.05	2
delta-BHC	0.05	2
gamma-BHC	0.05	2
Heptachlor	0.05	2
Aldrin	0.05	2
Heptachlor Epoxide	0.05	2
Endosulfan I	0.05	2
Dieldrin	0.10	4
4,4’-DDE	0.10	4
Endrin	0.10	4
Endosulfan II	0.10	4
4,4’-DDD	0.10	4
Endosulfan Sulfate	0.10	4
4,4’-DDT	0.10	4
Methoxychlor	0.50	20
Endrin Ketone	0.10	4
Endrin Aldehyde	0.10	4
alpha-Chlordane	0.05	2
gamma-Chlordane	0.05	2
Toxaphene	5.00	200
Technical Chlordane	0.25	10

MANUAL INTEGRATIONS

Perform and document manual integrations as described in SOP QA-010.

DATA REVIEW

For data review procedures and checklist, please see SOP QA-002.

SOFTWARE TROUBLESHOOTING

The Agilent GC utilizes Agilent software GC Chemstation Version A.10.02 to control the instrument and transfer data acquisition to Target Data Integration software. Target software is

utilized to calculate all data. In the event of software malfunction for the GC Chemstation, please contact Agilent technical support for troubleshooting help. In the event of software malfunction when using Target, please contact GCAL's IT Director for troubleshooting help.

METHOD PERFORMANCE

1) The method detection limit (MDL) is determined annually using procedures in SOP QA-009. Limit of detection and limit of quantitation are verified quarterly.

2) Precision and accuracy limits shall be developed through the continued performance of this method by determining the standard deviation over at least 20 LCS determinations. Recovery limits shall be set at ± 3 X standard deviation.

3) The single operator precision goal for the analytical portion is SD a ≤ 3% as measured using CCV data. This shall be evaluated quarterly. Control charts shall be used to determine if goals are achieved and potential improvements of both method performance and analyst training.

4) The accuracy and precision obtainable with this method depend on the sample matrix, sample preparation technique, optional cleanup techniques, and calibration procedures used.

5) Tables 9 and 10 of the 8081B method contain precision and recovery data generated for sewage sludge and Dichloroethane still-bottoms. Table 11 of the 8081B method contains recovery data for a clay soil, taken from Reference 10. The spiking concentration was for the clay soil was 500 ug/kg. The spiking solution mixed into the soil and then immediately transferred to the extraction device and immersed in the extraction solvent. The spiked sample was then extracted by Method 3541 (Automated Soxhlet). The data represent a single determination. Analysis was by capillary column gas chromatography/electron capture detector following Method 8081 for the Organochlorine Pesticides.

POLLUTION PREVENTION — See QAPP Section 10.2

WASTE MANAGEMENT — See SOP GEN-009

IDOC — See SOP QA-014

MDL — See SOP QA-009

GULF COAST ANALTYICAL LABORATORIES
STANDARD OPERATING PROCEDURE
GC – PCBs
SW-846 8082A

PROCEDURE: GC-023
PAGES: 13
EFFECTIVE DATE: 04/08/13
SUPERCEDES DATE: 11/11/11
APPROVED BY:
QA/QC APPROVED:

SCOPE AND APPLICATION This method provides gas chromatographic procedures for the detection of ppb levels of certain polychlorinated biphenyls (PCBs) as aroclors. Prior to the use of this method, appropriate extraction techniques must be used. The extraction is described in EXT-002 for solid samples and EXT-010 for aqueous samples. An aliquot of the sample extract is injected into a GC equipped with an ECD detector.

MATRIX Water and Solid

REFERENCE SW-846 Method 8082A, 8000B, 8000C

PRESERVATIVE Cool to 0-6° C, but not frozen; protect from light

HOLDING TIME
Water – From collection to extraction – 1 year
From extraction to analysis – 1 year
Solid – From collection to extraction – 1 year
From extraction to analysis – 1 year

DEFINITIONS Refer to SOP GEN-016

SAFETY Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards and all associated personal protective equipment and spill clean-up procedures PRIOR to the use of any chemical. In all cases, the applicable Material Safety Data Sheet (MSDS) and the supervisor or safety officer should be consulted. The bottle labels also provide important information that must be noted. Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. In particular, approved gloves, safety glasses, and labcoats must be worn. In addition to other measures prescribed by the division, solvents must be handled in ventilated hoods.

The electron capture detectors employed in this method must have a wipe test performed twice a year. In accordance with the federally mandated, state administered programs, the wipes are checked for degradation of the radionuclide foil by a contracted nuclear counting firm. Evidence of these tests are

kept in file in the laboratory.

INTERFERENCES

Solvents, reagents, glassware, and other sample artifacts may interfere with sample analysis. Interferences are monitored by the analysis of a method blank performed with each batch.

INSTRUMENTATION

Gas Chromatograph should be suitable for split/splitless injection. The system is equipped with an electron capture detector. The instruments used are Agilent Technology 6890N GC/uECD (micro ECD).

The data system must be capable of time stamping, all data produced, with the correct date and time. The data system employed is Target.

COLUMNS

Recommended Columns are
XLB or similar phase 30m X 0.32mm ID
35MS or similar phase 30m X 0.32mm ID

REAGENTS

Hexane-pesticide grade. Store away from sources of Phthalates.

STANDARDS

1. Purchasing Standards: All standards should be purchased from a certified vendor. The ICV shall be from a secondary source.

2. Stock standards for the nine aroclors are ordered from certified vendors at varying concentrations.

3. ICV Standard: Stock standard solution containing Aroclor 1016 and Aroclor 1260 prepared from a source independent of the calibration standards.

4. Surrogate stock standard is purchased certified and contains decachlorobiphenyl and Tetrachloro-m-xylene at 200ug/mL.

5. AR 1016, AR 1260 and the surrogate solution are combined into 50 mL of hexane to make a working standard at a concentration of 1600 ug/L. This standard is cut down to make up the working initial calibration range. The remaining 7 aroclors are made individually by adding the correct amount of standard to 50 mL of hexane that makes 7 working standards at a final concentration of 400 ug/L.

6. ICV working standard: Dilute 1 mL of the prepared spike solution for with 9 mL of hexane for a final concentration of 400 ug/L.

7. Standard Storage: Stock Standards can be stored for up to one year. All other working standards can be kept for up to 6 months or until stock standard it was made from expires, whichever is sooner. Standards must be replaced sooner if suspected of degrading or concentrating. All standards shall be kept at 4°C when not in use. Store standards in amber glass with PTFE- lined caps and protect from light.

Preparing Calibration Standards:

1. A standard containing a mixture of Aroclor 1016 and Aroclor 1260 is diluted into six working levels.

Table 1 Concentrations (ug/L)

	**Level 6	Level 7	Level 1	Level 2	Level 3	Level 4	Level 5
Aroclor 1016	10	50	100	200	400	800	1600
Aroclor 1260	10	50	100	200	400	800	1600

* Note: 10ug/L standard is only analyzed when low reporting limits are needed, such as tissue analysis. In this case, between 5 and 7 standards are analyzed.
** Not a working level - optional.

2. The remaining seven Aroclors (Aroclor 1221, Aroclor 1232, Aroclor 1242, Aroclor 1248, Aroclor 1254, Aroclor 1262 and Aroclor 1268) are calibrated using one working level of each. The concentrations of each are equivalent to the concentration of Level 3 of the Aroclor 1016/1260 mix.

RETENTION TIME STUDY

1. For all individual components and surrogates a retention time study is performed over approximately 72 hours whenever a new column is installed, after major maintenance, or during initial set-up. The standard deviation (SD) is calculated based on this study using at least three determinations, measured to 0.001 minutes. The width of the retention time window is three times the SD for each of the analytes. Alternatively, if the calculated SD is less than 0.01 minutes, a default window of ± 0.03 minutes shall be employed.

2. The daily retention time window for the analyte is equal to the retention time of the analyte in the first CCV of the day, ± 3 times the standard deviation or a ± 0.03 minutes when the default is employed.

INITIAL CALIBRATION CURVE

The initial calibration consists of a series of six levels of Aroclor 1016/1260 mix and one mid-level of each of the remaining seven Aroclors. An initial calibration curve for each target analyte must be analyzed and evaluated before any result for that analyte can be quantitated.

Average Response Factor Calibration.

1. For each of the six levels for Aroclor 1016/1260, calculate the response factor of 5 major characteristic Aroclor peaks in each of the initial calibration standards. It is impossible to choose 5 discreet peaks for each of the nine PCB's because many peaks are the same in several peaks. Because so many peaks are shared between the PCBs, five discreet peaks are chosen for each of the nine PCB's. These five peaks are identified in the chromatograms attached. The five peaks have been chosen distinctly for both columns so each PCB has two patterns attached - one for each column. This was done to provide continuity and repeatability between varying lab analysts and personnel. Each peak chosen should have a sufficient response to allow for accurate quantitation of the detected Aroclors. The analyst should be aware of the affect of weathering on Aroclor patterns and careful consideration should be given to patterns detected in samples when choosing peaks. Although five peaks are used for quantification, all peaks in the pattern are used in identification. Additionally, a DDT degraded standard run when distinct PCB patterns were chosen. No peak was chosen for a pattern that had the same retention time for DDT, DDD, or DDE to prevent these commonly found environmental constituents from interfering with the quantitative measurements.

2. For Aroclor 1016 and 1260, calculate the average of these six response factors and the standard deviation across the six response factors. Use the average RF and the standard deviation to calculate the percent relative standard deviation (%RSD). When the six response factors of the standards

demonstrate less than 20 %RSD for all target analytes, linearity through the origin can be assumed.

3. For each of the single-point midlevels of the remaining Aroclors, calculate the response factor for five of the characteristic Aroclor peak in each single-point.

4. For those compounds that the RSD exceeds 20%, a linear regression equation that is not forced through the origin may be used. The coefficient of determination must be at least 0.990 for the curve to be acceptable. As part of the evaluation, check the y-intercept (b) and any negative factors (b or M). Negative factors may result in false negatives and positives. Large shifts in the y-intercept from zero will impact the data. If the intercept is greater than half the reporting limit, this option shall not be used. Check the required reporting limit and any impacts on the data. Peaks with an area less than the low level standard are not reported if this option is chosen.

5. A quadratic curve fit may be used if the coefficient of determination $r^2 \geq 0.990$. A minimum of a six-point calibration is used if this option is chosen and the curve shall not be forced through zero. As part of the evaluation, check the y-intercept (b) and any negative factors (b or M). Negative factors may result in false negatives and positives. Large shifts in the y-intercept from zero will impact the data. If the intercept is greater than half the reporting limit, this option shall not be used. Check the required reporting limit and any impacts on the data. Peaks with an area less than the low level standard area not reported if this option is chosen. For South Carolina projects, quadratic curve fits are not allowed.

6. If a compound fails the initial calibration criteria, re-analyze for the compound that failed. If the compound fails in the re-analysis, perform column maintenance and clean injection port, then re-analyze the initial calibration for all analytes.

INITIAL CALIBRATION VERIFICATION

1. Immediately following the initial calibration procedure, the analyst will perform an initial calibration verification (ICV). This will consist of a solution containing Aroclor 1016 and 1260 prepared

from a standard that is independent from the standards used for the initial calibration.

2. The ICV must be analyzed following the initial calibration. The ICV recovery must be 85-115% recovery.

3. If any target analyte exceed(s) the recovery criteria, corrective action must be taken. This may include instrument maintenance, re-analysis of ICV or initial calibration, or re-preparation of the standards involved.

CONTINUING CALIBRATION VERIFICATION STANDARDS

1. The continuing calibration verification standard (CCV) is a mid-level of the Aroclor 1016/1260 mix. The calibration verification standard is analyzed to verify that the calibration curve and retention time windows are still valid.

2. The CCV is analyzed at the beginning of each analytical run. The run begins with the injection of the CCV and ends after the completion of analysis of the last sample or standard <u>injected</u> within 12 hours of the beginning of shift. A CCV must also be injected every 10 samples and at the end of the sequence.

3. The criteria for the CCV is that all analytes must be <20 Percent Difference (%D) from the initial calibration. For each CCV, each compound must fall within the retention time window.

4. If the calibration verification standard fails to meet this criterion, repeat the injection of the standard. If the standard continues to fail, take appropriate corrective action (inspection of GC, re-prep. standard, etc.) If the criteria cannot be met, instrumental maintenance and a new initial calibration curve should be prepared.

5. If the CCV analyzed <u>after</u> a group of samples has a response for an analyte >20% and the analyte was <u>not</u> detected in any of the previous samples during the analytical shift, then the samples do not need to be re-analyzed. If an analyte was <u>not</u> detected in the sample and the standard response is more than 20% <u>below</u> the initial calibration response, then re-injection is necessary.

SAMPLE ANALYSIS

1. Up to 10 samples (not including MB, LCS/LCSD) can be analyzed after the CCV.

2. All samples are evaluated on a primary column then a secondary column if an analyte above detection limit was detected. The secondary column confirms the presence of that analyte.

4. If the analyte falls within the retention time window and the Aroclor pattern is verified on both the primary and secondary analysis, then calculate the concentration present. If weathered peaks are present, they may fall outside the retention time window but should be identified by pattern. This data would be reported with a narrative. The higher value of the two analyses is reported. (The lower value maybe reported if required by the project.) If the difference between the two results, calculated as an RPD, is greater than 40%, narrate the sample results. The results are flagged in the report. For DOD projects, the analyst should use project specific requirements for reporting if available. Otherwise, report the result from the primary column and flag results where the confirmation result is greater than 40% RPD.
5. Sometimes more than one 'front end' or 'back end' PCB will appear to be in the same sample. If more than one PCB appears to be in the sample, the PCB concentrations may be affected by the PCBs present that share peaks. If more than one PCB is present in a sample, GCAL reports the PCB that has the stronger pattern. A narrative is written to suggest that there is evidence of a second PCB present.

SAMPLE RE-EXTRACTION

Samples are to be re-extracted due to failed QC or due to the surrogate results. When a MB, LCS, or LCSD fails to meet criteria, the entire batch is sent to extractions for re-extraction. If the MS, MSD, or surrogates fail criteria, only the affected samples are sent to extractions. Particular samples may be re-extracted if the sample results do not match historical values, if a sample and a duplicate do not match, or if physical differences are noted in samples. If samples are re-extracted outside of method specified holding times, both analyses are reported. To request sample/batch re-extraction, do the following:

1. If the extract has been analyzed, process the file and load to LIMS.
2. Enter the code "RP" into the analysis code; this

will schedule new sample prep.

3. Complete the Re-extraction Request and Tracking Form (attached) and submit a copy to extraction supervisor.
4. When new extracts are brought to the lab, complete the original Re-extraction Request and Tracking Form and report the data appropriately.
5. If additional sample is not available to re-prep, check with project manager to determine appropriate action to report the available data.
6. If two sets of data will be reported, see login to obtain a re-extracted sample number.

CALCULATION

1. $$\text{MS \% REC} = \frac{\text{MS Concentration-Sample Concentration}}{\text{spike added}} \times 100$$

2. $$\text{MSD \% REC} = \frac{\text{MSD Concentration-Sample Concentration}}{\text{spike added}} \times 100$$

3. $$\text{\% RPD} = \frac{\text{MS-MSD}}{(\text{MS+MSD})/2} \times 100$$

   LCS/LCSD results are substituted to calculate %RPD between LCS and LCSD. Results are calculated using the concentration (not percent recovery).

4. Response Factor = A_s/C_s

   As = Peak Area of analyte or surrogate
   Cs = Concentration of the analyte or surrogate

5. $$\text{Surrogate/LCS Recovery} = \frac{\text{Concentration Found}}{\text{Concentration Added}} \times 100$$

6. Concentration using RF:

   $$\text{Concentration } (\mu g/L) = \frac{(A_s)(D)(V_t)}{(RF)(V_s)}$$

   $$\text{Concentration } (\mu g/kg) = \frac{(A_s)(D)(V_t)}{(RF)(W_s)}$$

   A_s = Area of peak for the analyte in sample
   D = Dilution factor
   RF = Mean Response factor from initial calibration
   W_s = Weight of sample extracted in g
   V_t = Total volume of concentrated extract in µL
   V_s = Volume of aqueous sample extracted in mL

7. Concentration using linear curve fit:

   $$\text{Concentration } (\mu g/L) = [m(A_S)+b]D$$

Concentration (mg/kg) $=[m(A_S)+b]D(5/W_S)$

m = Inverse of slope
A_s = Area of peak for the analyte in sample
b = Intercept of the y-axis
D = Dilution factor
W_s = Weight of sample extracted

8. Concentration using a quadratic curve fit:

Concentration (mg/L) $= [b + a(A_S) + a_2(A_S)^2]D(5/V_S)$

Concentration (mg/kg) $= [b + a(A_S) + a_2(A_S)^2]D(5/W_S)$

9. % Difference $= [(RF_I - RF_C) / RF_I\} \times 100$

RF_I = Average response factor from initial calibration
RF_C = Response factor from current verification check standard

10. % Drift $= \frac{(\text{Calculated Conc.} - \text{Theoretical Conc.})}{\text{Theoretical Conc.}} * 100$

11. % RSD = (SD/X) X 100

RSD = Relative Standard Deviation
X = mean of initial RF's for a compound
SD = Standard Deviation of average RF's for a compound

QUALITY CONTROL

METHOD BLANK

1. The method blank (extraction blank) is analyzed to demonstrate the extraction procedure did not introduce contamination.

2. No target analytes should be detected in the method blank above ½ the reporting limit. If any target analytes are detected, data may not be reported and samples must be re-extracted and re-analyzed unless the following apply.

   A. If a target analyte is detected above ½ the reporting limit, data may be reported if the concentration is not greater than 5% of the measured concentration in associated samples. Include a narrative with the data.

   B. If a target analyte is detected in the method blank but there are no hits in the samples, the data may be reported with a narrative.

C. Additional project criteria may apply. See SOP GEN-019.

SURROGATES

1. The surrogate is used to verify that each sample was properly extracted. A surrogate is a non-target compound that is chemically similar to the analytes. The surrogate used is decachlorobiphenyl (DCB).

2. If a surrogate recovery fails below the lower control limit, re-extract and re-analyze the sample. If the surrogate is outside QC limits in the re-extract sample, then indicate in the case narrative and state that the recovery was outside the control limits due to sample matrix. If re-extraction cannot be performed due to insufficient sample, report the data with a narrative.

3. If the surrogate recovery is above the control limits and the sample results are less than the reporting limit, the data may be reported with a narrative.

Surrogate	Rec. Limits % Water	Rec. Limits % Soil
DCB	30-139%	55-139%

4. Project specific limits may apply and may be more stringent; project limits are listed in the LIMS. See SOP GEN-019.

LABORATORY CONTROL STANDARD (LCS/LCSD)

1. A LCS and LCSD (if required) are included in each batch to demonstrate the system is in control. Routinely the LCS/LCSD will be spiked with a mixture of Aroclors 1016/1260. Spikes for specific Aroclors may be required for specific projects. Control limits are listed in the table below. For South Carolina projects, LCS/LCSD recoveries must be 70-130% to report data.

LCS/LCSD CONTROL LIMITS

COMPOUND	% RECOVERY WATER	RPD WATER	% RECOVERY SOLID	RPD SOLID
Aroclor 1016	57-130	35	55-130	31

Aroclor 1260	55-130	34	49-130	36

*Other Aroclors- based on project requirements

2. All recoveries must be within the control limits. If a recovery is above the upper control limit and the sample results are below the reporting limit, the data may be reported with a narrative.

3. If a recovery is below the lower control limit, the batch must be re-extracted and re-analyzed. If a re-extraction is not possible due to insufficient sample volume, report the data with a narrative.

4. Project specific recovery and precision limits may apply and may be more stringent; project limits are listed in the LIMS. See SOP GEN-019.

MATRIX SPIKES (MS/MSD)

1. The purpose of the MS/MSD is to assess the performance of the method for a particular sample matrix. Use the same precision and accuracy control limits listed for the LCS/LCSD.

2. Whenever the MS and/or MSD recoveries are outside the control limits, review data to verify that a lab error has not occurred (wrong spike amount, not spiked) before automatically identifying a failure as matrix interference.

3. If recoveries for both the MS/MSD are outside the control limits and the recoveries are similar, the data is reportable with a narrative stating the LCS recoveries were acceptable. The failure is attributed to sample matrix.

4. If precision is outside of control limits and spike recoveries are outside OC limits , re-extract the parent, MS, and MSD. If the failure is repeated, check that the samples are homogenous. Narrate the sample results including corrective action and sample appearance if applicable.

5. If precision is outside of control limits but all spike recoveries are acceptable and all LCS recoveries are acceptable, narrate the failures.

6. Native sample concentrations may be high in comparison to the spiking concentration and therefore an accurate recovery cannot be

calculated. Document this in the case narrative.

7. Spikes may be diluted out in the analysis process. Document this in the case narrative.

8. Project specific recovery and precision limits may apply and may be more stringent; project limits are listed in the LIMS. See SOP GEN-019.

REPORTING LIMITS

Below is a list of the default reporting limits for PCBs. Reporting limits may be lowered by altering the prep and, when allowable, calibrating lower. The reporting limit should be no lower than 2X the verified MDL. Some projects may have different criteria for setting reporting limits. Check SOP GEN-019 and with the project manager.

Reporting limits below are applicable for the following analyte list:

PCB-1016
PCB-1221
PCB-1232
PCB-1242
PCB-1248
PCB-1254
PCB-1260
PCB-1262
PCB-1268

Water – 1 ug/L
Solid – 40-1200 ug/kg

DATA REVIEW

For data review procedures and checklist, please see SOP QA-002.

SOFTWARE TROUBLESHOOTING

The Agilent GC utilizes Agilent software GC Chemstation Version A.10.02 to control the instrument and transfer data acquisition to Target Data Integration software. Target software is utilized to calculate all data. In the event of software malfunction for the GC Chemstation, please contact Agilent technical support for troubleshooting help. In the event of software malfunction when using Target, please contact GCAL’s IT Director for troubleshooting help.

METHOD PERFORMANCE

1. The accuracy and precision obtainable with this method depend on the sample matrix, sample preparation technique, optional cleanup techniques, and calibration procedures used. Table 9 of Method 8082 provides single

laboratory recovery data for Aroclors spiked into clay and soil and extracted with automated Soxhlet. Table 10 of Method 8082 provides multiple laboratory data on the precision and accuracy for Aroclors spiked into soil and extracted by automated Soxhlet.

2. During method performance studies, the concentrations determined as Aroclors were larger than those obtained using the congener method. In certain soils, interference prevented the measurement of congener 66. Recoveries of congeners from soils spiked from Aroclor 1254 and Aroclor 1260 were between 80% and 90%. Recoveries of congeners from environmental reference materials ranged from 51-66% of the certified Aroclor values.

MANUAL INTEGRATIONS — Perform and document manual integrations as described in SOP QA-010.

POLLUTION PREVENTION — See QAPP Section 10.2

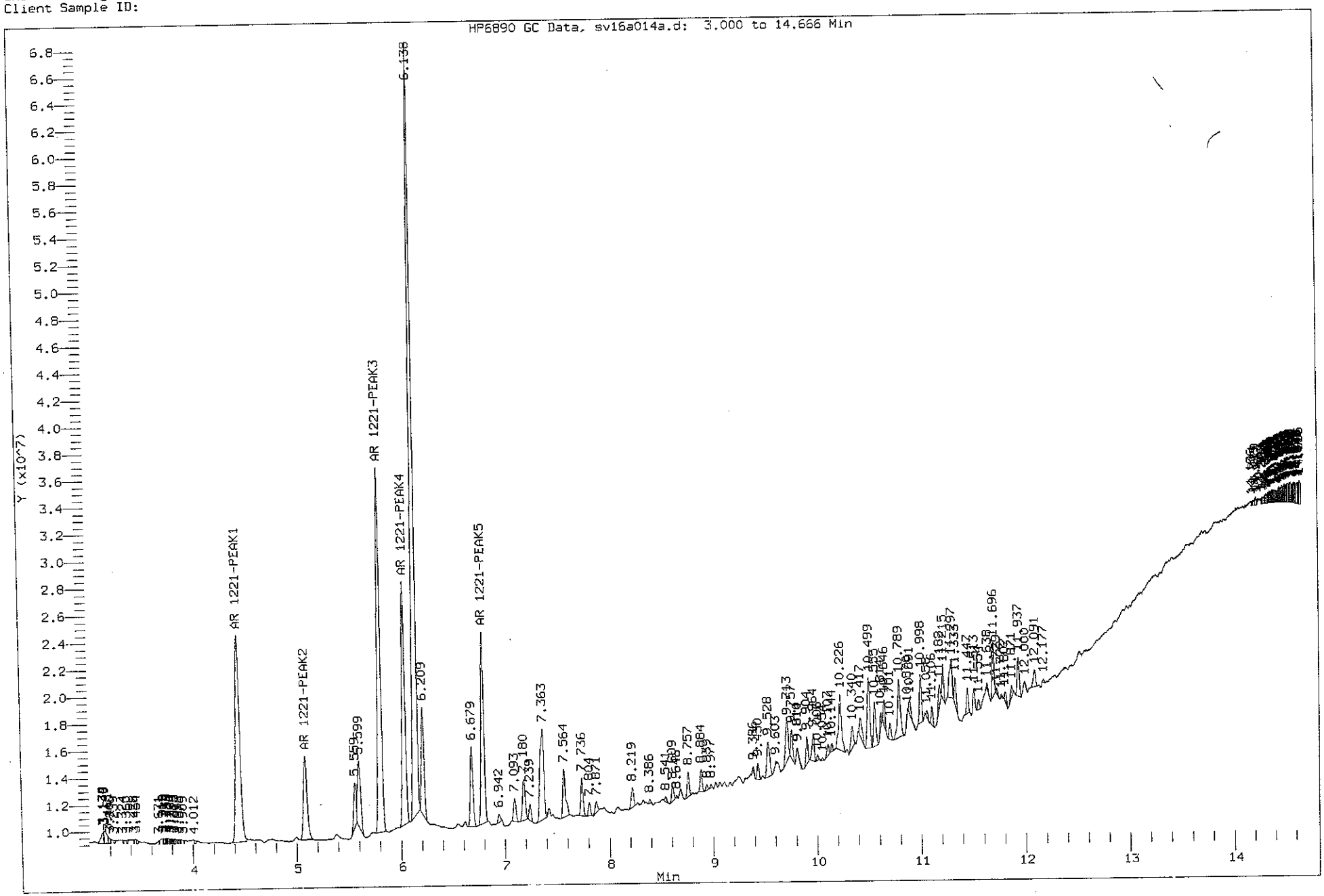
WASTE MANAGEMENT — See SOP GEN-009

IDOC — See SOP QA-014

MDL — See SOP QA-009

21
35ms

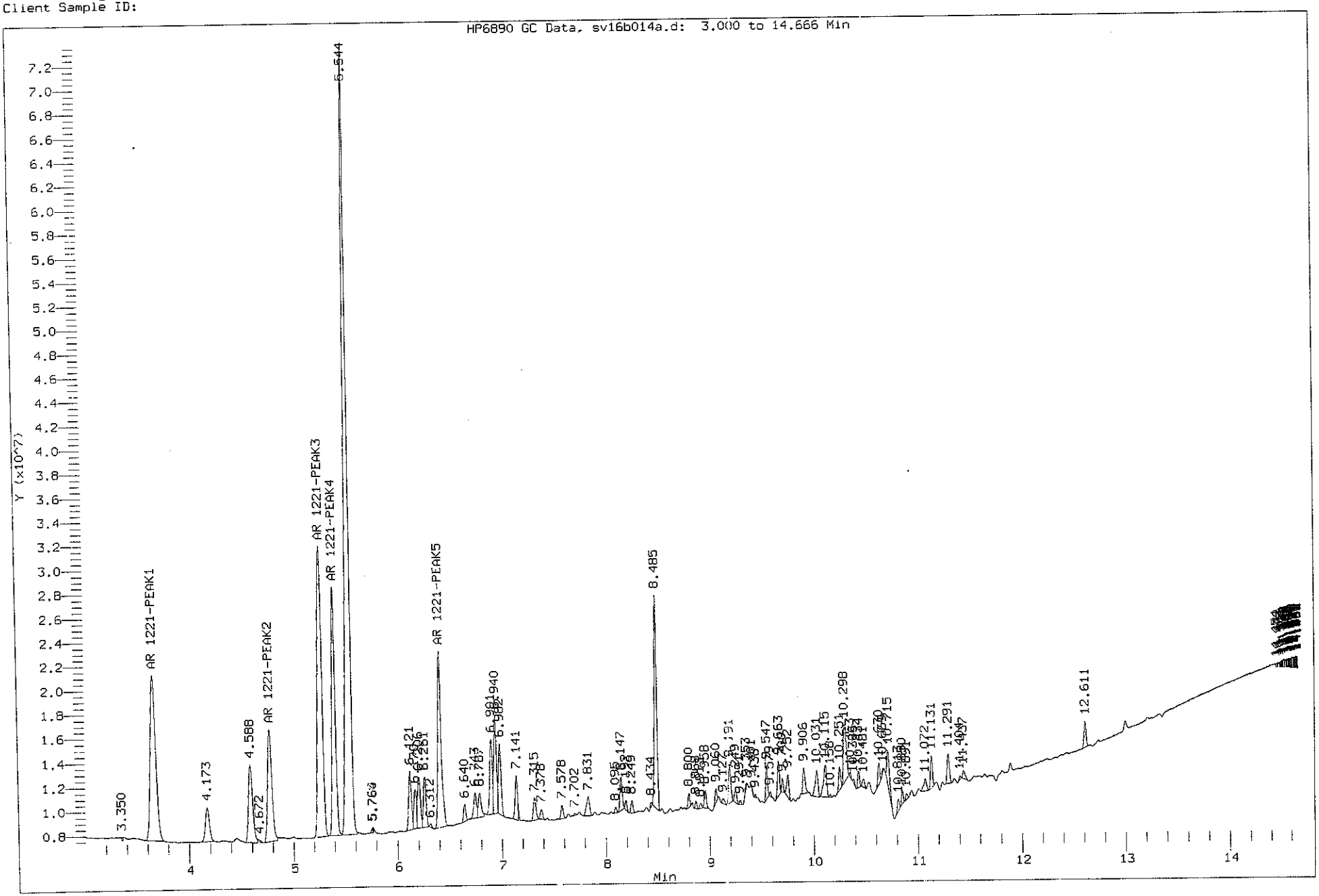
Data File: /var/chem/gcsv16a.i/2110104.b/sv16a014a.d
Injection Date: 04-JAN-2011 19:17
Instrument: gcsv16a.i
Client Sample ID:



21

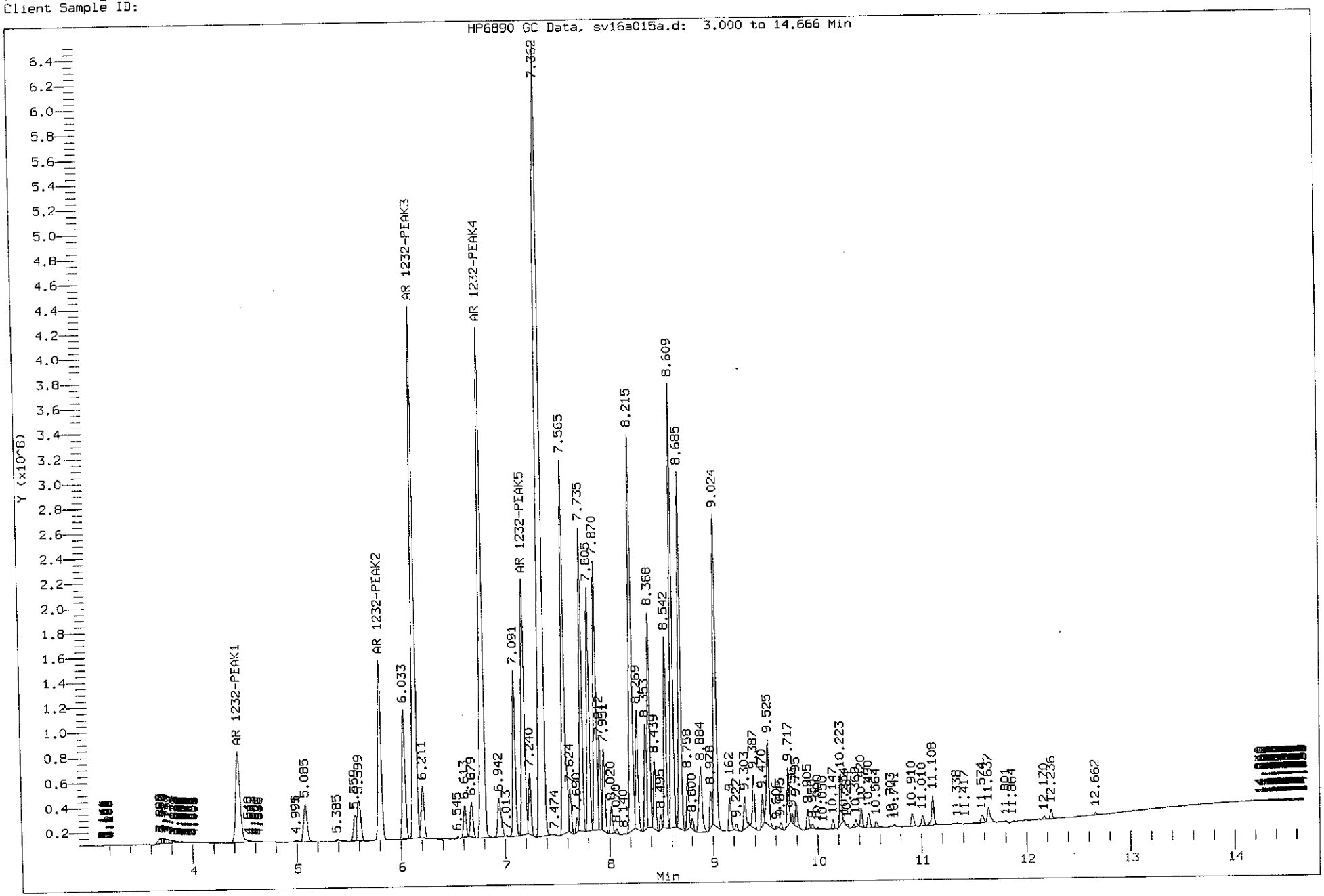
XLB

Data File: /var/chem/gcsv16b.i/2110104.b/sv16b014a.d
Injection Date: 04-JAN-2011 19:36
Instrument: gcsv16b.i
Client Sample ID:



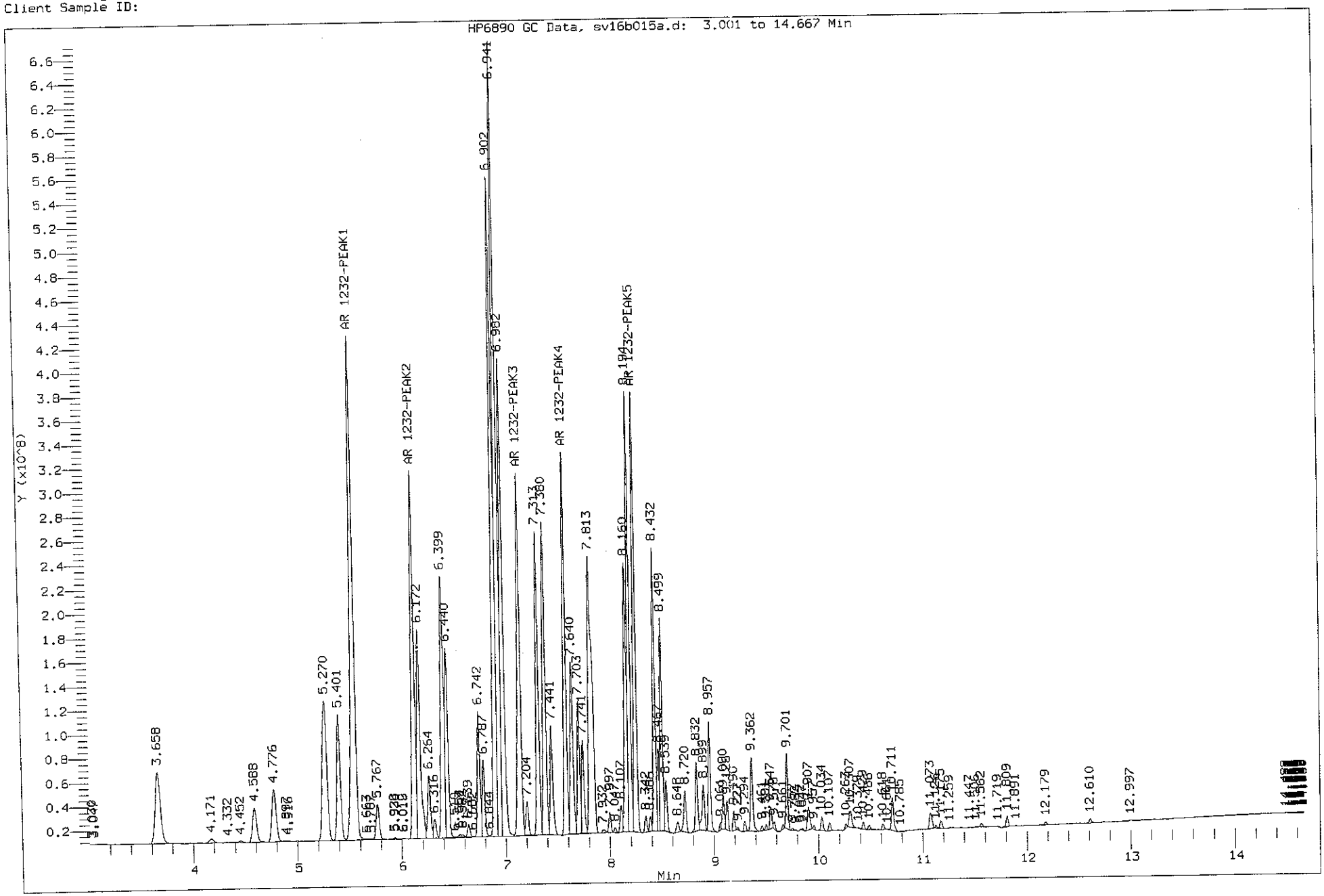
32
35mS

Data File: /var/chem/gcsv16a.i/2110104.b/sv16a015a.d
Injection Date: 04-JAN-2011 19:36
Instrument: gcsv16a.i
Client Sample ID:



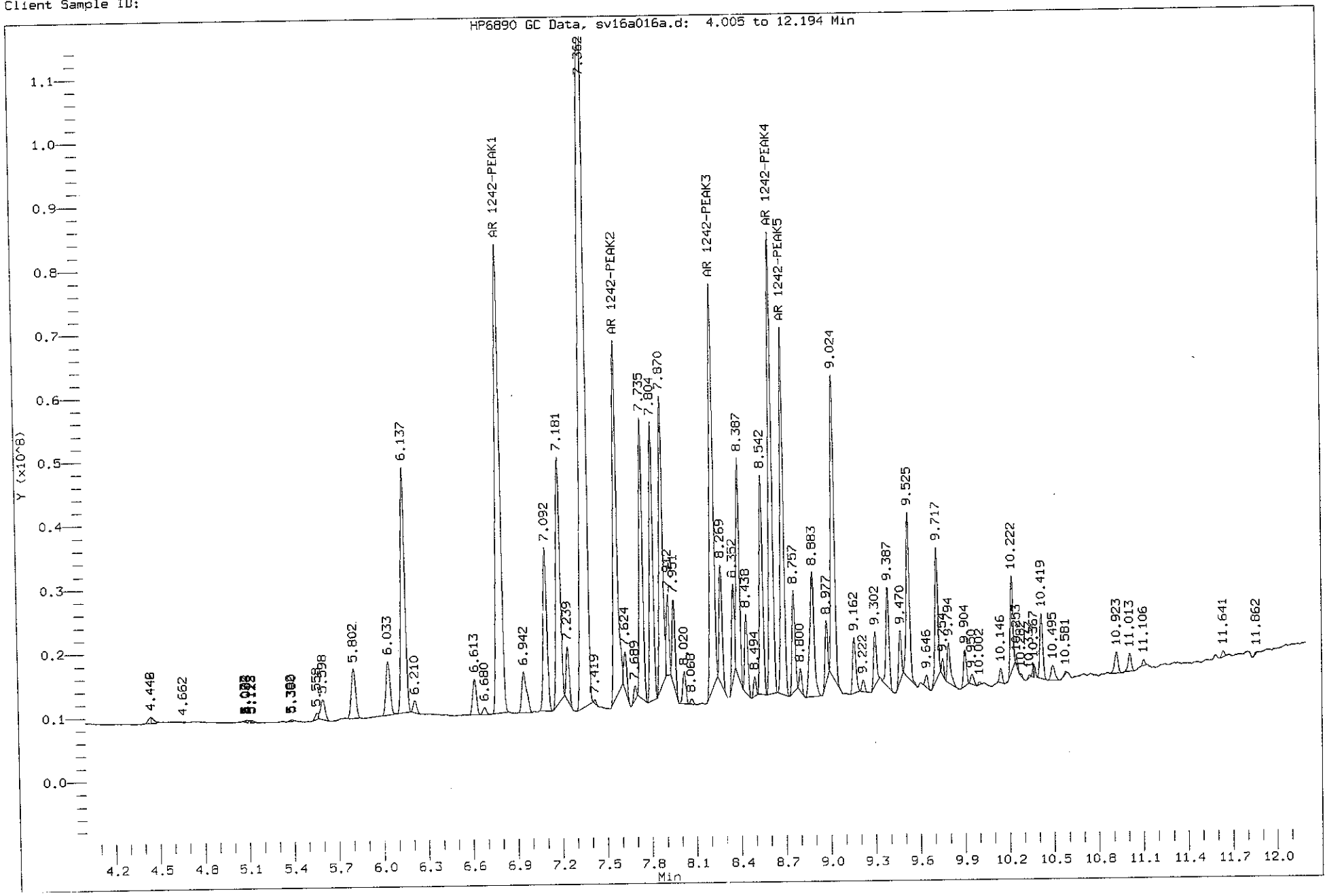
32
XCB

Data File: /var/chem/gcsv16b.i/2110104.b/sv16b015a.d
Injection Date: 04-JAN-2011 19:54
Instrument: gcsv16b.i
Client Sample ID:



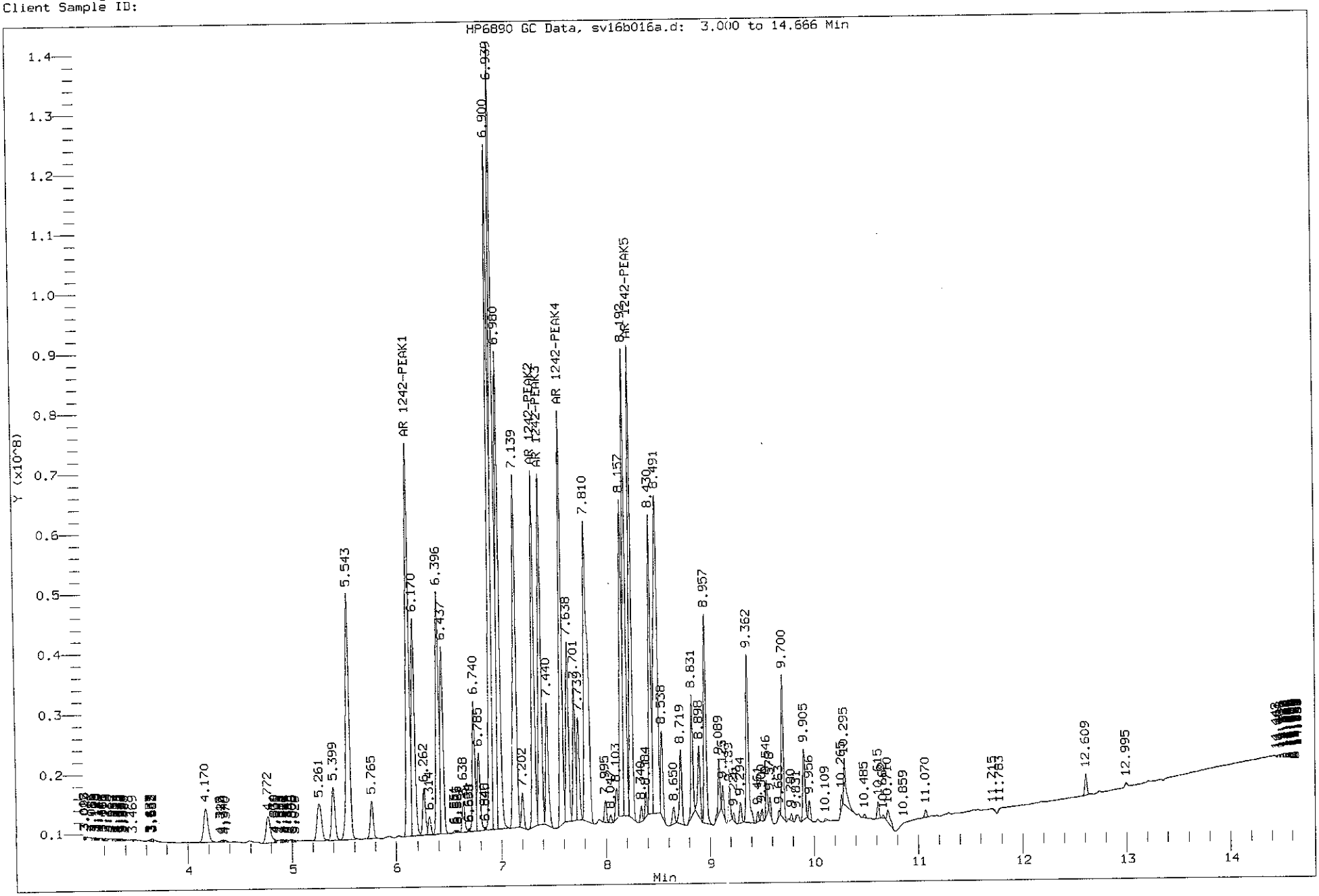
42
35ms

Data File: /var/chem/gcsv16a.i/2110104.b/sv16a016a.d
Injection Date: 04-JAN-2011 19:54
Instrument: gcsv16a.i
Client Sample ID:



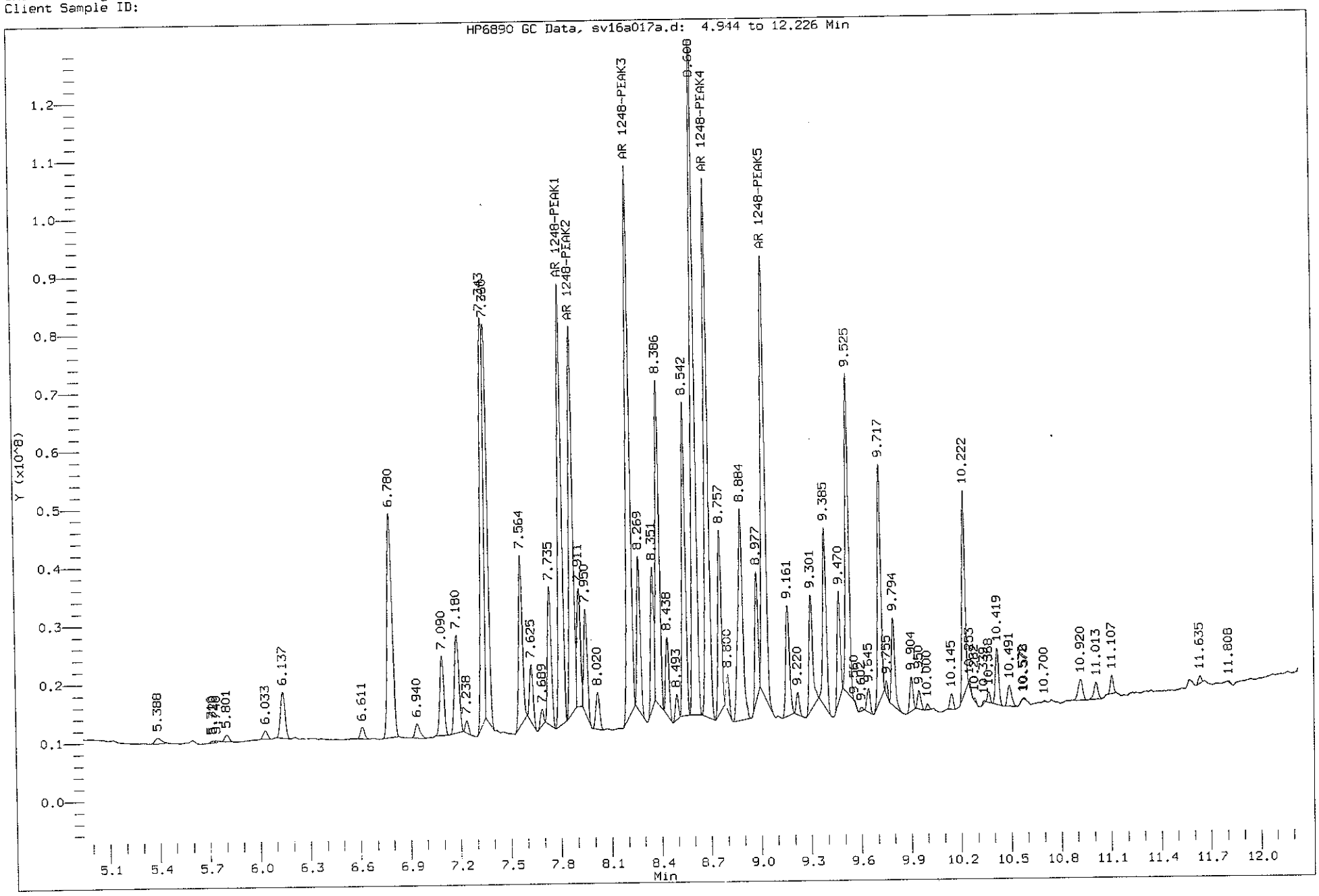
42
XLB

Data File: /var/chem/gcsv16b.i/2110104.b/sv16b016a.d
Injection Date: 04-JAN-2011 20:13
Instrument: gcsv16b.i
Client Sample ID:



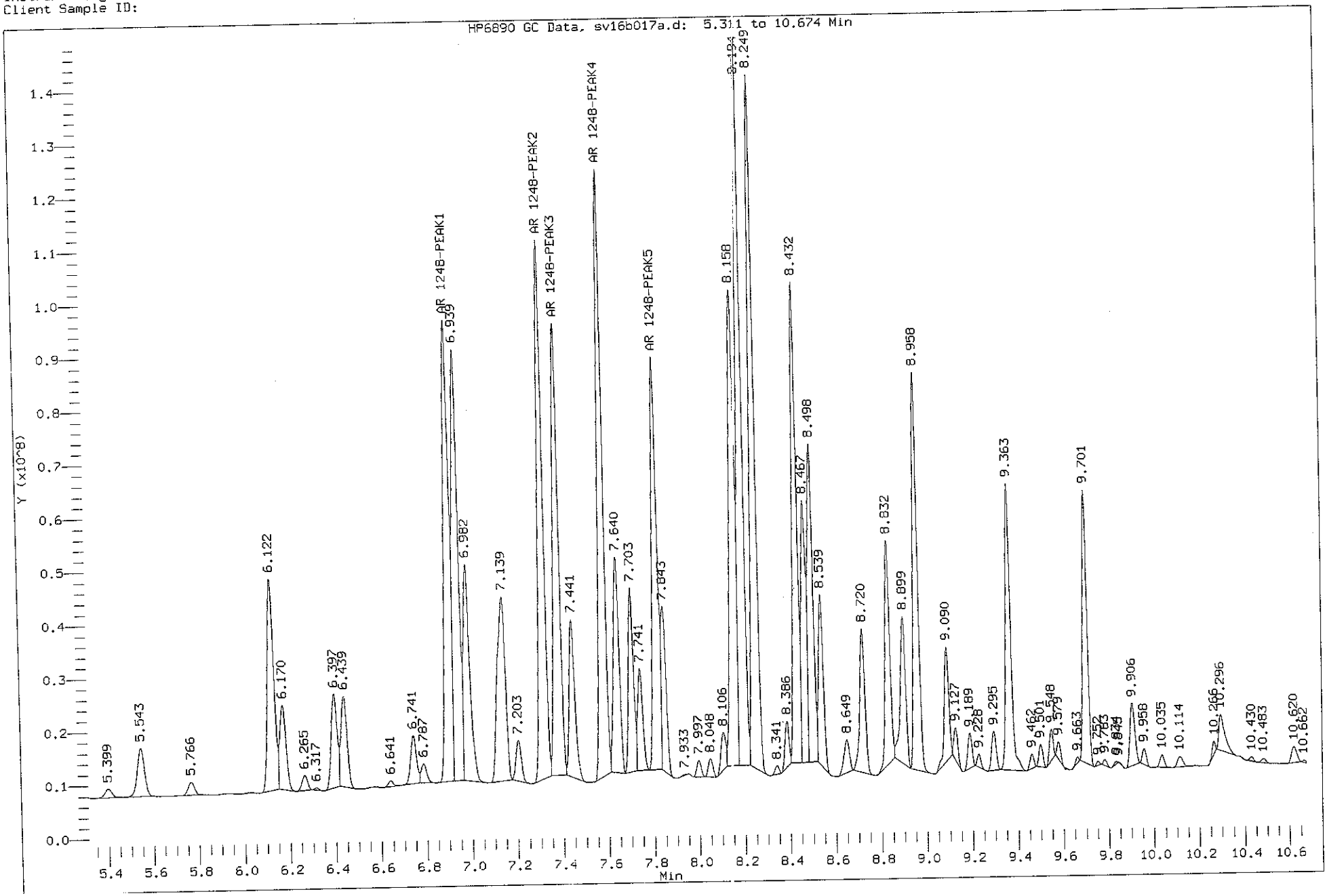
48
35 ms

Data File: /var/chem/gcsv16a.i/2110104.b/sv16a017a.d
Injection Date: 04-JAN-2011 20:13
Instrument: gcsv16a.i
Client Sample ID:



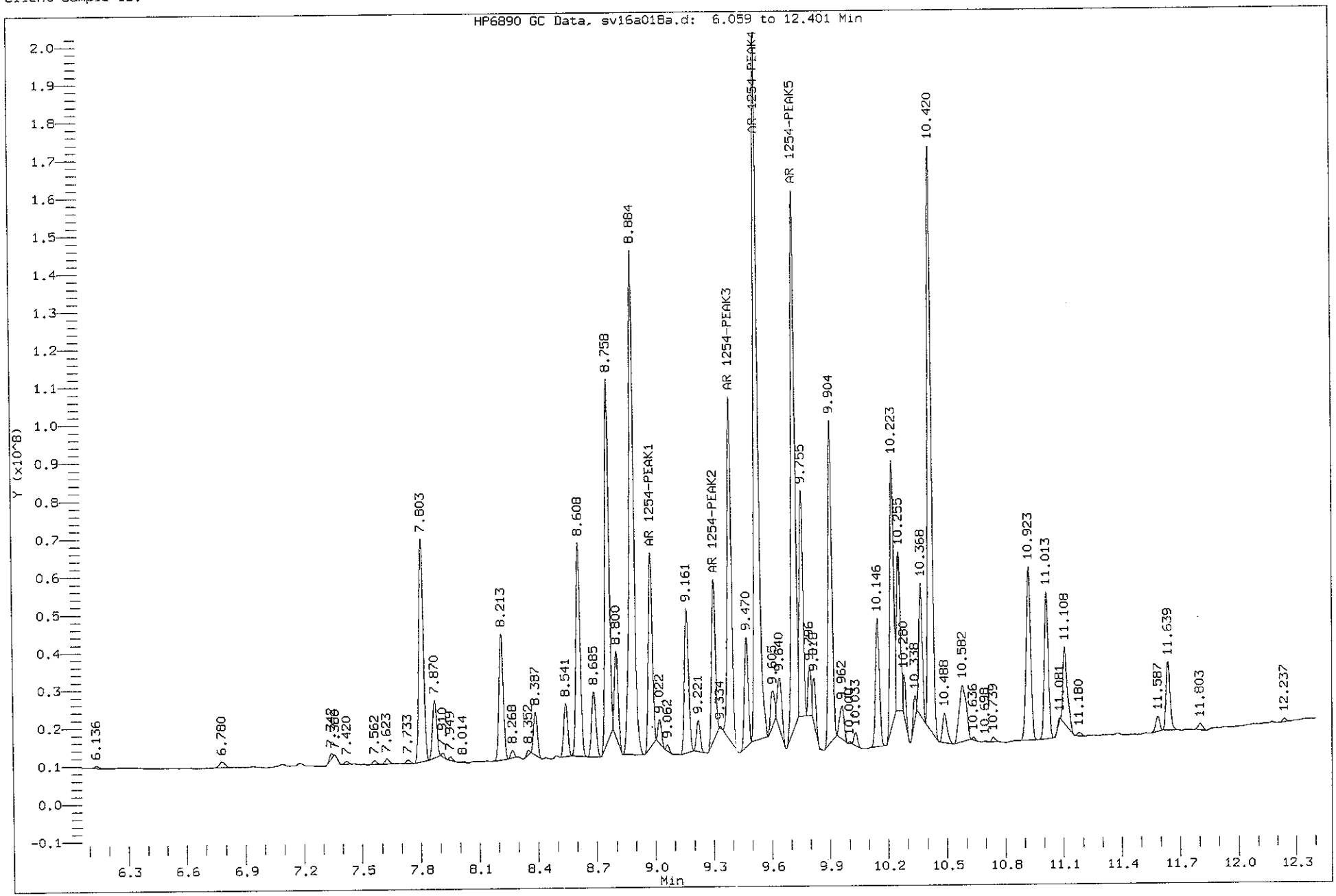
48
XLB

Data File: /var/chem/gcsv16b.i/2110104.b/sv16b017a.d
Injection Date: 04-JAN-2011 20:31
Instrument: gcsv16b.i
Client Sample ID:



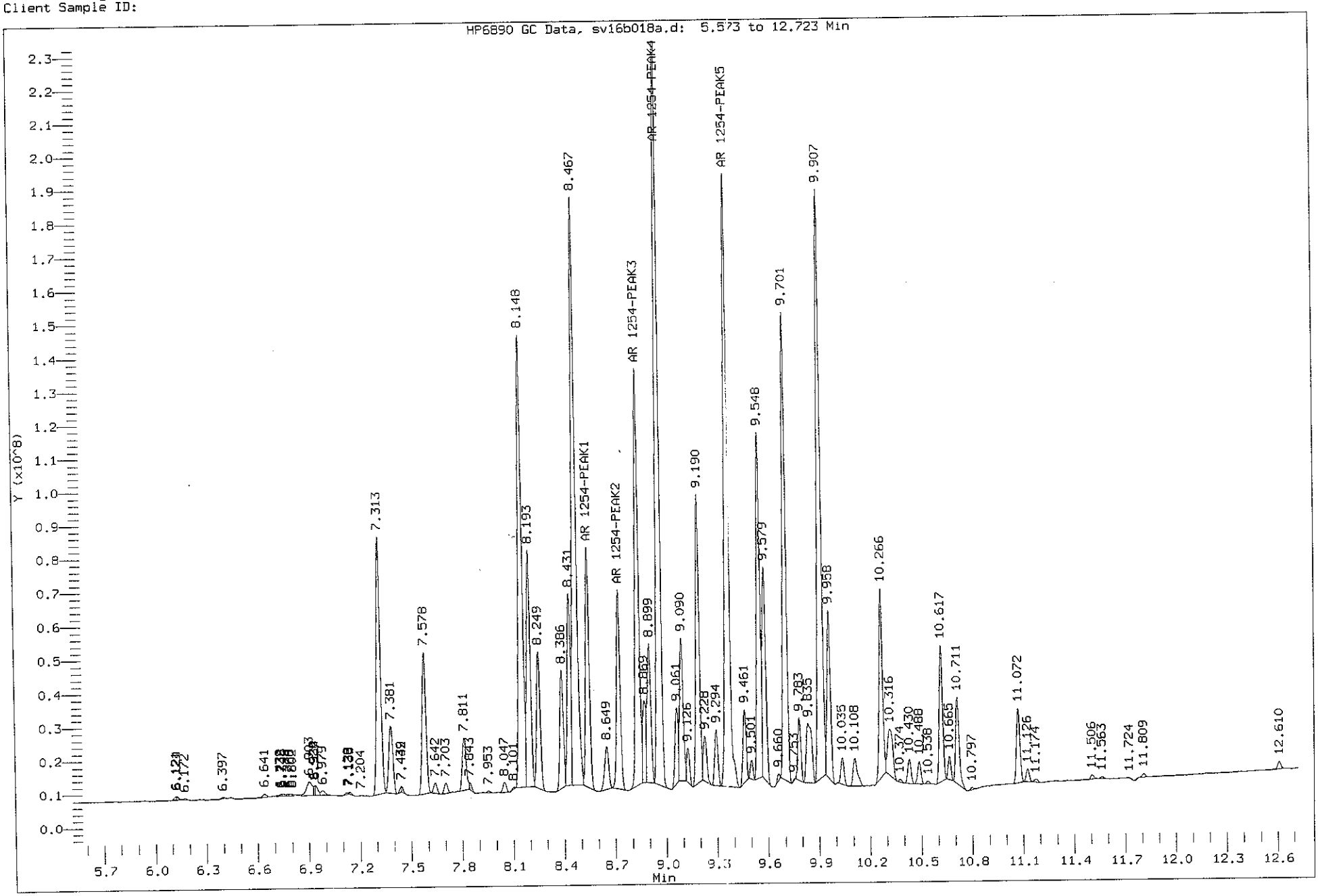
54
35 ms

Data File: /var/chem/gcsv16a.i/2110104.b/sv16a018a.d
Injection Date: 04-JAN-2011 20:31
Instrument: gcsv16a.i
Client Sample ID:



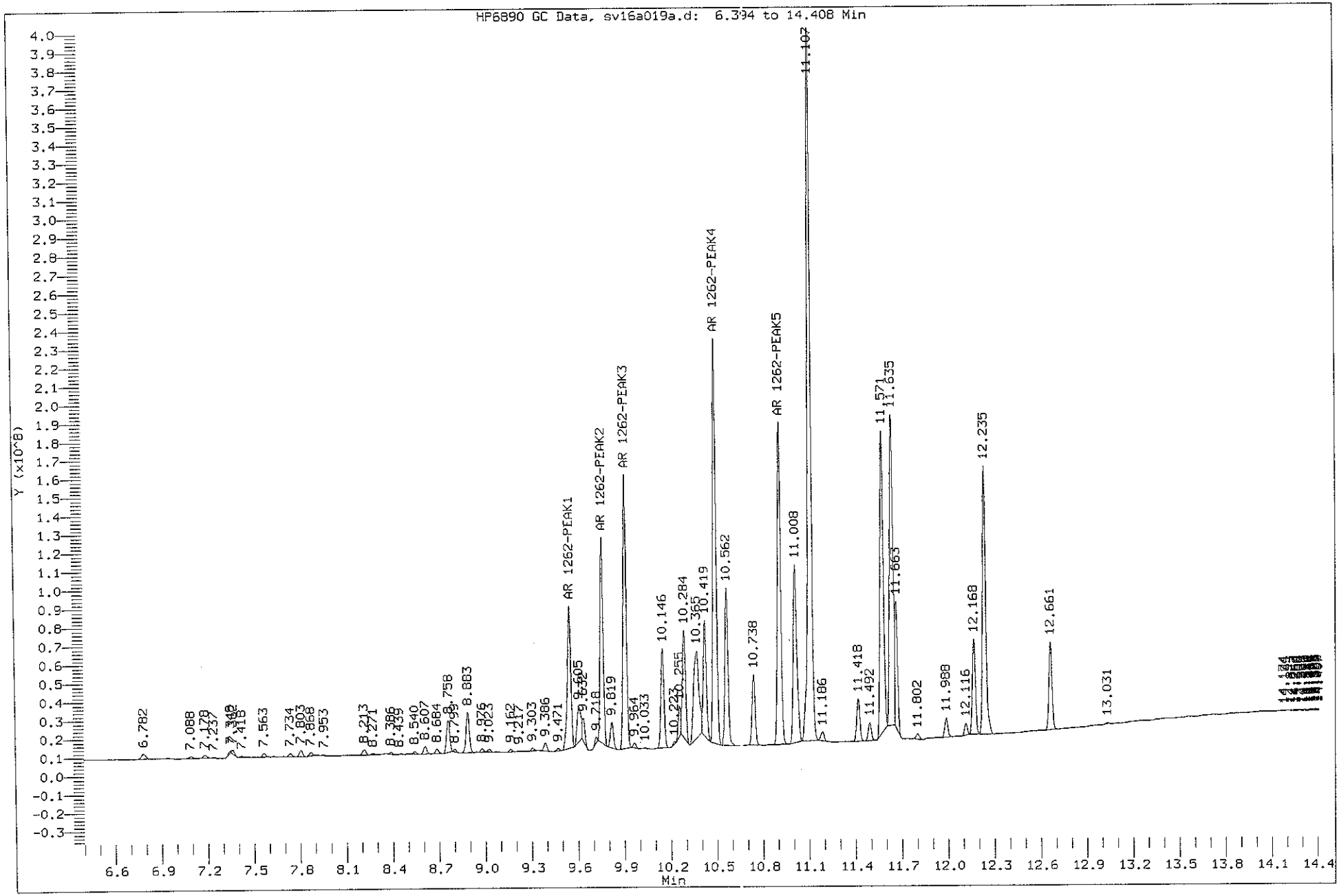
54
XLB

Data File: /var/chem/gcsv16b.i/2110104.b/sv16b018a.d
Injection Date: 04-JAN-2011 20:50
Instrument: gcsv16b.i
Client Sample ID:



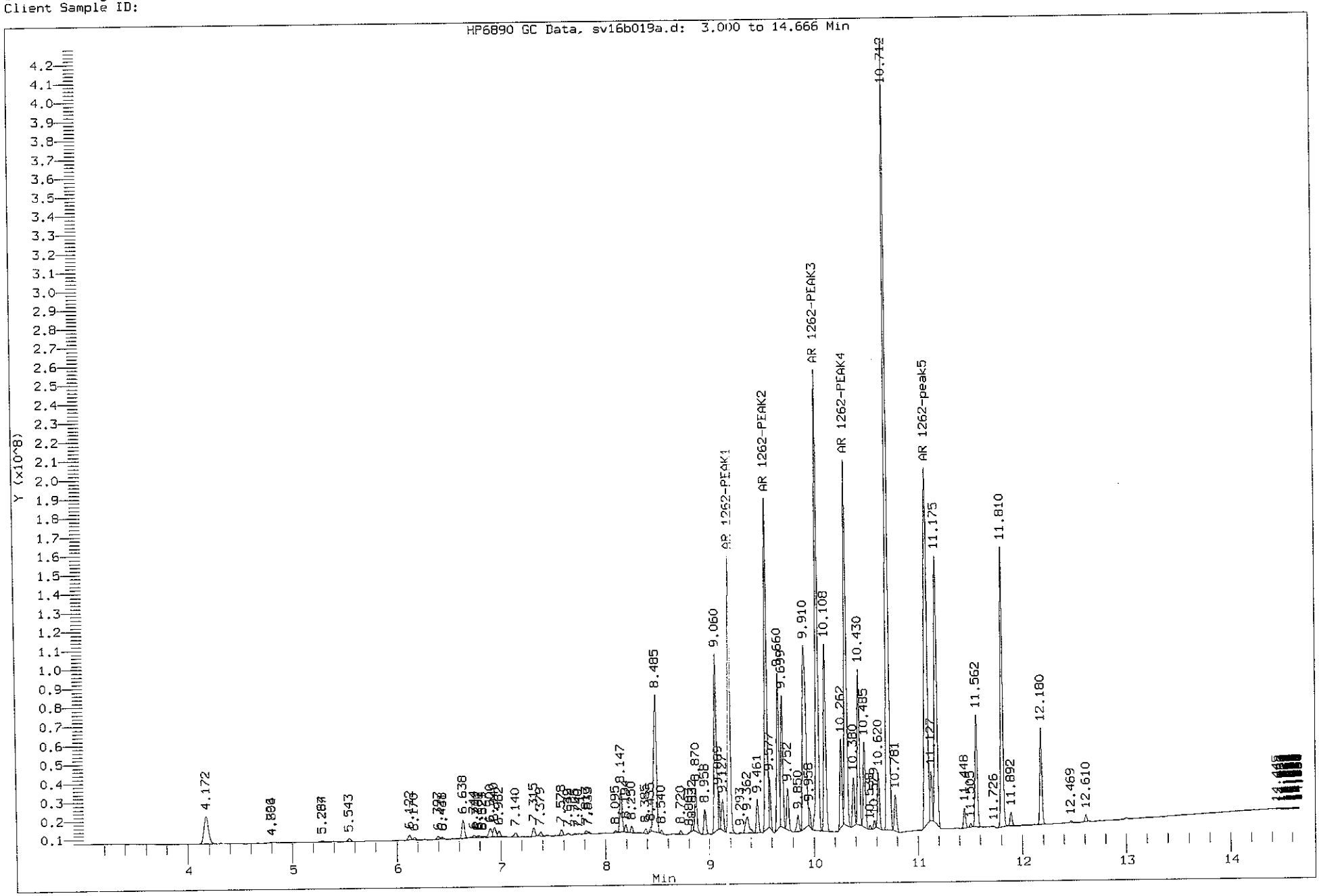
b2
35ms

Data File: /var/chem/gcsv16a.i/2110104.b/sv16a019a.d
Injection Date: 04-JAN-2011 20:50
Instrument: gcsv16a.i
Client Sample ID:



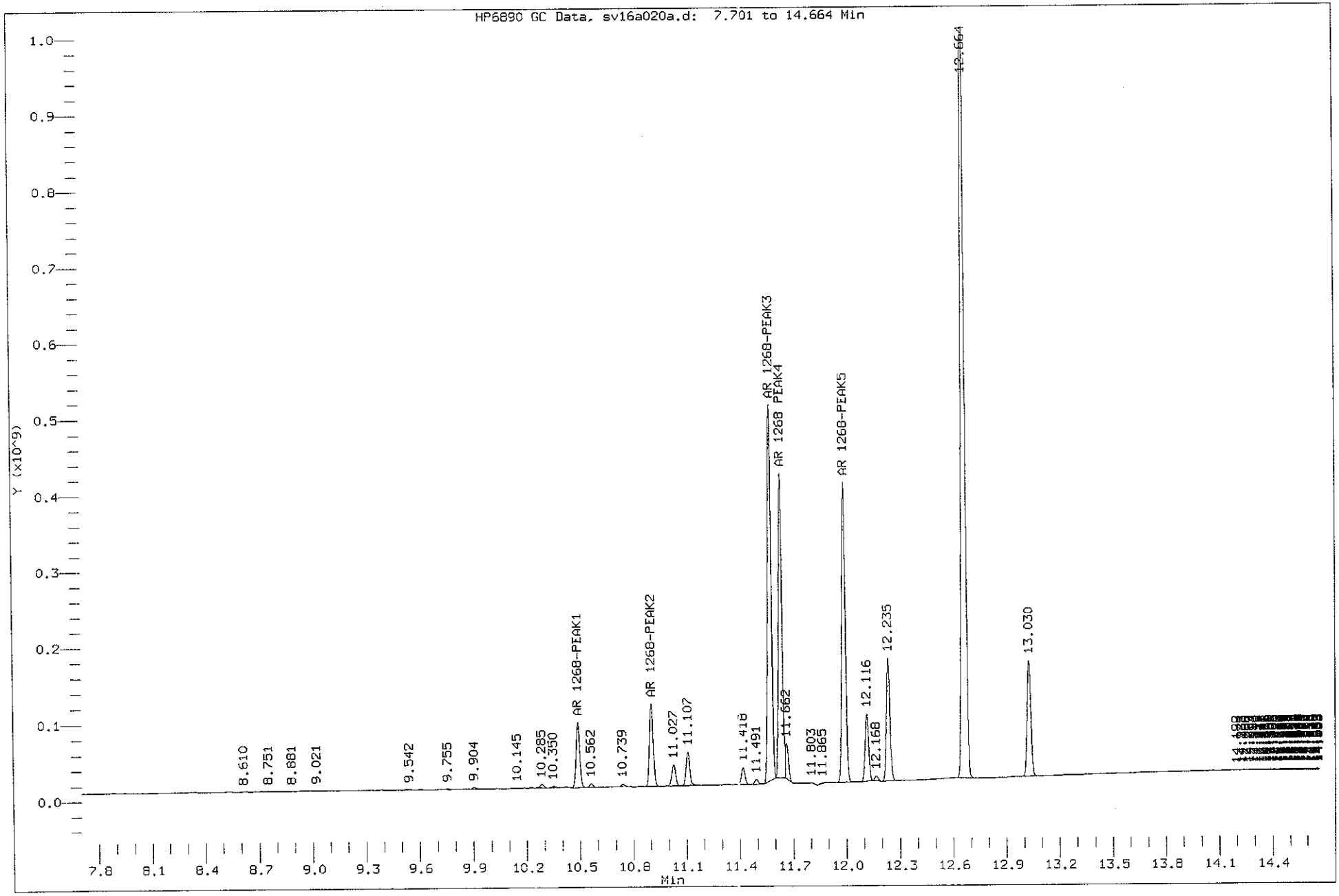
62XLB

Data File: /var/chem/gcsv16b.i/2110104.b/sv16b019a.d
Injection Date: 04-JAN-2011 21:08
Instrument: gcsv16b.i
Client Sample ID:



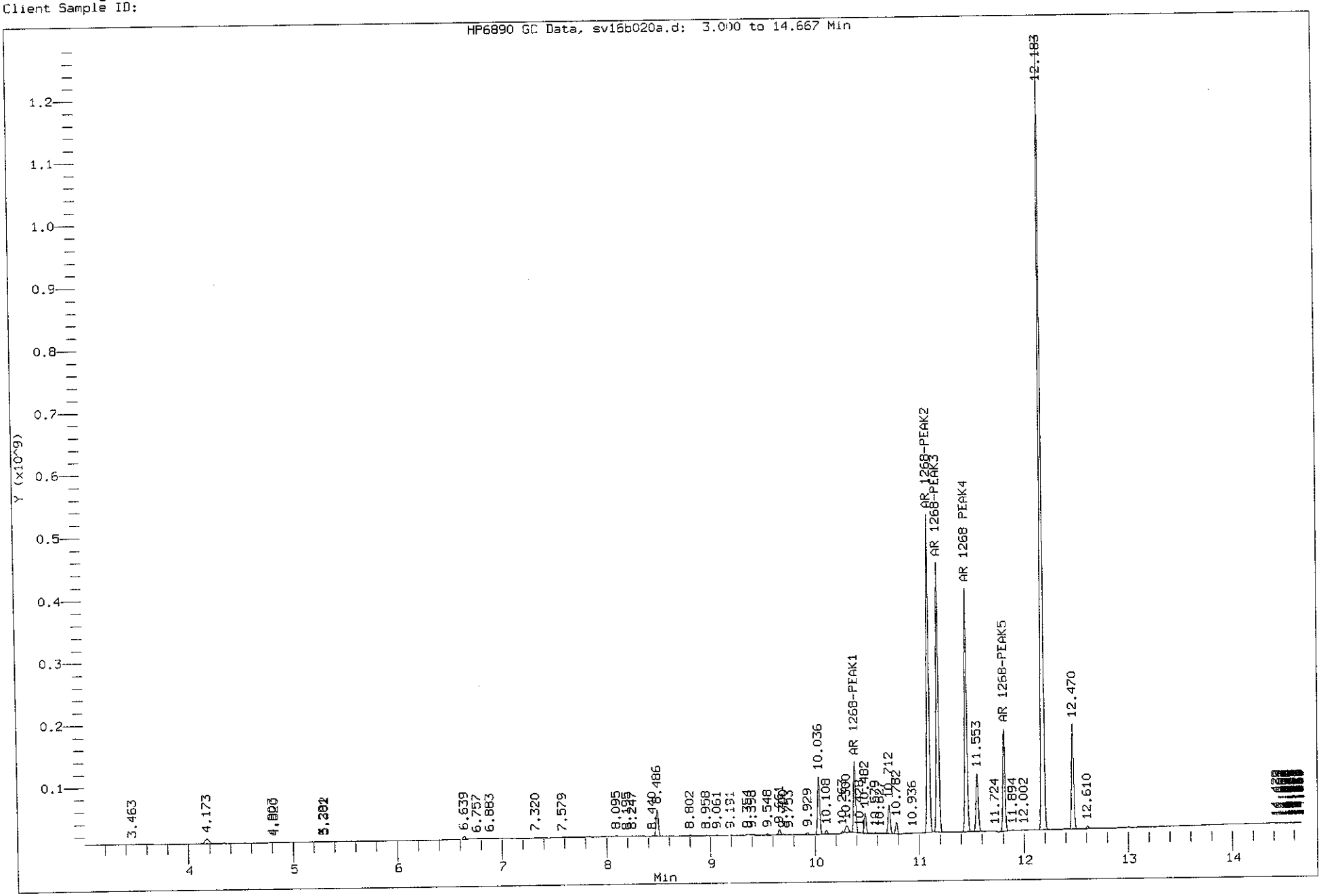
68
35mS

Data File: /var/chem/gcsv16a.i/2110104.b/sv16a020a.d
Injection Date: 04-JAN-2011 21:08
Instrument: gcsv16a.i
Client Sample ID:



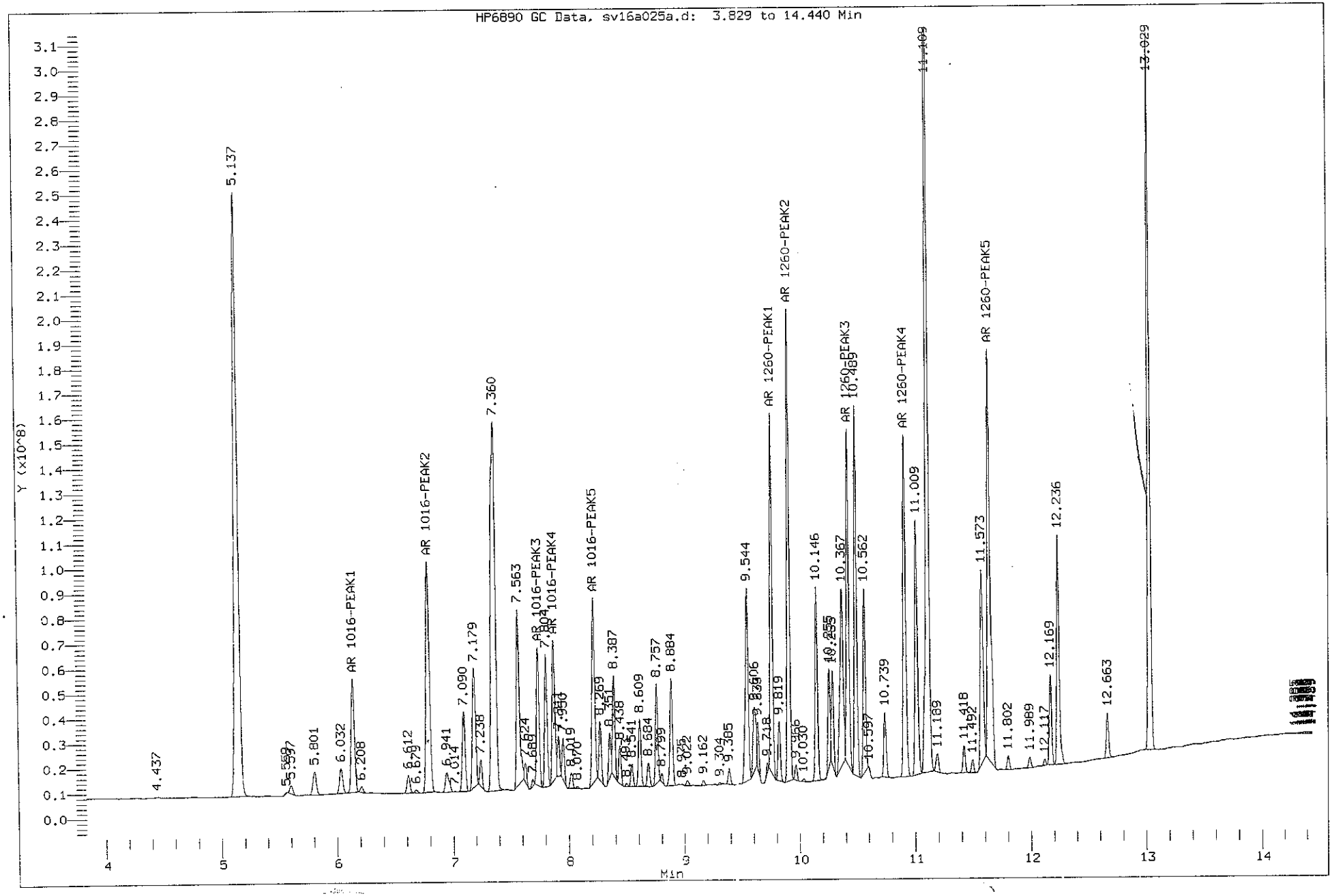
68
XCB

Data File: /var/chem/gcsv16b.i/2110104.b/sv16b020a.d
Injection Date: 04-JAN-2011 21:27
Instrument: gcsv16b.i
Client Sample ID:



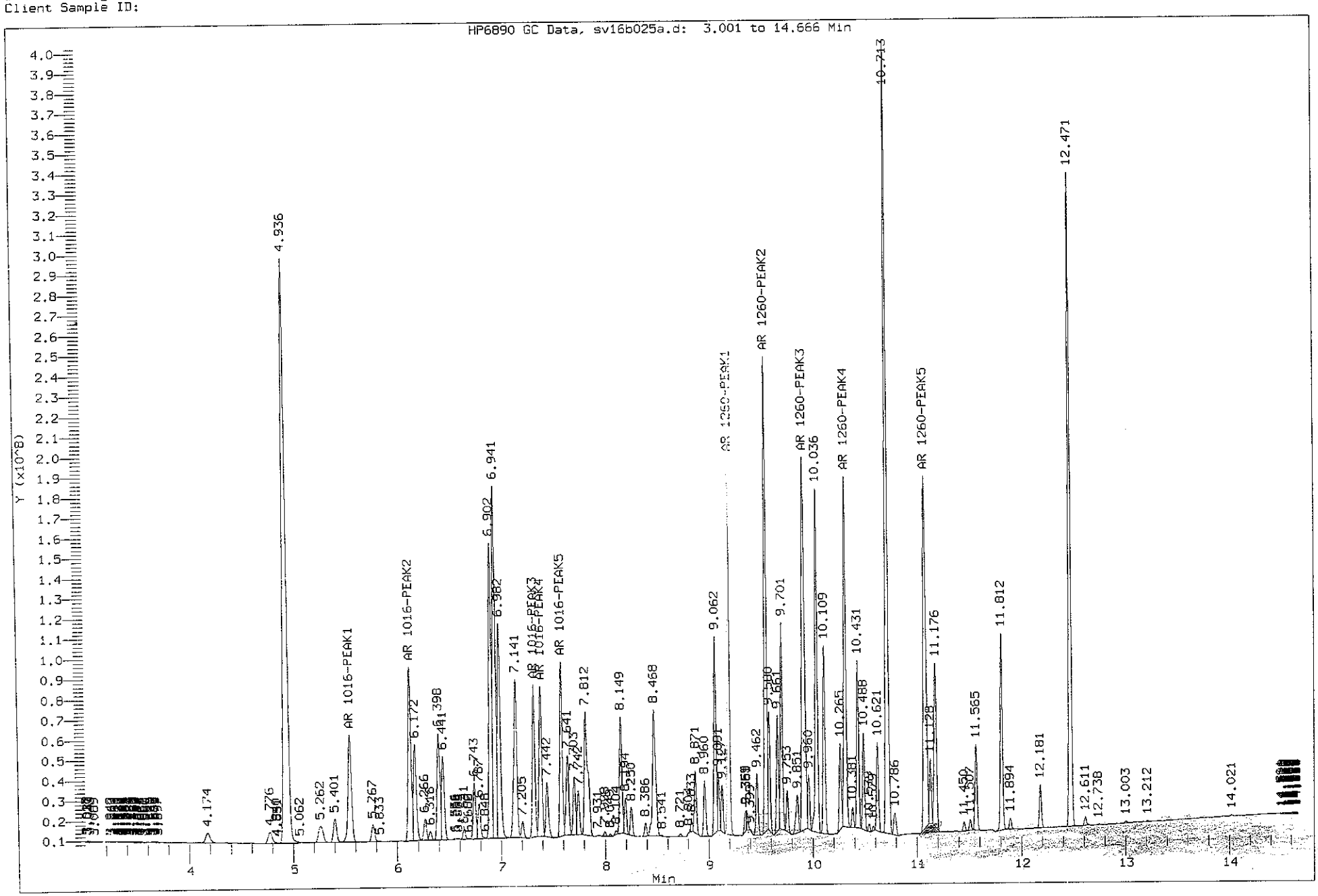
1016 /1260
35 MS

Data File: /var/chem/gcsv16a.i/2110104.b/sv16a025a.d
Injection Date: 04-JAN-2011 22:40
Instrument: gcsv16a.i
Client Sample ID:



1016/1260
XLB

Data File: /var/chem/gcsv16b.i/2110104.b/sv16b025a.d
Injection Date: 04-JAN-2011 22:59
Instrument: gcsv16b.i
Client Sample ID:



SUBJECT

SCOPE AND APPLICATION

EPA Method 8270D (SW-846) is used to quantitatively analyze most neutral, acidic and basic (BNA) organic compounds that are soluble in methylene chloride and capable of being eluted without derivatization as sharp peaks from a gas chromatographic fused-silica capillary column coated with a slightly polar silicone. Such compounds include polynuclear aromatic hydrocarbons, chlorinated hydrocarbons and pesticides, phthalate esters, organophosphate esters, nitrosamines, haloethers, ethers, aldehydes, ketones, anilines, pyridines, quinolines, aromatic nitro compounds and phenols, including nitrophenols. BNAs are generally extracted using SOPs EXT-001 for solids and EXT-003 for aqueous samples. High-level wastes are prepared by waste dilution. A list of target analytes is available in the LIMS.

Theory & Principle - Gas chromatographic analysis utilizing Mass Selective Detectors eliminates, to a great extent, the secondary column and detector for confirmation. Mass selective detectors ionize each compound to produce its own unique mass fragmentation profile. Direct injection by autosampler is the introduction method for samples to be analyzed via EPA Method 8270 (SW-846). The polarity of the column phase, molecular weight and temperature determine the elution order. The end of the column is positioned so that the eluting compounds are ionized immediately. The ensuing charged ions are directed along an electronically charged quadruple to the electron multiplier, where the signal is amplified. The MSD can be used in selective ion monitoring and scan mode. In the scan mode, the detector scans for all ions in a selected range. The resulting ion fragmentation profiles are compound fingerprints. The selective ion monitoring (SIM) mode allows for the detection of two to three selected ions per compound in each retention window resulting in lower detection limits. Isomeric compounds must also depend upon retention times as a determining factor. Semi-volatile analysis primarily involves medium to high molecular weight compounds that are readily soluble in methylene chloride. The BNA sample preparation process utilizes the very polar methylene chloride, to extract the target compounds. Helium is used as the carrier gas.

MATRIX

Water and Solid Extracts

REFERENCE	SW846 8270D and 8000B
HOLDING TIME & PRESERVATIVE	Waters - store at 0°C to 6°C for up to but not exceeding seven days before extraction. Hold up to 40 days after extraction at −15 ± 5°C in sealed vials. Protect from light. Solids - store at 0°C to 6°C for up to but not exceeding fourteen days before extraction. Hold up to 40 days after extraction at −15 ± 5°C in sealed vials. Protect from light.
DEFINITIONS	See Appendix A for Glossary.
ANALYTE LIST	See Appendix IV.
SAFETY	Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards, and all associated protective wear and spill clean-up procedures PRIOR TO the use of any chemical. In all cases consult the applicable material safety data sheet (MSDS) and the supervisor or safety officer. The bottle labels also provide important information that must be noted. Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. In particular, approved gloves, safety glasses, and lab coats must be worn. In addition to other measures, solvents and chemicals must be handled in ventilated hoods.
INTERFERENCES	Interferences due to contamination are monitored by analysis of a method blank performed with each batch. Interferences with the parent (quantitation) ion may occur with co-elution and must be monitored by the analyst.
INSTRUMENTATION & APPARATUS	Agilent/5973-689ON or 5975-6890N GC/MS with autosampler Target data acquisition system DB-5MS or RTX Ssil MS columns Volumetric flasks Syringes – gas-tight Pasteur pipets Disposable glass micropipettes 2 mL autosampler vials with crimp tops Bottles – amber glass with PTFE-lined screw tops or crimp tops
REAGENTS	All organic solvent shall be of pesticide grade or equivalent. Label all containers and squeeze bottles with reagent ID, lot, and expiration date.

Methylene chloride (DCM)
Helium gas

STANDARDS

All standards used must pure material or from prepared certified solutions. The certificate of analysis shall be kept on file. Follow manufacturer's instruction for standard expiration and storage. Label all working standards using completed standard labels.

1. All stock standards are received in glass sealed ampoules.
   A. The following stock standards are used to prepare solutions for calibration and CCV samples:
      A.1 Stock calibration standard -A custom-made stock standard (TCL-200 ug/ml level) is purchased from NSI. It is stored in an amber vial in the freezer at -15° ± 5°C, until the documented manufacturer's expiration date. This standard includes the surrogates.
      A.2 Stock calibration standards – 2000 ug/mL –for Appendix IX compounds – commercially prepared stored at -15°C ± 5°C until the documented manufacturer's expiration date.
      A.3 Additional standards may be run that are project specific. All standards shall be certified and stored according to the manufacturer's instructions.

   B. Independent stock standards – standard mixes identical to those listed above from a secondary source or a different lot number from the same manufacturer. These standards are used to prepare the ICV.

   C. Stock Internal Standard Mixture: 4000 ug/mL – commercially prepared in methylene chloride, stored at -15°C ± 5°C until the documented manufacturer's expiration date.

   D. Tuning Standard: 1000 ug/mL – commercially prepared in methylene chloride, stored at -15°C ± 5°C until the documented manufacturer's expiration date.

2. Working standards – working standards are prepared by diluting the stock standard as described below.

   A. Assemble the necessary glassware, syringes and solvent. Spectroscopic grade methylene chloride is used in making all standards.

   B. Ensure that all glassware and syringes are clean and free of moisture by rinsing with at least three aliquots of methylene chloride. Volumetric glassware must never be stored in or placed in heated ovens. The use of dedicated glass will help prevent cross-contamination of standards.

C. Fill the volumetric glassware to approximately 75 percent volume.

D. Add the proper volume of standards using a syringe.

E. After the addition of standard, dilute to the calibration mark in the volumetric flask

F. Insert the glass stopper and mix.

G. Using a Pasteur pipette, transfer the standard to a 2 mL ampoule. Seal the ampoule immediately.

H. Label the vial with the following information:
Expiration Date
Standard ID #

I. Store the vial the same as the stock standard.

J. Dispose of excess materials in accordance with established laboratory procedures.

K. Always quantitate new standards against known standards to ensure accurate concentration levels.

L. Fill out the standards logbook in accordance with proper laboratory procedure and enter required information in LIMS.

3. The working standards are prepared in the following manner:

A. Working Appendix IX standards – prepare a 200 ug/mL standard mix from the 2000 ug/mL stock standards.

B. Working standards from 0.2 ug/mL to 160 ug/mL are prepared as needed before a calibration is performed. They are stored in amber vials in the freezer at -15° ± 5°C. To make 1.0 mL of each "working standard" of a calibration, do the following:

- Add 0.001 mL of TCL-200 to 0.999 mL DCM* for a 0.2 ug/mL standard
- Add 0.005 mL of TCL-200 to 0.995 mL DCM* for a 1 ug/mL standard
- Add 0.05 mL of TCL-200 to 0.95 mL DCM* for a 10 ug/mL standard
- Add 0.25 mL of TCL-200 to 0.75 mL DCM* for a 50 ug/mL standard
- Add 0.40 mL of TCL-200 to 0.60 mL DCM* for an 80 ug/mL standard
- Add 0.60 mL of TCL-200 to 0.40 mL DCM* for a 120 ug/mL standard

- Add 0.80 mL of TCL-200 to 0.20 mL DCM* for a 160 ug/mL standard
- The high concentration standard is the stock standard – 200 ug/mL
- Add 10 µL of 4000 ng/µL Internal Standard Mix to each 1.0mL of the "working standard" before shooting

To make the calibration standards for SIM analysis, the TCL standard is used to make the following working and calibration standards. **Please note that for South Carolina samples, SIM analysis is not allowed.**

- Add 125 µL of TCL-200 to 4.875 mL DCM* for a 5 µg/mL standard
- Add 200 µL of the 5 µg/mL standard to 800 µL DCM for a 1 µg/mL standard.
- Add 100 µL of the 5 µg/mL standard to 900 µL DCM for a 0.5 µg/mL standard.
- Add 20 µL of the 5 µg/mL standard to 980 µL DCM for a 0.1 µg/mL standard.
- Add 10 µL of the 5 µg/mL standard to 990 µL DCM for a 0.05 µg/mL standard.
- Add 10 µL of 4000 µg/mL Internal Standard Mix to each 1.0mL of the "working standard" before shooting

C. The Appendix IX calibration standards are prepared in the same manner from the 200ug/mL working standard. The 200 ug/mL standard will serve as the high concentration standard.

D. Additional stock standards shall be purchased for compounds not included in the mixes.

GC RECOMMENDED CONDITIONS

The following lists conditions that may be used in the lab. Conditions vary for each instrument. Adjustments are made when new columns are installed. The analyst is allowed to modify settings to optimize operating conditions.

Initial Temperature: 40°C
Rate A: ~40°C/min to ~245°C
Hold: ~4 to 5 minutes
Injector Temperature: ~ 250°C
Injection volume: 1 uL

PROCEDURE

Analysis Procedure

1. Injection port maintenance is performed every day of use at a minimum. This includes replacement of septa and liner.
2. Tuning - Before analysis begins each GC/MS must meet tuning criteria specified in the method. A solution containing 50

ug/ml each of Decafluorotriphenylphosphine (DFTPP), 4,4'-DDT, Pentachlorophenol and Benzidine is analyzed. The DFTPP tuning criteria listed below must be met before proceeding with analysis. DDT breakdown shall not exceed 20% and is calculated as:

$$\%\text{Breakdown} = \frac{\text{area DDE + area DDD}}{\text{area DDE + area DDD + area DDT}} \times 100$$

Evaluate the tailing factor for Benzidine and Pentachlorophenol. Check that response is normal and that there is not excessive tailing. If tailing is observed, calculate tailing factors using the equation below. The calculated tailing factor for Benzidine and Pentachlorophenol shall be less than 2. Excess tailing indicates the need for instrument maintenance. If there is no visible tailing document this.

$$\text{Tailing Factor} = \frac{BC}{AB}$$

Analyze The DFTPP result using three scans, the apex and the scan prior and following the apex and subtracting the background no more than 20 scans prior to elution of the DFTPP peak. If the DFTPP fails the criteria listed below, then the analyst shall re-tune the instrument, then run another DFTPP. If the DFTPP still fails the criteria, the analyst shall perform instrument maintenance. These criteria must be met once for every 12 hours of analysis time.

DFTPP KEY ION ABUNDANCE CRITERIA

MASS	ION ABUNDANCE CRITERIA
51	30 to 60% of mass 198
68	less than 2% of mass 69
69	mass 69 relative abundance
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

3. Calibration - The initial calibration consists of a series of standards analyzed at the concentration noted in the Standards Section 3.B-D. An initial calibration curve for each target

analyte must be analyzed and evaluated before any peak for that analyte can be quantitated.

The calibration range is defined as the on-column concentration range adjusted for sample prep. Because nine calibration standards are used, the analyst has the option of eliminating several of the points using the criteria below.

a) Points may not be removed from the middle of the curve.
b) Calibration acceptance criteria must be met as described below.
c) The lowest calibration point must support the lowest reporting limit needed in the associated samples.
d) The QC spike amount must be within the calibration range.

Replacing points in the middle of a curve is not allowed unless the analyst can document a technical issue at the time of analysis or spiking of the standard. The new point must be analyzed in the same analytical batch. If the problem appears to be associated with a single standard, that one standard may be reanalyzed. Replacing the standard may be necessary in some cases.
Prepare the calibration standards and Add 10 µL of 4000 ug/ml Internal Standard Mix to each.

When performing analysis in the SIM mode, use the same retention windows used in scan analysis and at least two of the ions listed in Table 1 of SW-846 8270D. The primary ion is used for quantitation and the secondary ion(s) as confirmation.

The calibration curve is now ready for analysis.

The acceptance criteria for initial calibration must be satisfied before analysis of samples begin. Select projects may have additional or more stringent criteria that must be achieved for the applicable samples. See SOP GEN-019.

A. Initial Calibration Acceptance Criteria:
   A.1 Minimum target compound response factor requirements are shown on Appendix 1.

B. Additionally one of the following options must be met. Always attempt to meet calibration criteria using the average response factor. If the average response factor does not pass, options B.2 maybe evaluated. The calibration options and requirements are as follows:
   B.1 Average Response Factor Calibration. For each of the standards, calculate the response factor of each compound. Calculate the average of a minimum of five response factors and the standard deviation across the selected five response factors. Use the average RF and the standard deviation to calculate the percent

relative standard deviation (%RSD). All equations can be found in the Calculation section. When the five (or more) response factors of the standards demonstrate less than 20% RSD for a target analytes, linearity through the origin can be assumed. If the RSD for any analyte is greater than 20%, the analyst may wish to review the results for those analytes to ensure that the problem is not associated with just one of the initial calibration standards.

B.2 For those compounds that the RSD exceeds 20%, a linear regression equation that is not forced through the origin may be used. The correlation coefficient must be at least 0.990 for the curve to be acceptable. When calculating the calibration curves using the linear regression model, a minimum quantitation check on the viability of the lowest calibration point shall be performed by re-fitting the response from the low concentration calibration standard back into the curve. It is not necessary to re-analyze a low concentration standard; rather the data system can recalculate the concentrations as if it were an unknown sample. The recalculated concentration of the low calibration point shall be within ± 30% of the standard's true concentration. Analytes which do not meet the minimum quantitation calibration re-fitting criteria should be considered "out of control" and corrective action such as redefining the lower limit of quantitation and/or reporting those "out of control" target analytes as estimated when the concentration is at or near the lowest calibration point may be appropriate.

NOTE: If more than 10% of the compounds included with the initial calibration exceed the 20% RSD limit and do not meet the minimum correlation coefficient of 0.990; then the chromatographic system is considered too reactive for analysis to begin. System maintenance should be performed and the calibration procedure repeated.

B.3 A quadratic curve fit may be used if the correlation coefficient is at least 0.990. A minimum of a six-point calibration is used if this option is chosen and the curve shall not be forced through zero. As part of the evaluation, check the y-intercept (b) and any negative factors (b or M). Negative factors may result in false negatives and positives. Large shifts in the y-intercept from zero will impact the data. If the intercept is greater than half the reporting limit, this option shall not be used. Check the required report limit any impacts on the data. False positives shall be indicated in the case narrative. Please note that quadratic curves may not be employed for an analyte if normally it passes calibration criteria for

average response or linear regression. For South Carolina samples, quadratic curve fits are not allowed.

C. If the calibration criteria are not met, possible corrective action includes cleaning the injection port, cutting off the first 4 inches of column or source cleaning, and adjusting the calibration range.

D. Check the position of the retention time by using the mid-point of an initial calibration. Check and reset as necessary after source cleaning or column maintenance.

4. INITIAL CALIBRATION VERIFICATION

Immediately following the initial calibration procedure or before sample analysis, the analyst shall perform initial calibration verification (ICV). This will consist of a solution containing all target analytes prepared from a standard that is independent from the initial calibration.

The ICV must be analyzed following the initial calibration. The ICV recovery must be 70-130%.

If any target analyte recovery is outside the control limits, corrective action must be taken. This may include instrument maintenance, re-analysis of the ICV or initial calibration, or re-preparation of the standards involved. If holding time or agreed project due dates will not be met because of ICV failure, the client must be contacted and approve of proceeding with the analysis. Note all failures in the case narrative.

5. CONTINUING CALIBRATION VERIFICATION –

If the instrument has been previously calibrated, then a continuing calibration is required. A mid-level standard, 50 ug/mL for scan and 0.5 ug/mL for SIM is analyzed and checked against the initial calibration for verification every 12 hours. Target compounds must have a %D of ≤20 and must have a minimum RF as listed in Appendix 1. If there are any deviations, the calibration check standard must be re-analyzed or if necessary, column maintenance should be performed. If the calibration check standard still fails the criteria, then another initial calibration must be run. If there are no hits in the sample and the target compound is above 20% D, the sample may be reported with a narrative.

The retention time for any internal standard shall not vary any more than 30 seconds from the last calibration check (12 hours). The extracted Ion Current Profile area for any internal standard must not deviate by more than a factor of two.

6. SAMPLE ANALYSIS

Samples are analyzed after an acceptable CCV. Add 10 uL of the internal standard mixture to each extract before analysis.

Compound identification – positive hits are achieved by the following criteria:

A. The quantitation ion used shall be the ion listed in the reference method unless there are interferences. Qualifier ions shall be used as a replacement, if possible. If the quantitation ion used is not the ion listed in the reference method, this shall be documented.
B. The characteristic m/z's must maximize within one scan of each other.
C. The retention time of the compound in the sample must be within ± 0.50 minutes of the retention time of that compound in the standard and have an RRT of ± 0.06.
D. The relative abundance of the three characteristic m/z's in the sample must fall within ± 30% of the relative abundances of that parameter in the standard.
E. Structural isomers can be differentiated only if the height between the baseline and the valley between the pairs is less than 50% of the average of the two peak heights. Otherwise they must be reported as isomeric pairs.
F. If samples have compounds that are above the calibration range, the sample must be diluted. A portion of the sample, measured with a syringe, is diluted to one mL with DCM. Additional internal standard is added to maintain a concentration of 40µg/L. Surrogate recovery is affected and is considered diluted out of the sample with a dilution of 10X or greater. The dilution factor is recorded in Target and used to calculate analyte concentrations and to adjust reporting limits and MDLs. Multiple dilutions are required for some projects. Report multiple dilutions as required. If historical values indicate that the sample needs to be performed at multiple dilutions and all analytes must be reported at the lowest reporting limit possible, the sample extract may be prepared and performed at multiple dilutions without screening.
G. Manual integrations shall be performed as appropriate. Manual integrations undergo several layers of review and the raw data is flagged. For additional information see SOP QA-010.
H. Monitor drift by using the internal standard report in target to check the % Difference of internal area response and retention time. Internal area response must be between 50% and 200% of the internal standard response in the continuing calibration verification. Retention time must be within ± 0.5 minutes. If the criteria are not met reanalyze at a dilution for the affected analytes or report with a narrative.

QUALITY CONTROL

METHOD BLANK

1. The method blank (extraction blank) is analyzed with each preparatory batch to demonstrate the extraction procedure did not introduce contamination. Run batch QC in the same analytical batch whenever possible. The batch QC must be analyzed with at least one client sample from the prep batch. This blank also establishes the instrument to be free of contamination.

2. No target analytes should be detected in the method blank above one half the reporting limit. If any target analytes are detected, data shall not be reported and samples must be re-extracted and re-analyzed unless the following apply.
   A. If a target analyte is detected above the reporting limit, data may be reported if the concentration is not greater than 5% of the measured concentration in associated samples. Include a narrative with the data.
   B. If a target analyte is detected in the method blank but there are no hits in the samples, the data may be reported with a narrative.

SURROGATES

1. The surrogates are used to verify that each sample was properly extracted and is not adversely affected by the sample matrix. A surrogate is a non-target compound that is chemically similar to the analytes. The surrogates used are listed in the table below. Surrogates are spiked in each sample at the levels listed in Table 1. Some samples use the same extract for scan and SIM analysis. In these cases the surrogates will be spiked at the scan level.

2. Control limits are evaluated after sample analysis. Determine for each sample the project-required limits. If no specific limits are needed, evaluate the recoveries using step 3. If specific limits are needed evaluate using step 4. Evaluate limits as soon as possible to allow necessary re-preps to be performed within holding time.

3. Laboratory derived control limits are listed in the LIMS. One surrogate in each fraction (base-neutral or acid) may have a recovery outside the control limits. When this occurs, report the data with a narrative. If more than one surrogate recovery for each fraction is below the lower control limit, re-extract and re-analyze the sample. If the recoveries are outside control limits in the re-extract sample, then indicate in the case narrative and state that the recovery was outside the control limits due to sample matrix. If re-extraction cannot be performed due to insufficient sample, report the data with a narrative. If the surrogate recovery is above the control limits and the sample results are less than the reporting limit, the data may be reported with a narrative.

4. Project specific recovery limits may apply that must be achieved for the associated samples. See SOP GEN-019. Some projects require reprep and/or reanalysis if any surrogate fails recovery criteria either high or low. Check project criteria before proceeding.

Table 1
Surrogates

Surrogates	Scan Conc. mg/L (On column)	SIM Conc mg/L (On column)
Acid Surrogates:		
2-Fluorophenol	100	2
Phenol-d5	100	2
2,4,6-Tribromophenol	100	2
Base – Neutral Surrogates:		
Nitrobenzene-d5	50	1
2-Fluorobiphenyl	50	1
Terphenyl-d14	50	1

LABORATORY CONTROL STANDARD (LCS/LCSD)

1. A LCS and LCSD are included in each preparatory batch to demonstrate the system is in control. Routinely the LCS/LCSD will be spiked with the full list of analytes. The control limits for waters and solids are available in the LIMS. Control limits may be project specific and must be achieved for the associated samples. Evaluate the data and perform corrective action based on the project limits. Run batch QC in the same analytical batch whenever possible. The batch QC must be analyzed with at least one client sample from the prep batch. For South Carolina projects, the LCS must be recovered between 70-130%.

2. If a recovery is above the upper control limit and the sample results are below the reporting limit, the data may be reported with a narrative. Check project criteria. Required corrective action may differ in different projects and must be followed for associated samples.

3. If a recovery is below the lower control limit or precision fails, the entire batch must be re-extracted and re-analyzed. If a re-extraction is not possible due to insufficient sample volume, report the data with a narrative.

MATRIX SPIKES (MS/MSD)

1. The purpose of the MS/MSD is to assess the performance of the method for a particular sample matrix. The recovery criteria for waters and solids are available in the LIMS and are

typically the same as the LCS recovery criteria. Project specific recovery and RPD limits may apply, and the data evaluated and corrective action performed based on project requirements.

2. The MS/MSD spike includes the full list of analytes.

3. Whenever the MS and/or MSD recoveries are outside the control limits, check that the LCS and LCSD passed criteria to verify the system was in control. If the LCS and LCSD recoveries and precision are acceptable then continue processing the data. If the LCS and/or LCSD failed then follow the procedure in the LCS section.

4. Review data to verify that a lab error has not occurred (wrong spike amount, not spiked) before automatically identifying a failure as matrix interference.

5. If recoveries for both the MS/MSD are outside the control limits and the recoveries are similar, the data is reportable with a narrative stating the LCS recoveries were acceptable. The failure is attributed to sample matrix.

6. Precision is calculated as %RPD. Acceptance criteria are listed in the LIMS. Failures are noted in the narrative.

7. Native sample concentrations may be high in comparison to the spiking concentration and therefore an accurate recovery cannot be calculated. Document this in the case narrative.

8. Spikes may be diluted out in the analysis process. Document this in the case narrative. The spike is diluted out if the dilution is a 10X or greater. MS/MSD are analyzed at the same dilution as the parent sample.

SAMPLE RE-EXTRACTION

Samples are to be re-extracted due to failed QC or due to the sample results. When a MB, LCS, or LCSD fails to meet criteria, the entire batch is sent to extractions for re-extraction. If the MS, MSD, or surrogates fail criteria, only the affected samples are sent to extractions. Particular samples may be re-extracted if the sample results do not match historical values, if a sample and a duplicate do not match, or if physical differences are noted in samples. If samples are re-extracted outside of method specified holding times, both analyses are reported. To request sample/batch re-extraction, do the following:

1. If the extract has been analyzed, process the file and load to LIMS.
2. Enter the code “RP” into the analysis code; this will schedule new sample prep.
3. Complete the Re-extraction Request and Tracking Form (attached) and submit a copy to extraction supervisor.

4. When new extracts are brought to the lab, complete the original Re-extraction Request and Tracking Form and report the data appropriately.
5. If additional sample is not available to re-prep, check with project manager to determine appropriate action to report the available data.
6. If two sets of data will be reported, see login to obtain a re-extracted sample number.

CALCULATIONS

1. $$\text{MS \% REC} = \frac{\text{MS Concentration-Sample Concentration}}{\text{spike added}} \times 100$$

2. $$\text{MSD \% REC} = \frac{\text{MSD Concentration-Sample Concentration}}{\text{spike added}} \times 100$$

3. $$\text{\% RPD} = \frac{\text{MS-MSD}}{(\text{MS+MSD})/2} \times 100$$

LCS/LCSD results are substituted to calculate %RPD between LCS and LCSD. Results are calculated using the concentration (not percent recovery).

4. $$\text{Response Factor} = \frac{A_s \times C_{is}}{A_{is} \times C_s}$$

As = Peak Area of analyte or surrogate
Ais = Peak Area of Internal standard
Cs = Concentration of the analyte or surrogate
Cis = Concentration of Internal standard

5. $$\text{Surrogate/LCS Recovery} = \frac{\text{Concentration Found}}{\text{Concentration Added}} \times 100$$

6. Concentration using RF:

$$\text{Concentration } (\mu g/L) = \frac{(A_s)(C_{is})(D)(V_t)}{(A_{is})(RF)(V_s)}$$

$$\text{Concentration } (\mu g/kg) = \frac{(A_s)(C_{is})(D)(V_t)}{(A_{is})(RF)(W_s)}$$

A_s = Area of peak for the analyte in sample
D = Dilution factor
RF = Mean Response factor from initial calibration
A_{is} = Area of internal standard in sample
C_{is} = Concentration of internal standard in µg/mL
W_s = Weight of sample extracted in g
V_t = Total volume of concentrated extract in µL
V_s = Volume of aqueous sample extracted in mL

7. Concentration using linear curve fit:
   Concentration (µg/L) = $[m(A_S/A_{IS})+b]C_{IS}D$

   Concentration (mg/kg) = $[m(A_S/A_{IS})+b]C_{IS}D(5/W_S)$

   m = Inverse of slope
   A_s = Area of peak for the analyte in sample
   A_{is} = Area of internal standard in sample
   b = Intercept of the y-axis
   C_{is} = Concentration of internal standard in µg/mL
   D = Dilution factor
   W_s = Weight of sample extracted

8. Concentration of TICS:
   Concentration (mg/kg) = $\frac{(A_s)(C_{is})(D)}{(A_{is})(1000)}$

   A_s = Area of peak for the analyte in sample
   D = Dilution factor
   A_{is} = Area of internal standard in sample
   C_{is} = Concentration of internal standard
   W_s = Weight of sample (if aqueous sample W_s = 1 and report in (µg/L)

9. % Difference = $[(RF_I - RF_C) / RF_I\}$ X 100 where:
   RF_I = Average response factor from initial calibration
   RF_C = Response factor from current verification check standard

10. % Drift = $\frac{(\text{Calculated Conc. - Theoretical Conc).}}{\text{Theoretical Conc.}}$ * 100

11. % RSD = (SD / X) X 100 Where:
    RSD = Relative Standard Deviation
    X = mean of 5 initial RF's for a compound
    SD = Standard Deviation of average RF's for a compound

TENTATIVELY IDENTIFIED COMPOUNDS SEARCH (TIC's)

A TIC search, or library search, may be performed when analyzing samples or sample extracts by GC/MS. A client may request a TIC search for specific compounds that are not calibrated for, or to determine other compounds present in a sample. Generally the client will request a reporting of the 10 or 20 highest concentration "unknowns" in a sample. This is performed by performing a spectral match between an unknown peak and a spectral library. Unknowns are identified based on the spectral data only. In general the retention time is not considered when identifying unknowns. In addition the concentration is an estimate based on the assumption that the response factor of the unknown is 1.0. This may lead to a considerable positive or negative bias in the reported concentration.

The Target method is set-up using the following parameters:

Primary Library - NBS75K.1
Match Quality Threshold - 85
Remove Duplicate Matches
Background Subtraction Method - Average of Front and Rear
Minimum percent for ID - 10% of nearest Internal Standard Area
Quantitation by - Area
RF Mode - Nearest ISTD

The library search does not use a normalization routine. These parameters are set in the Method and are not altered unless approved by a Supervisor or Manager. Note that the selection of peaks and the calculated amount uses the peak area of the nearest internal standard, not the response of quant ion. The area is found in the area.rp report in Target. The amount of an unknown is estimated using an RF factor of 1. To check the calculations performed by Target, use Equation 1.

When performing a library search select Quant Unknown Compounds in Edit Quantitation Parameters and process the data file. The software will identify unknown peaks meeting the set criteria. If the software misses a peak that in the analyst opinion appears to meet the area requirements, the analyst may add an unknown. Select Spectra – Search, then Edit – Edit Unknown. Select the TIC with the best fit (highest quality match). If no match is higher than 50% select the result as "UNKNOWN". If in the analyst's opinion the Target selected best match is incorrect, the match is changed to reflect the best match or is reported as an unknown.

Review the assigned match using the following guidelines:

1) Major ions in the reference spectrum (ions >10% of the most abundant ion) should be present in the sample spectrum.
2) The relative intensities of the major ions should agree with the reference spectrum within ± 30%. Major ions that show increased intensity may be due to co-eluting compounds, and ions showing decreased intensity may be due to the background subtraction. When this is encountered examine the spectrum across the peak to determine if co-elution is an issue. If necessary, alter the background subtraction program to best handle the sample matrix.
3) Molecular ions present in reference spectrum should be present in sample spectrum (this is usually the heaviest ion).

Save changes and upload results to the LIMS. Only use the Quant Unknown Compound option when a library search is requested. If a library search is added after the file is processed, copy the file using the same file number and append a "T" behind the file number. Process the file and perform the TIC search. Do not reprocess a data file that has already been uploaded to the LIMS.

If a specific analyte is requested to report as a library search, perform the MS library search as described. If the analyte is identified, post the result. If the analyte is not identified, post the TIC file and enter the CAS number, target analyte, and ND in the CAS/Name column of the sample results. Leave the amount column empty.

MANUAL INTEGRATIONS See GCAL SOP QA-010 for manual integration policy.

REPORTING LIMITS Quantitation limits (PQLs) are defined by the low-level calibration standard. Default reporting limits are employed for reporting and cannot be lower than the PQL. The PQL cannot be lower than the estimated MDL and project specific requirements may define the relationship between the PQL and the MDL that must be achieved for the associated samples. See SOP GEN-019.

DATA REVIEW For data review procedures and checklist, please see SOP QA-002.

SOFTWARE TROUBLESHOOTING The Agilent GC/MS's utilizes Agilent software MSD Chemstation Version D.02.00.275 to control the instrument and transfer data acquisition to Target Data Integration software. Target software is utilized to calculate all data. In the event of software malfunction for the MSD Chemstation, please contact Agilent technical support for troubleshooting help. In the event of software malfunction when using Target, please contact GCAL's IT Director for troubleshooting help.

METHOD PERFORMANCE Method 8250 (the packed column version of Method 8270) was tested by 15 laboratories using organic-free reagent water, drinking water, surface water, and industrial wastewater spiked at six concentrations ranging from 5 to 1,300 ug/L. Single operator accuracy and precision, and method accuracy were found to be directly related to the concentration of the analyte and essentially independent of the sample matrix. Linear equations to describe these relationships are presented in Table 7 of Method 8270C. These values are presented as guidance only and are not intended as absolute acceptance criteria.

Internal control limits are generated for laboratory QC samples including LCS/LCSD, MS/MSD, and surrogates.

POLLUTION PREVENTION See QAPP Section 10.2

WASTE MANAGEMENT See SOP GEN-009

IDOC See SOP QA-014

MDL See SOP QA-009

GULF COAST ANALYTICAL LABORATORIES, INC
GCMS - VOLATILES
STANDARD OPERATING PROCEDURE

PROCEDURES: GCMSV-003
PAGE: 1 OF 22
EFFECTIVE DATE: 12/12/11
APPROVED BY:
QA/QC APPROVED:

SUBJECT — SCOPE AND APPLICATION

This is a purge and trap GC/MS method, which quantitatively identifies purgeable organic compounds. A list of target analytes is available in the LIMS.

A 5-mL water sample is purged, with helium at ambient temperature. The purgeable compounds are transferred to the vapor phase and are carried to the trap. Once the purging has been completed, the trap is heated and back flushed with helium to desorb the purgeable compounds onto the column. The compounds are then separated by their molecular weight, the column phasing and increasing temperature, and then detected by a mass spectrometer.

MATRIX — Water and Solids

REFERENCE — SW846 Methods 8260B, 5030B, 5030C, 5035A, 8000B, 8000C
NOTE: For North Carolina projects, SW-846 Methods 8260B and 8000B must be used. For South Carolina projects SW-846 Methods 8260B, 5030B, 5035 and 8000B must be used.

PRESERVATIVE — Cool <6°C Aqueous pH <2 with HCl and/or $Na_2S_2O_3$ (unless unpreserved requested)

Acrolein and Acrylonitrile pH 4-5 with $Na_2S_2O_3$, if unpreserved holding time is 3 days.

HOLDING TIME — Water - 14 days from sample collection when preserved in HCl
Solid - 14 days from sample collection
Solid – Encore™ Samplers – 48 hours to preservation/then 14 days to analysis

Water samples that are target for Styrene, Vinyl chloride, and 2-CVE must be collected without HCL preservation and analyzed within 7 days of collection. If samples for these analytes are received with HCl preservative, the data must be qualified with a narrative in the final report.

Specific projects may require non-acid preservation of water samples. If water samples are unpreserved the analysis must be performed in 7 days.

Water samples must be checked for pH preservation after analysis unless a vial was provided for a pH check at sample receiving. Record the pH on the batch sheet. If the sample has a pH greater than 2 and the sample was analyzed after 7 days, narrate results.

DEFINITIONS — See Appendix A Glossary

SAFETY — Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards, and all associated protective wear and spill clean-up procedures PRIOR

TO the use of any chemical. In all cases, the applicable material safety data sheet (MSDS) and the supervisor or safety officer should be consulted. The bottle labels also provide important information that must be noted. Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. In particular, approved gloves, safety glasses, and lab coats must be worn. In addition to other measures, solvents and chemicals must be handled in ventilated hoods.

INTERFERENCES

Contamination can be related to impurities in the purge gas and solvent vapors in the lab. The system is shown to be free from contamination by running a reagent blank each 12-hour period.

Samples can be contaminated by diffusion of vapors through the septum seal during shipment and storage. A field blank can be prepared during sample collection and can act as a check for this type of contamination. Holding blanks are analyzed every two weeks to provide an additional check for this type of contamination. These holding blanks are stored in coolers C22, C30, and C4.

Contamination can also be seen when a low level sample is analyzed immediately after a high level sample. Freedom from contamination must be established before sample analysis is considered valid. After analysis of a sample containing high concentrations of volatile organic compounds, a blank should be analyzed to check for contamination. Alternatively, if the sample following the high concentration sample does not contain the volatile organic compounds present in the high level sample above quantitation limits, freedom from contamination has been established. If the blank or preceding sample shows contamination, analyze blanks until an acceptable blank is achieved and/or clean the purge vessel and bake trap. Reanalyze samples with potential carryover contamination.

TENTATIVELY IDENTIFIED COMPOUNDS (TICs)

See Appendix II for procedure.

INSTRUMENTATION & APPARATUS

Agilent 6890 and 7890 GC with a 5973 or 5975 Mass Spectrometer coupled with a Teledyne Tekmar purge and trap and autosampler

HP5890 GC with 5972 Mass Spectrometer coupled with a Velocity XPT concentrator using a Solatek 72 or
Each instrument is assigned a maintenance logbook. All maintenance performed on the instrument must be recorded.

Target data acquisition system

Restek (Cat no. 19915) RTX-VMS 30m, 0.25um ID, 1.4 um df

Gas-tight syringes

Electronic Balance – capable of weighing to 0.01g. See SOP GEN-002 for calibration procedures.

Volumetric flasks

44 mL VOA vials

2 mL autosampler vials

Glass culture tubes

Pasteur pipets

Magnetic stir bars

Scoopula, spatulas

pH paper

REAGENTS

All organic solvent shall be of pesticide grade or equivalent. Label all containers and squeeze bottles with reagent ID, lot, and expiration date.
Water

Methanol – purge and trap reagent grade or equivalent

Blank sand

Sodium bisulfate

STANDARDS

All standards used must be pure material or from prepared certified solutions. The certificate of analysis shall be kept on file. Follow manufacturer's instruction for standard expiration and storage. Label all working standards using completed standard labels.

The following describes the standards used and their preparation:

1. All stock standards are received in glass sealed ampules.

   A. The following stock standards are used, as necessary to prepare solutions for calibration, CCV, LCS, and MS samples:

      A.1 Stock standard solutions – 2000mg/L (8260 mix)- Ultra Part# DWM-588 - commercially prepared certified solutions in methanol, stored at -15°C ± 5°C, until the documented manufacturer's expiration date.

      A.2 Stock standard solutions – 2000mg/L (ketone mix)- Ultra Part# CUS 12327 - commercially prepared certified solutions in 4:1 methanol/water, stored at -15°C ± 5°C until the documented manufacturer's expiration date.

      A.3 Stock standard – 2000 mg/L custom mix Ultra Part# CUS 12326 – commercially prepared certified solution in methanol, stored at -15°C ± 5°C, until the documented manufacturer's expiration date.

      A.4 Stock standard – Acrolein/Acrylonitrile (A-2000 mg/L; Vinyl Acetate – 400 mg/L) (AAV) NSI Part# Q2143 – commercially prepared certified solution in water, stored at 4°C ± 2°C, until the documented manufacturer's expiration date.

      A.5 Stock standard – 2-Chloroethyl vinyl ether (CVE)NSI Part# 17-04-15 – 1000 mg/L - commercially prepared certified solutions in methanol, stored at -15°C ± 5°C, until the documented manufacturer's expiration date.

A.6 Stock standard – Appendix IX compounds – 2 mixes – 2500/200 mg/L Ultra Part# CUS 12032 and CUS 11407 – commercially prepared certified solutions in methanol, stored at -15°C ± 5°C, until the documented manufacturer's expiration date.

A.7 Stock standard solutions – oxygenate mix (4 mixes – Ultra Part# CUS 11575, CUS 11651, CUS 11389, CUS 11390 - commercially prepared certified solutions in methanol, stored at -15°C ± 5°C, until the documented manufacturer's expiration date.

A.8 Additional standards may be run that are project specific. All standards shall be certified and stored according to the manufacturer's instructions.

NOTE: For South Carolina LCS samples will not be prepared from the same standard as the calibration standard.

B. Independent stock standards – standard mixes identical to those listed above from a secondary source or a secondary lot number from the same manufacturer. These standards are used to prepare the ICVs.

C. Stock IS/SS mix – 5000 mg/L – Ultra Part# STM-541-1 – commercially prepared certified solution in methanol, stored at -15°C ± 5°C, until the documented manufacturer's expiration date. This solution is also used to prepare BFB tune check solution.

2. Secondary standards – Secondary standards are prepared by diluting the stock standard as described below. The first three standards listed in Table 1 and labeled 8260 are prepared together then transferred to 2mL ampule vials with minimum headspace and stored at –15°C ±5°C. These standards may be stored for up to 14 days. However, please note that for the individual vials, they should not be used for more than 7 days once opened. All other secondary standards are prepared as listed in Table 1, and then transferred to 2mL ampule vials with minimum headspace and stored at –15°C ±5°C. These standards may be stored for up to 6 months or until the manufactures expiration, whichever is sooner. Procedure for Volatile standard preparation:

A. Assemble the necessary glassware, syringes and solvent. Purge and trap reagent grade methanol shall be used for all VOA standard preparation.

B. Ensure that all glassware and syringes are clean and free of moisture by rinsing with at least three aliquots of methanol. Volumetric glassware should never be stored in or placed in heated ovens. The use of dedicated glass will help prevent cross-contamination of standards.

C. Fill the volumetric glassware to volume with Methanol. Remove the appropriate amount of Methanol that will be replaced by the standard volume. Addition of standards shall proceed by adding the more highly volatile compounds last to prevent compound loss.

D. Add the proper volume of standards using a syringe. Minimum agitation should occur upon adding the standard solution.

E. After the addition of standard, the volumetric flask should be diluted until the meniscus reaches the calibration mark.

F. Insert the glass stopper and mix by inverting three times.

G. Cool the flask and its contents to approximately 5°C.

H. Using a Pasteur pipette, transfer the standard to a 2 mL ampule. Seal the ampule immediately.

I. Standards may be stored in mininert vials with minimal headspace.

J. Label the vial with the following information:

Standard Name
Standard ID #
Initials of Person Preparing Sample
Date of Preparation
Expiration Date

K. Store the vial the same as the stock standard.

L. Dispose of excess materials in accordance with established laboratory procedures.

M. Always quantitate new standards against known standards to ensure accurate concentration levels.

N. Fill out the standards logbook in accordance with proper laboratory.

O. A combined solution containing the internal standards and surrogates is prepared as the secondary standard. IS/SS is added automatically by the Solatek autosampler.

O.1 Internal standards - The recommended internal standards are Fluorobenzene, Chlorobenzene-d5, and 1,4-Dichlorobenzene-d4. Each calibration standard, blank, LCS, and sample undergoing GC/MS analysis must be spiked with 50 ug/L of the internal standard spiking solution prior to analysis. Different internal standards may be used as necessary.

O.2 Surrogate standards – The recommended surrogates are Toluene d-8, Bromofluorobenzene, 1,2 – Dichloroethane-d4, and Dibromofluoromethane. Each, blank, LCS, and sample undergoing GC/MS analysis should be spiked with 50 ug/L of the surrogate spiking solution prior to analysis. Different surrogate standards may be used as necessary.

Table 1
Secondary Standards

	Stock Conc.	Initial Vol.	Final Vol.	Final Conc.	Solvent

	Stock Conc.	Initial Vol.	Final Vol.	Final Conc.	Solvent
8260 mix	2000 mg/L	1.25 mL	10 mL	250 mg/L	Methanol
8260 custom	2000 mg/L	1.25 mL	10 mL	250 mg/L	Methanol
8260 Ketones	2000 mg/L	1.25 mL	10 mL	250 mg/L	Methanol
CVE	1000 mg/L	2.5 mL	10 mL	250 mg/L	Methanol
AAV	2000/400 mg/L	1.25 mL	10 mL	250/50 mg/L	Deionized water
APP IX Mix 1	2500 mg/L	1.0 mL	10 mL	250 mg/L	Methanol
APP IX Mix 2	various	2.5 mL	10 mL	various	Methanol
Oxygenate Mix 1	2000 mg/L	1.25 mL	10mL	250 mg/L	Methanol
Ethanol	250,000 mg/L	2.0 mL	10 mL	50,000 mg/L	Methanol
3,3-Dimethylbutanol	25,000 mg/L	2.0 mL	10 mL	5,000 mg/L	Methanol
IS/SS	5000 mg/L	2.5 mL	250 mL	50 mg/L	Methanol

3. The following working standards are prepared from the secondary standards and diluted in reagent water:

   A. Calibration standards are prepared at a minimum of five concentrations for all target compounds and surrogates (additional concentrations may be analyzed) from the secondary dilution of stock standards. Prepare these standards in deionized water. The calibration standards are prepared immediately before use at concentrations of 5, 20, 50, 100, and 200 ug/L for solids and waters using a 5mL purge. For waters using a 25mL purge prepare the standards at concentrations of 1, 2, 5, 10, and 25 ug/L. Each standard is prepared in a volumetric flask or a 5ml gas tight syringe. Lower concentration standards may be required to meet project requirements. The 8260 mix, ketones, gases, CVE, and AAV are combined. The three APP IX mixes are also combined and are calibrated separately. Analysis of analytes not contained in any of the aforementioned standards may be calibrated for in combination with the 8260 mix, ketones, gases, CVE, and AAV if sufficient resolution is achieved, or may be calibrated for separately. 44mL of each standard is transferred to a 44mL VOA vial for water calibrations performed using the Solatek 72 autosampler. 5mL of each standard is transferred to a 44mL low bleed septa vial for

solid calibrations.

B. Initial calibration verification standard – Prepare a 50 ug/L standard from the secondary dilution of the independent stock standard (250/50 mg/L). The mixes are combined in the same manner as the calibration standards.

C. LCS and Matrix Spiking Standards – spike at a concentration of 10 ug/L (25 mL purge) and 50 ug/L (5 mL purge and solids) using the working standards. For South Carolina, DOD, and AFCEE project, the LCS must be spiked with all target analytes.

RECOMMENDED CONDITIONS

The following lists conditions that may be used in the lab. The analyst is allowed to modify settings to optimize operating conditions only prior to a valid tune period. Settings cannot be modified within a valid tune period.

GC Instrument Conditions
Oven Temperature: 35°C
Rate A: 25°C/min to 180°C
Rate B: 45°C/min to 245°C
Hold: 2.26 min
Carrier Gas - Helium

Purge & Trap Conditions
Purge: 11 minutes at 30°C
Desorb Preheat: 205°C
Desorb: 1.5 minutes at 250°C
Bake: 6.5 minutes at 260°C

CHEMSTATION PROCEDURE

Due to shift overlaps which creates the probability that more than one analyst will be accessing a given instrument during a 12-hour tune sample batch, GCAL utilizes a master username and password to access Chemstation software. The password expires every 30 days and access to the passwords is granted by the GCMSV supervisor.

To Log In to Chemstation:

1. Enter “gcmsv” for the user name.

2. Obtain password from the GCMSV supervisor and enter the password when prompted by the Chemstation software.

To Change a Password

1. When a current password has expired, Windows prompts the user to enter current credentials including user name and password.
2. Once this information has been entered, the user is then notified that the password has expired and must be changed.

3. Enter a new password into the software when prompted, confirm the new password, and notify the GCMSV supervisor of the password change.

Chemstation Use

1. Chemstation use is limited to those employees who have been given password access by the GCMSV supervisor and are

involved in the process of data production in the GCMSV laboratory. New employees are not granted password access until the GCMSV supervisor is satisfied that the employee has been properly trained on its use. All employees listed on current organizational chart maintained by the QA/QC department are eligible for password access if granted by the GCMSV supervisor.

2. To create an audit trail, each line in the sequencing file represents a unique sample injection. The analyst that is programming the Chemstation and loading a particular sample must include their initials in the miscellaneous information field as part of the sample sequence. This information is then transferred to Target which is used for all data acquisition. Sequence files must be saved by analytical batch and include the date in the name. On days when multiple batches are performed, letters should be added to the data to denote different analytical batches. The format for individual sample sequencing is as follows:

TYPE	Vial	Data File	Method	Sample Name
"Sample"	Autosampler Position	Unique sequential ascending number	"8260"	GCAL sample number

Miscellaneous Information
GCAL Batch Number*Dilution Factor*Analyst Initials

* Please note, only the vial, datafile, sample name, and miscellaneous information fields are edited when programming sequences. Type and method fields always remain the same for each sequence file.

PROCEDURE

1. Procedures for instrument tuning

   A. The instrument should be tuned using FC-43 (perfluorotributylamine) such that all tuning criteria for BFB can be met (Table 2). Before analysis begins, each instrument must be tuned checked by direct injecting 1 uL of a solution containing 50 mg/L BFB or by purging an amount equivalent to 50ng of BFB standard.

   B. The mass spectrum of 4-Bromoflurorobenzene (BFB) is acquired by using the average of three scans: the peak apex scan and the scans immediately preceding and following the apex. Background subtraction is required using a single scan no more than 20 scans prior to the elution of BFB. The tune method is hard coded to perform the above functions and is checked manually if BFB tune criteria fails.

   C. The BFB tuning criteria in Table 2 must be met before proceeding with analysis. If these criteria cannot be met, the instrument should be manually tuned with FC-43. If tune criteria is still not met instrument maintenance is performed.

   D. Once the BFB tune criteria have been met, the instrument is considered to be tuned for a twelve-hour period starting from the injection time of the BFB.

   E. The instrument must be retuned before the twelve-hour period has elapsed if any major adjustments are made to

the mass spectrometer that may affect the tuning criteria.

Table 2
BFB ACCEPTANCE CRITERIA

M/Z	ION ABUNDANCE CRITERIA
50	15 - 40% OF MASS 95
75	30 - 60% OF MASS 95
95	BASE PEAK, 100% RELATIVE ABUNDANCE
96	5 – 9% OF MASS 95
173	LESS THAN 2% OF MASS 174
174	50 - 120 OF MASS 95
175	5 – 9% OF MASS 174
176	>95 BUT <101% OF MASS 174
177	5 – 9% OF MASS 176

2. Procedures for initial calibration

A. The initial calibration standards are prepared at a minimum of five different concentrations from the secondary dilution. Additional standards are usually included for specific compounds including a 0.2ppb, 0.4ppb, 1ppb, 2ppb, and 10ppb.

The calibration range is defined as the on-column concentration range.

1. At least five contiguous points must be used (six if a quadratic curve fit is employed).

2. Calibration acceptance criteria must be met as described below.

3. The lowest calibration point must support the lowest reporting limit needed in the associated samples.

4. The QC spike amount must be within the calibration range.

B. The standards are analyzed in the following sequence:

B.1. BFB (50 NG)
B.2. 5 PPB initial calibration
B.3. 20 PPB initial calibration
B.4. 50 PPB initial calibration
B.5. 100 PPB initial calibration
B.6. 200 PPB initial calibration

Note: These are the routine concentrations analyzed. In all cases the standards shall be run from lowest concentration to highest, or a blank shall be run following a high concentration standard (standards greater than 50 ppb) to establish a contaminant free instrument.

C. Once the five levels of standards have been analyzed, the validity of the initial calibration must be verified by comparing the SPCCs and CCC's to the following criteria.

C.1. Calibration check compounds (CCC) listed below must be ≤ 30 % RSD.

CCC's	% RSD
1,1-Dichloroethene	<30%
Chloroform	<30%
1,2-Dichloropropane	<30%
Toluene	<30%
Ethylbenzene	<30%
Vinyl Chloride	<30%

C.2. System Performance Check Compounds (SPCC) must have a minimum (RF) as indicated. All SPCC's must be evaluated at each level of the calibration curve to insure that compound instability and degradation are checked as required by the method.

SPCC's	MINIMUM RF
Chloromethane	0.1
1,1-Dichloroethane	0.1
Bromoform	0.1
1,1,2,2-Tetrachloroethane	0.3
Chlorobenzene	0.3

D. Additionally one of the following options must meet criteria. The analyst will judge criteria in the order given or with prior knowledge of the behavior of target compounds. One of the following must pass before a calibration is considered acceptable:

D.1 All target analytes have an RSD less than 15%.

D.2 A first order least square regression may be used if $r^2 \geq 0.995$. The curve shall not be forced through zero. The analyst should check the y-intercept (b). If the intercept is greater than half the reporting limit, this option cannot be used.

D.3 A quadratic curve fit is used with the coefficient of determination $r^2 \geq 0.990$. A minimum of a six-point calibration is used if this option is chosen and the curve shall not be forced through zero. The analyst should check the y-intercept (b). If the intercept is greater than half the reporting limit, this option cannot be used. The quadratic calibration option is not allowed for South Carolina projects.

D.4 Alternatively, if the analyte is listed as a poor performer and does not meet the criteria listed above, the data may be reported with a narrative if authorized by the client. NOTE: Compounds cannot be classified as poor performers for South Carolina projects.

D.5. If a CCC compound is a target analyte, then it must exhibit and average %RSD of <15%. If the average %RSD is >15% but <30%, it may be evaluated using a linear or quadratic curve fit.

E. If the initial calibration does not conform to the above listed criteria, corrective action must be taken.

F. The position of the retention time should be set using the mid-point of an initial calibration, and must be checked and reset as necessary after source cleaning or column maintenance.

3. Initial Calibration Verification

   A. Immediately following the initial calibration procedure or before sample analysis, the analyst shall perform initial calibration verification (ICV). This will consist of a solution containing all target analytes prepared from a standard that is independent (second source) from the standards used for the initial calibration.

   B. The ICV must be analyzed following the initial calibration. The ICV must exhibit a recovery of 70-130%, except for the targets listed in Table 3, which must be recovered between 60-140%. Recovery requirements may differ on a project specific basis. See SOP GEN-019. All analytes must exhibit a recovery of 70-130% for South Carolina samples.

   C. If any target analyte recovery is outside the control limits, corrective action must be taken (project specific exceptions may apply). This may include instrument maintenance, re-analysis of the ICV or initial calibration, or re-preparation of the standards involved. If the target fails high and is not present in the associated samples, the data may be reported with a narrative.

4. Procedures for Continuing Calibration

   A. The 50 PPB continuing calibration is analyzed in each batch after acceptable BFB tune and before samples. The following criteria shall be achieved before sample analysis:

      A.1 CCC's must meet the specified criteria for all target analytes. Calibration Check Compounds (CCC's) are allowed no greater than 20% difference from the initial calibration if calibration option 2.D.1 or 2.D.4 is used or % drift ≤20% if a linear or quadratic calibration option was used. The quadratic calibration option is not allowed for South Carolina projects.

      A.2 System performance-check compounds (SPCC's) are required to maintain a relative response factor (RF) as indicated in 2C.2.

      A.3 All target analytes should have a %Difference ≤ 20% from the initial calibration if calibration options 2.D.1 or 2.D.4 were used or %Drift ≤20% of expected value if a linear or quadratic calibration option was used. All targets must have difference/drift ≤ 30%. Project specific limits may apply and are listed in the LIMS. The quadratic calibration option is not allowed for South Carolina projects.

      NOTE: For Exxon samples any %differences/drift that exceed 20% for target analytes but meet the 30% in house criteria, should be narrated in the final report.

      A.4 Some compounds have been classified as poor performers due to poor purging efficiency. These analytes are listed in Table 3 and are acceptable at ≤40% difference/drift. Poor performer exceptions are not allowed for South Carolina samples.

Table 3
Targets that exhibit poor purging efficiency

Acetone	Ethyl acetate
Acetonitrile	2-Hexanone
Acrolein	Isobutyl alcohol
Acrylonitrile	Methacrylonitrile
2-Butanone	4-methyl-2-pentanone
t-Butyl alcohol	Pentachloroethane
1,2-Dibromo-3chloropropane	Propionitrile
1,4-Dichloro-2-butene	Benzal chloride
1,4-Dioxane	1-Nitropropene
2-Chloropropene	1,3 Butadiene
Isopropyl ether	Tetrahydrofuran
2-Nitropropane	2,2,4-Trimethylpentane
2-Chloroethylvinyl ether	Ethyl ether
2-Butanol	Ethyl methacrylate
Cyclohexanone	Dicyclopentadiene
3-Dichloro-1-propene	n-Butanol
Allyl chloride	Methyl methacrylate
Chloroprene	Dichlorodifluoromethane
Bromomethane	TBA
3,3-Dimethylbutanol	t-Amyl Alcohol
Ethanol	Ethyl tertbutyl ether
tert amylmethyl ether	Tertbutyl formate

A.5 If the target analyte (not a CCC) has failed, the RF has increased, and there are no hits during sample analysis, the data is reportable with a narrative. Note: no failures are allowed for South Carolina projects.

A.6 The retention time for any internal standard shall not vary any more than 30 seconds from the mid- point standard of the most recent initial calibration.

A.7 The internal standard area must not deviate by more than a factor of two (-70% to + 100%) from the mid-point standard of the most recent initial calibration.

A.8 Project specific criteria may apply and may be more stringent. See SOP GEN-019.

B. If specified criteria are not met, corrective action must be taken. If no source of the problem can be determined after corrective action has been taken, a new initial calibration must be generated.

5. The purpose of the method blank is to ensure that the analytical system is free of contamination and carryover. The method blank is run at least once per batch (not to exceed 20 samples) before sample analysis. The method blank shall be handled in exactly the same manner as the samples that it represents.

A. The following are a description of the three types of method blanks commonly used in routine analysis and the analysis and evaluation of storage blanks.

A.1 Water - Water blanks require no special preparation. Fill a VOA vial with reagent water. Place the full 44 mL VOA vial on the SOLATek autosampler. 5 uL of the internal standard/surrogate standard will be added automatically.

A.2 Low-level soil – Low-level soil method blanks require special preparation techniques. Place the 5.0 grams of sand in a 44 mL vial and add 5.0 mL of deionized water. Place on the autosampler. The SOLATek will add 5.0 mL of deionized water and the internal/surrogate standards.

A.3 Medium/High level soil – medium/high level soil blanks are prepared by weighing 5.0 grams of sand into a 44 ml VOA vial. Add 5.0 ml Methanol. Shake the vial to extract any volatiles into the solvent. A 1000 uL extract aliquot is diluted to 50ml in a volumetric flask with deionized water. Place on the autosampler. The autosampler will add an amount of internal standard/ surrogate solution equivalent to 50ug/L. Document preparation of blank in logbook.

A.4 Storage Blanks – A set of at least two storage blanks filled with reagent water are kept in each cooler used to store samples. Storage blanks are analyzed every two weeks. If there is detection above ½ the reporting limit, analyze the second vial to confirm the detection. If the results are confirmed immediately notify QA of the affected blank, cooler tested, and storage time. All data must be filed in the appropriate logbook.

B. To prove a contaminant free system, no target analytes shall be detected in the method blank above one half the reporting limit except for common laboratory contaminants, which shall be less than the reporting limit. If any target analytes are detected above this level, data shall not be reported and samples must be re-extracted and re-analyzed unless the following apply:

B.1 If a target analyte is detected above the reporting limit, data may be reported if the concentration is not greater than 10% of the measured concentration in associated samples. Include a narrative with the data.

B.2 If a target analyte is detected in the method blank but there are no hits in the samples, the data may be reported with a narrative.

B.3 If re-analysis is not possible, flag the associated samples and include a narrative in the report. Document the action taken.

C. The source of blank contamination shall be investigated and measures taken to eliminate future contamination.

D. Project specific criteria may apply and may be more stringent. See SOP GEN-019.

6. Procedure for Laboratory Control Spike (LCS/LCSD). An LCS and LCSD are included in each batch of up to 20 samples to demonstrate the system is in control. An LCSD is not required if an MS/MSD is performed. Routinely the LCS/LCSD will be spiked with the full list of 8260 analytes at 50ug/L. The CCV performed that day may be used as the LCS if allowed by the project. Check with the project manager for project specific spiking criteria; some projects may require all target analytes are spiked. The LCS is assessed using the following criteria:

NOTE: For all sample batches involving Exxon samples or South Carolina samples, the LCS/LCSD pair analysis must be independent of the CCV analysis.

A. The percent recovery is calculated for all analytes spiked (see Calculation section). Recoveries are compared to the appropriate control limits. In-house control limits are used if project specific limits have not been requested, and are available in the LIMS. Project specific control limits may be requested; check with the project manager for limits needed. For South Carolina samples, all analytes must be recovered at 70-130% of the expected value.

B. If a recovery is above the upper control limit and the sample results are below the reporting limit, the data may be reported with a narrative. All analytes must pass for South Carolina samples.

C. If a recovery is below the lower control limit, the batch must be re-analyzed unless it meets the requirements of a sporadic failure (see below). If a re-extraction is not possible due to insufficient sample volume, report the data with a narrative. All analytes must pass for South Carolina samples.

D. If the full list of target analytes is spiked, a small number of sporadic failures will be allowed. The failure cannot include a primary compound of interest as defined by the client. See Table 4 for the number of allowable failures. The failures are noted in the case narrative. These failures shall be monitored to ensure randomness. This shall be defined as not exceeding failure in 1 of 3 LCS determinations. If the same analyte fails repeatedly and is not included in Table 3, locate the source of the problem and perform corrective action. All analytes must pass for South Carolina samples.

Table 4
Number of Allowable Failures

Number of Analytes	Failures Allowed
<11	0
11-30	1
31-50	2
51-70	3
71-90	4
>90	5

E. If an LCS and an LCSD are analyzed, calculate precision using the RPD in the Calculation section, equation 2.

Substitute the LCS and LCSD results for the MS/MSD. Precision is assessed using the criteria in the LIMS.

7. Procedures for Matrix Spikes

   A. Analyze one matrix spike/matrix spike duplicate (MS/MSD) pair with each batch of up to 20 samples processed together. The purpose of the spikes is to confirm the matrix being analyzed is not interfering with the recovery of the analytes.

   B. The MS/MSD spike includes the full 8260 list of analytes; the spiking level is 50 ug/L. Check with the project manager for project specific spiking criteria; some projects may require all target analytes are spiked.

   C. Calculate % recovery for all compounds using Calculations equations 1 and 2. All compounds are evaluated to determine acceptance of the MS/MSD.

   D. Whenever the MS and/or MSD recoveries are outside the control limits, check the LCS and LCSD to verify the system was in control, and include this in the case narrative.

   E. Precision is calculated as %RPD. Acceptance criteria are listed in the LIMS. Failures are noted in the narrative.

   F. Review data to verify that a lab error has not occurred (wrong spike amount, not spiked) before automatically identifying a failure as matrix interference.

   G. If recoveries for both the MS/MSD are outside the control limits and the recoveries are similar, the data is reportable with a narrative stating the LCS recoveries were acceptable. The failure is attributed to sample matrix.

   H. Native sample concentrations may be high in comparison to the spiking concentration and therefore an accurate recovery cannot be calculated. Document this in the case narrative. Additionally, soil weights may vary significantly for some MS/MSD pairs and will affect the RPD calculation.

8. QC and Sample Preparation:

   A. Aqueous sample - place the full 44 mL VOA vial on the SOLATek autosampler. 5 uL of the internal standard/surrogate standard will be added automatically. All dilutions must be prepared using volumetric flasks or performed by the autosampler. To prepare MB and LCS/LCSD samples use reagent water.

   B. Low-level soil – SOLATek autosampler is used, place the 5.0 grams of sample in a 44 mL vial and add 10.0 mL of reagent water. Place on the autosampler. The SOLATek will add 5.0 mL of reagent water and the internal/surrogate standards. To prepare LCS/LCSD samples use blank sand.

   C. Medium/High level soil and Concentrated Waste – medium/high level soil and concentrated waste samples are prepared by weighing 5.0 grams of sample into a 44 ml VOA vial. Add 5.0 ml Methanol. Shake the vial to extract the

volatiles into the solvent. A 1000 uL extract aliquot is diluted into a 50ml volumetric flask containing deionized water. The contents are then transferred to a 44ml VOA vial. The SOLATEK autosampler will add the internal standard/surrogate solution to yield a concentration of 50ug/L. To prepare LCS/LCSD samples use reagent water.

D. EnCore™ sampler (En Chem, Inc)

D.1 Preservation – A 200g/L sodium bisulfate solution is prepared by weighing 200g of sodium bisulfate and bringing this to volume with deionized water, in a 1L volumetric flask. 5mL of this solution is added to a VOA vial and a magnetic stirring bar. Record the lot # of the sodium bisulfate solution in the sample prep logbook. Tare the balance. Dispense the contents of the EnCore™ sampler into the vial and record the weight of the sample.

D.2 Load the vial onto the SOLATek autosampler. The autosampler will add 10 mL of deionized water containing the internal standard and surrogate standard.

9. Sample Analysis:

A. Samples may be screened by GCAL.

A.1 Reasons for screening may include but are not limited to the following:

A.1.1 Inconsistent historical data
A.1.2 Physical appearance of the sample
A.1.3 Client notification of suspected high concentration of VOC's
A.1.4 No historical data

A.2 Samples that are deemed necessary for screening must have adequate volume for the screening process and the subsequent volume for the reportable analysis.

A.3 Screening data is not reportable, as the screening analysis is performed on an instrument that has not met acceptable criteria for reportable analysis. The screening data may be provided upon client request, if applicable.

A.4 The screening process is performed in an attempt to prevent contamination of instrumentation performing reportable analysis, thus reducing the possibility of carryover contamination from samples containing high levels of VOC's and resulting in instrument down time.

A.5 Screening analyses are typically performed at a dilution factor in the range of 20 to 1000. Dilution factors may be performed outside of this range. Screening dilutions may be determined by, but are not limited to the following:

A.5.1 Client notification of suspected high concentrations of VOC's
A.5.2 Physical appearance of the sample
A.5.3 Historical data from similar projects

B. All samples are spiked with the following surrogates: 1,2-Dichloroethane-d4, Toluene-d8, Dibromofluoromethane, and Bromofluorobenzene

B.1 All surrogates recoveries must be within the ranges as listed in Table 5 below.

B.2 If any surrogate is below QC limits and target analytes are present, then the sample must be reanalyzed. If the same surrogate still fails in the same manner, then matrix interference is indicated and is included in the case narrative.

B.3 If the recoveries for surrogates are above the upper control limits and no target analytes are detected, the sample is reported with a case narrative indicating surrogate recovery above control limits.

B.3 Control limits are updated annually. Project specific control limits and corrective action may apply and may be more stringent. See SOP GEN-019. All project specific limits shall be in the LIMS.

Table 5

Surrogate	Water Recovery Limits	Solid Recovery Limits
1,2-Dichloroethane-d4	71-127	62-125
4-Bromofluorobenzene	78-130	62-127
Dibromofluoromethane	77-127	65-130
Toluene-d8	76-134	71-132

C. Internal Standards (IS) - All samples are spiked with Fluorobenzene, Chlorobenzene-d5, and 1,4-Dichlorobenzene-d4.

C.1 The Internal Standard area for any internal standard must not deviate by more than (-70% to + 100%) from the daily CCV.

C.2 The retention time of the IS in the sample must not shift greater than ± 0.5 min of the retention time of the corresponding IS in the CCV.

C.3 If the sample fails any of the IS criteria it must be reanalyzed at the same dilution. If it is apparent that the IS is outside criteria due to interference from sample matrix, then contact the client to determine a course of action.

C.4 Project specific criteria may apply and may be more stringent. DOD and AFCEE projects require the internal standard response drift be evaluated using the most recent ICAL mid-point with control limits of −50 to +100%.

D. All dilutions are prepared in volumetric flasks or by using the dilution feature on the autosampler. Dilute samples so that the on-column amount is approximately in the mid-range of the calibration curve.

E. Load samples onto Solatek 72 autosampler. Sample sequences should be saved for future review, if needed.

F. Targets are qualitatively identified based on the retention time and on comparison of the analytes mass spectrum with a reference mass spectrum. A reference mass spectrum is generated using the same conditions of the method. In the reference mass spectrum three characteristic ions are identified, one of which is the primary characteristic ion. If there are not three ions, than any ion over 30% relative intensity may be used. The target is said to be present when the following criteria are met:\

F.1 The intensities of the characteristic ion(s) maximize within one scan.

F.2 The RRT is within ±0.06 RRT units of the RRT of the standard.

F.3 The relative intensities of the characteristic ion(s) agree within 30% of the relative intensities of these ions in the reference spectrum.

F.4 Structural isomers may be identified as individual isomers if the height of the valley between them is less than 25% of the sum of the two peak heights.

G. Samples are quantitated once a positive identification has been made. The quantitation will be based on the area of the primary characteristic ion's EICP and the associated internal standard. Calculations are described in the calculation section. The quantitation ion used shall be the ion listed in the reference method(s) unless there are interferences. Qualifier ions shall be used as a replacement, if possible. If the quantitation ion used is not the ion listed in the reference method, this shall be documented and the documentation stored in the lab.

H. TICS may be reported if requested by manually entering data into the LIMS. If no TICS were found, and the client requested a TIC search, this shall be noted in LIMS. A data system library search is used for identification, and the concentration is estimated using an RF of 1 and the area and concentration of the internal standard with the closest retention time.

I. Manual integrations shall be performed as appropriate. The supervisor reviews manual integrations and the raw data is flagged. For additional information see SOP QA-010.

CALCULATIONS

1. $$\text{MS \% REC} = \frac{\text{MS Concentration-Sample Concentration}}{\text{spike added}} \times 100$$

2. $$\text{MSD \% REC} = \frac{\text{MSD Concentration-Sample Concentration}}{\text{spike added}} \times 100$$

3. $$\text{\% RPD} = \frac{\text{MS-MSD}}{\text{MS + MSD}} \times 100$$

2

4. Response Factor = $\frac{A_s \times C_{is}}{A_{is} \times C_s}$

   As = Peak Area of analyte or surrogate
   Ais = Peak Area of Internal standard
   Cs = Concentration of the analyte or surrogate
   Cis = Concentration of Internal standard

5. %Recovery = $\frac{\text{Concentration Found}}{\text{Concentration Added}} \times 100$

6. Concentration using RF:
   Concentration (µg/L) = $\frac{(A_s)(C_{is})(D)}{(A_{is})(RF)(1000)}$

   Concentration (mg/kg) = $\frac{(A_s)(Cis)(D)}{(A_{is})(RF)(W_s)(1000)}$

   A_s = Area of peak for the analyte in sample
   D = Dilution factor
   RF = Mean Response factor from initial calibration (area/ng)
   A_{is} = Area of internal standard in sample
   C_{is} = Concentration of internal standard
   W_s = Weight of sample

7. Concentration using linear curve fit:
   Concentration (µg/L) = $[m(A_S/A_{IS})+b]C_{IS}D$

   Concentration (mg/kg) = $[m(A_S/A_{IS})+b]C_{IS}D(5/W_S)$

   m = Inverse of slope
   A_s = Area of peak for the analyte in sample
   A_{is} = Area of internal standard in sample
   b = Intercept of the y-axis
   C_{is} = Concentration of internal standard
   D = Dilution factor
   W_s = Weight of sample

8. For quadratic curve fit see Target3 Data Analysis Software Reference Guide page 3-17. The quadratic calibration option cannot be used for South Carolina projects.

9. Concentration of TICS:
   Concentration (mg/kg) = $\frac{(A_s)(C_{is})(D)}{(A_{is})(1000)}$

   A_s = Area of peak for the analyte in sample
   D = Dilution factor
   A_{is} = Area of internal standard in sample
   C_{is} = Concentration of internal standard
   W_s = Weight of sample (if aqueous sample W_s = 1 and report in (µg/L)

10. Calculations for various hydrocarbon ranges. See Appendix I

11. % Difference = $[(RF_I - RF_C) / RF_I\} 100$

    RF_I = Average response factor from initial calibration
    RF_C = Response factor from current verification check standard

12. $\% \text{ Drift} = \left| \frac{\text{Measured Conc} - \text{Spike Conc}}{\text{Spike Conc}} \right| * 100$

13. % RSD = (SD / X) 100

RSD = Relative Standard Deviation
X = mean of 5 initial RF's for a compound
SD = Standard Deviation of average RF's for a compound

REPORTING LIMIT

Samples analyzed by Method 8260B have a routine reporting limit of 5 ppb for all analytes of interest with the exception of the following compounds:

Acetone – 25 ppb
Acetonitrile – 100 ppb
Acrolein – 25 ppb
Acrylonitrile – 25 ppb
1,4-Dioxane – 200 ppb
Isobutanol – 100 ppb
Methyl Ethyl Ketone – 25 ppb
Methyl Methacrylate – 100 ppb
Propionitrile – 100 ppb
Methylene Chloride – 10 ppb
Benzal Chloride – 20 ppb
n-Butyl Alcohol – 100 ppb
Ethyl Acetate – 100 ppb
Ethyl Ether – 100 ppb
Cyclohexanone – 100 ppb
Cyclohexane – 100 ppb
1,3-Butadiene – 10ppb
1,3-Dichloropropene – 10 ppb
1-nitropropane – 10 ppb
2-methyltetrahydrofuran – 20 ppb
2-methyltetrahydropyran – 10 ppb
2-nitropropane – 20
2-H-tetrahydropyran – 20 ppb
Allyl Chloride – 25 ppb
Chloroprene – 80 ppb
Cumene hydroperoxide – 20 ppb
Ethylene oxide – 100 ppb
Tetrahydrofuran – 100 ppb
Sec-Butanol – 10 ppb
t-Butanol – 10 ppb

Lower limits may be achieved for specific projects. Reporting limits are achieved by running a low level standard at the same level as the reporting limit. The RL should be at least 2X the MDL. Specific project criteria may apply. See SOP GEN-019.

DATA REVEIW

For data review procedures and checklist, please see SOP QA-002.

SOFTWARE TROUBLESHOOTING

The Tekmar Solatek 72 instruments utilize Tekmar software VOC TEKLINK Version 2.4.4647 to control the autosampler and purge and trap function. The Agilent GC/MS's utilize Agilent software MSD Chemstation Version D.02.00.275 to control the instrument and transfer data acquisition to Target Data Integration software. Target software is utilized to calculate all data. In the event of software malfunction for the Tekmar Solatek 72, please contact Tekmar technical support for troubleshooting help. In the event of software

malfunction for the GC/MS, please contact Agilent technical support for troubleshooting help. In the event of software malfunction when using Target, please contact GCAL's IT Director for troubleshooting help.

METHOD PERFORMANCE

1. The method detection limit (MDL) is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the value is above zero. The MDL actually achieved in a given analysis will vary depending on instrument sensitivity and matrix effects.

2. This method has been tested using purge-and-trap (Method 5030) in a single laboratory using spiked water. Using a wide-bore capillary column, water was spiked at concentrations between 0.5 and 10 ug/L. Single laboratory accuracy and precision data are presented for the method analytes in Table 6 of the 8260 method. Calculated MDLs are present in Table 1 of the 8260 method.

3. The method was tested using purge-and-trap (Method 5030) with water spiked at 0.1 to 0.5 ug/L and analyzed on a cryofocussed narrow-bore column. The accuracy and precision data for these compounds are presented in Table 7 of the 8260 method. MDL values were also calculated from these data and are presented in Table 2 of the 8260 method.

4. Single laboratory accuracy and precision data were obtained for the Method 5035 analytes in three soil matrices; sand; a soil collected 10 feet below the surface of a hazardous landfill, called C-Horizon; and a surface garden soil. Sample preparation was by Method 5035. Each sample was fortified with the analytes at a concentration of 4 ug/kg. These data are listed in Tables 17, 18, and 19 of the 8260 method. All data were calculated using fluorobenzene as the internal standard added to the soil sample prior to extraction. This causes some of the results to be greater than 100% recovery because the precision of results is sometimes as great as 28%.

5. In general, the recoveries of the analytes from the sand matrix are the highest, the C-Horizon soil results are somewhat less, and the surface garden soil recoveries are the lowest. This is due to the greater adsorptive capacity of the garden soil. This illustrates the necessity of analyzing matrix spike samples to assess the degree of matrix effects.

6. The recoveries of some of the gases, or very volatile compounds such as vinyl chloride, trichlorofluoromethane and 1,1-dichloroethene are somewhat greater than 100%. This is due to the difficulty encountered in fortifying the soil with these compounds, allowing an equilibration period, extracting them with a high degree of precision. Also, the garden soil results in Table 19 of the 8260 method include some extraordinary high recoveries for some aromatic compounds, such as toluene, xylenes, and trimethylbenzenes. This is due to contamination of the soil prior to sample collection, and to the fact that no background was subtracted.

POLLUTION PREVENTION See QAPP Section 10.2

WASTE MANAGEMENT See SOP GEN-009

Appendix I

3. Calculations for Total Other VOC's

The total ion chromatogram of a method 8260B gas chromatographic/mass spectrometric (GC/MS) analysis is integrated and peaks attributed to target analytes, internal standards, surrogates, and those compounds which may elute before Dichlorodifluoromethane and those compounds which may elute after 1,2,3-Trichlorobenzene are subtracted from the total peak area of the chromatogram. The total concentration of non-target volatile organic components is calculated and reported by relating the resultant ion peak area to the total ion peak area of an intern standard (Fluorobenzene) of known concentration (50ppb). An area report is loaded from the Samba server into the Filemaker program. After entering the minimum and maximum retention times (corresponding to the elution times of Dichlorodifluoromethane and 1,2,3-Trichlorobenzene, respectively) and the appropriate dilution factor, the area report is imported and results are generated.

2. Calculations for Other VOC's C6 and Lower

The total ion chromatogram of a method 8260B gas chromatographic/mass spectrometric (GC/MS) analysis is integrated. A sum of all peak areas beginning with the elution of Dichlorodifluoromethane and ending with the elution of Hexane is generated. The total concentration of C6 components is calculated and reported by relating the resultant C6 area to the peak area of an internal standard (Fluorobenzene) of know concentration (50ppb). An area report is loaded from the Samba server into the Filemaker program. After entering the minimum and maximum retention times (corresponding with the elution times of Dichlorodifluoromethane and 1,2,3-Trichlorobenzene), the retention time for Hexane, and the appropriate dilution factor, the area report is imported and results are generated.

3. Calculations for Other VOC's C7 and Higher

The total ion chromatogram of a method 8260B gas chromatographic/mass spectrometric (GC/MS) analysis is integrated. A sum of all peak areas beginning with the elution of Hexane and ending with the elution of 1,2,3-Trichlorobenzene is generated. The total concentration of C7 components is calculated and reported by relating the resultant C7 area to the peak area of an internal standard (Fluorobenzene) of know concentration (50ppb). An area report is loaded from the Samba server into the Filemaker program. After entering the minimum and maximum retention times (corresponding with the elution times of Dichlorodifluoromethane and 1,2,3-Trichlorobenzene), the retention time for Hexane, and the appropriate dilution factor, the area report is imported and results are generated.

STANDARD OPERATING PROCEDURE

PREPARATION OF WATER SAMPLES FOR ICP/ICP-MS ANALYSIS USING EPA 3050B

Reviewed by: _____ Date: 7/27/2012
Abigail Guerin, Metals Supervisor

Approved by: _____ Date: 7/27/2012
Bessie Claiborne, Wet Chemistry Manager

Approved by: _____ Date: 7/27/2012
Allison Naquin, Technical Director

Approved by: _____ Date: 7/27/2012
Karen Varnado, Quality Assurance Manager

UNCONTROLLED COPY - FOR REFERENCE USE ONLY

Document Review and Revision History

Note: Actions older than 5 years may be removed from this record.

Approval Date	Revision No.	Record of Activity	Author
10/01/2011	014	Previous version and old format.	James Turner
7/27/2012	0015	Put the SOP in the format. Revised to meet method requirements.	Abigail Guerin

UNCONTROLLED COPY - FOR REFERENCE USE ONLY

1.0 SCOPE AND APPLICATION

1.1 This digestion procedure is designed for the preparation of sediment, sludge and soil samples for determination of total metals by ICP or ICP-MS.

1.2 For the digestion of samples a representative sample of 1-2 grams wet weight is digested with repeated additions of HNO_3 and hydrogen peroxide.

1.3 This method has been modified from the original method. The original volume of acid used in each procedural step has been reduced by half to prevent contamination from the acid. GCAL uses Ultra Trace grade acid, but as detected calcium, iron and copper above half the reporting limit.

2.0 MATRIX

2.1 Solid

3.0 DEFINITION

Refer to Appendix 1

4.0 PERSONNEL QUALIFICATIONS/RESPONSIBILITIES

4.1 The analyst performing this test procedure must be a qualified analyst or technician that has received training for this procedure.

5.0 INTERFERENCES

5.1 Sludge samples can contain diverse matrix types, each of which may present its own analytical challenge.

6.0 SAMPLE COLLECTION

6.1 Samples are shipped to the lab by common carrier or hand delivered.

6.2 A chain-of-custody must accompany all samples and must document the date and time of sample collection and the preservation method used.

6.3 Samples may be collected and stored in plastic or glass containers. Sufficient sample should be collected so that the laboratory receives a 2 oz. sample.

6.4 The temperature of the samples must be taken upon receipt by the laboratory.

UNCONTROLLED COPY - FOR REFERENCE USE ONLY

7.0 PRESERVATION

7.1 Non-aqueous samples should be refrigerated upon receipt and analyzed as soon as possible.

8.0 HOLDING TIME

8.1 Samples for metals can be held for up to 180 calendar days from collection.

9.0 SAFETY

9.1 Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards and all associated protective wear and spill clean-up procedures PRIOR TO the use of any chemical. In all cases, the applicable material safety data sheet (MSDS) and your supervisor or safety officer should be consulted. The bottle labels also provide important information that must be noted.

9.2 Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. Therefore, exposure to these materials must be reduced to the lowest level possible.

9.3 Standard clothing (lab coat or apron), eye covering (safety glasses or goggles) and gloves shall be worn when handling samples.

9.4 Solvents and chemicals should be handled in ventilated hoods.

10.0 EQUIPMENT, SUPPLIES AND REAGENTS

10.1 70 mL digestion vessels

10.2 250 mL glass digestion flasks

10.3 Watch glasses – ribbed

10.4 100 mL graduated cylinders

10.5 Specimen container with lid

10.6 CPI Mod Block – Digestion Block

10.7 Hot plate

10.8 Balance accurate to 0.0001g and calibrated daily when in use.

UNCONTROLLED COPY - FOR REFERENCE USE ONLY

10.9 Teflon boiling beads (or equivalent)

10.10 Mechanical pipette, clear plastic pipette tips, accuracy ±2% verified daily when in use.

10.11 Nitric Acid -- Trace Metal grade (ICP); Ultra trace metal grade (ICP-MS)

10.12 Hydrochloric Acid -- Trace Metal grade (ICP); Ultra trace metal grade (ICP-MS)

10.13 30% Hydrogen Peroxide (ICP); Ultra trace 30% Hydrogen Peroxide (ICP-MS)

10.14 DI water from DI water polisher that is monitored daily.

Note: A Maintenance logbook is issued for each instrument. All maintenance performed by the analyst, GCAL employee, or service representative must be entered into the logbook.

11.0 REAGENTS AND STANDARDS

11.1 label all containers and squeeze bottles with the reagent ID, lot number, date prepared if appropriate, and expiration date.

11.2 All standards used are pure material or from prepared certified solutions. The certificate of analysis shall be kept on file. Follow manufacturer's instructions for standard expiration and storage.

11.3 Label all working standards using completed standard labels.

11.4 Concentrated Nitric Acid – Trace metal grade for ICP and Ultra Trace metal grade for ICPMS.

11.5 Concentrated Hydrochloric Acid – Trace metal grade for ICP and Ultra Trace metal grade for ICPMS.

11.6 DI water - with polishing unit, monitored daily.

11.7 Spiking solution for samples and LCS

11.7.1 GCAL – 1A: purchased certified custom solution

11.7.2 GCAL – 2C: purchased certified custom solution

11.7.3 ICP – MS: purchased certified custom solution

UNCONTROLLED COPY - FOR REFERENCE USE ONLY

11.7.4 ICP (ZR) Spike – Lab prepared spike at 100 ppm. Dilute 5 mL of 1,000 ppm custom stock standard to 50 mL using the ICP 6% HNO_3/10% HCL acid matrix as the solvent.

11.7.5 ICPMS (Sb, Se, Ag) spike – Lab prepared spike at 10 ppm Sb, Ag and 2ppm Se. Dilute 500 µL of 1,000 ppm custom stock Sb, 500 µL of 1,000 ppm custom stock Ag, and 100 µL of 1,000 ppm custom stock Se to 50 mL using 2% HNO_3 as the solvent.

11.7.6 ICPMS (Zr) spike – Lab prepared spike at 10 ppm. Dilute 500 µL of 1,000 ppm Zr custom stock standard to 50 mL using 2% HNO_3 as the solvent.

12.0 PROCEDURE

12.1 Creating a Batch

12.1.1 Log into LIMS

12.1.2 Select “Batching”.

12.1.3 Select “New Batch”. This will take you to the “Advance Find” box.

12.1.4 In the “Queue” field type in the queue code or click on the blue down arrow and choose the appropriate “Queue” code.

12.1.5 Uncheck “Partial Search” box and then select “Okay”.

12.1.6 Look up the method, highlight the appropriate method and double click.

12.1.7 Click on the box to add a check to the sample IDs to be added to the batch or if all samples are checked, click on the box to remove the check to exclude samples from the batch.

12.1.8 Click on the Build Batch button.

12.1.9 Delete “MS” and “Dup”.

12.1.10 Choose sample for Spike and Dup by highlighting the sample.

12.1.11 Click on “Add QC”.

12.1.12 Select the appropriated QC sample(s) to be included in the batch.

12.1.13 Click on “Save”.

UNCONTROLLED COPY - FOR REFERENCE USE ONLY

12.1.14 The Batch number and HBN numbers will be generated.

12.2 To print the Prep Sheet

12.2.1 On the Intranet, select "Prep Menu" and then select the appropriate Metals Form.

12.2.2 Enter the HBN number.

12.2.3 "Check" the matrix, "check" the method.

12.2.4 "Select" print.

12.3 Procedures for Digesting a Sample

12.3.1 Homogenize the wet sample by mixing well. The sample may be removed from the container and placed on butcher paper to allow for mixture of the whole sample. Weigh 1.25g – 1.26 g of a homogenized sample into a labeled 70 mL digestion vessel. A minimum weight may be required to meet the project required detection limit. Check with the metals supervisor or project manager to determine if a minimum weight is required. Record the weight to the nearest 0.01g. Prepare QC samples as required in the quality control section.

12.3.4 Add 5 mL of 1:1 HNO_3 and mix.

12.3.5 Set Mod Block to the required setting for temperature of 90-95°C. Allow 15 minutes for the block to stabilize at the appropriate temperature.

12.3.6 Place the digestion vessels in the block, cover with a watch glass and reflux the samples for 15 minutes without boiling.

12.3.7 Cool and add 2.5 mL of concentrated HNO_3 to each sample, replace the watch glasses and reflux for 30 minutes.

12.3.8 If brown fumes are generated, indicating oxidation of the sample by the HNO_3, repeat step 5 over and over until no brown fumes are given off by the sample indicating the reaction is complete.

12.3.9 Cool. Add 1 mL DI H_2O and 1.5 mL 30% of H_2O_2 (peroxide) and cover with the watch glass.

UNCONTROLLED COPY - FOR REFERENCE USE ONLY

12.3.10 On low heat, warm the sample to start the H_2O_2 reaction and heat until effervescence subsides. Continue adding 30% H_2O_2 in 1 mL aliquots (up to a maximum total of 5 mL of 30% H_2O_2) until the reaction is minimal.

12.3.11 Cover the sample with the watch glass and heat at 95°C for 2 hours or until the sample volume is about 5mL.

12.3.12 For ICP, add 5 mL of concentrated HCl, cover with a watch glass and reflux at 95^{0}C for 15 minutes.

12.3.13 For ICP-MS, add 0.5 mL of concentrated HCL, cover with a watch glass and reflux at 95^{0}C for 15 minutes.

12.3.14 Cool and adjust final volume to 50 mL with DI H_2O.

12.3.15 Document digestion by completing prep sheet (attached).

12.3.16 Filter through Whatman 41 (or this can be done in the lab) prior to analysis.

12.4 <u>HOT PLATE PROCEDURE</u>

Most liquid organic samples are digested on a hot plate due to the extended digestion time.

12.4.1 Homogenize the sample by mixing well. Mix in a well-ventilated area. Weigh 1.25g – 1.26 g of a homogenized sample into a labeled 250 mL glass digestion vessel. A minimum weight may be required to meet the project required detection limit. Check with the metals supervisor or project manager to determine if a minimum weight is required. Record the weight to the nearest 0.01g. Prepare QC samples as required in the quality control section.

12.4.2 Add 5 mL of HNO_3 and mix.

12.4.3 Set hot plate to the required setting for temperature of 90-95°C. Allow 15 minutes for the hot plate to stabilize at the appropriate temperature.

12.4.4 Place the digestion flasks on the hot plate, cover with a watch glass and reflux the samples for 15 minutes without boiling.

12.4.5 Cool and add 2.5 mL of concentrated HNO_3 to each sample, replace the watch glasses and reflux for 30 minutes.

UNCONTROLLED COPY - FOR REFERENCE USE ONLY

12.4.6 If brown fumes are generated, indicating oxidation of the sample by the HNO_3, repeat step 5 over and over until no brown fumes are given off by the sample indicating the reaction is complete. For concentrated organic samples, this step is performed many times and therefore the digestion may take several days.

12.4.7 Cover with watch glass. Heat at 95°C for 2 hours or until the sample volume is about 5 mL.

12.4.8 Cool. Add 1 mL DI H_2O and 1.5 mL 30% of H_2O_2 (peroxide) and cover with the watch glass.

12.4.9 On low heat, warm the sample to start the H_2O_2 reaction and heat until effervescence subsides. Continue adding 30% H_2O_2 in 1 mL aliquots (up to a maximum total of 5 mL of 30% H_2O_2) until the reaction is minimal.

12.4.10 Cover the sample with the watch glass and heat at 95°C for 2 hours or until the sample volume is about 5mL.

12.4.11 For ICP add 5 mL of concentrated HCl, cover with a watch glass and reflux at 95°C for 15 minutes.

12.4.12 For ICP-MS add 0.5 mL of concentrated HCl, cover with a watch glass and reflux at 95°C for 15 minutes.

12.4.13 Filter through Whatman 41 (or this can be done in the lab).

12.4.14 Cool and adjust final volume to 50 mL with DI H_2O.

12.4.15 Document digestion by completing prep sheet found on the GCAL Intranet site, under Laboratory, Prep Menu, Metals Forms.

12.5 <u>Optional Procedure for Antimony (Solid)</u>

.

UNCONTROLLED COPY - FOR REFERENCE USE ONLY

12.5.1 Weigh 2.50 g of sample in digestion tube.

12.5.2 Add 3.0 mL concentrated HNO3 and 10.0 mL concentrated HCl.

12.5.3 Set Mod Block to the required setting for temperature of 95^0C ± 5^0C. Allow 15 minutes for the block to stabilize at the appropriate temperature.

12.5.4 Place the digestion vessel in the block, cover with watch glass and reflux for 15 minutes.

12.5.5 Filter the digestate through Whatman #41 filter paper (or equivalent) and collect filtrate in another labeled 70mL digestion vessel. While still in funnel, rinse the filter paper with no more than 5.0 mL of hot HCl (~95 ^{0}C), then with 20 mL of hot (~95 ^{0}C) reagent water. Collect washings in same digestion vessel as the filtrate.

12.5.6 Remove filter and residue from funnel and place in original digestion vessel. Add 5.0 mL concentrated HCl, place vessel back in block with watch glass and sides of digestion vessel with reagent water. Repeat step 5 filter process.

12.5.7 Allow sample to cool and bring to volume, 100 mL. If precipitation occurs in digestion tube upon cooling the primary or secondary filtrate do not bring up to volume. Instead, add up to 10 mL of concentrated HCl to dissolve precipitate. Once precipitate is dissolved, bring to volume (50 mL) with reagent water.

13.0 QUALITY CONTROL

With each batch twenty or fewer samples, the following will be digested:

13.1 With each batch of samples, the following will be digested:

13.1.1 Prepare one method blank (MB), (approximately 1.25g of boiling beads, document exact weight) with each batch of twenty or fewer samples.

13.1.2 Prepare one Laboratory Control Sample (LCS) (approximately 1.25g of boiling beads, document exact weight) with each batch of twenty or fewer samples. Add 0.25 mL of GCAL-1A, GCAL-2C, and 0.25 mL of ICP (Zr) spike (as needed) for ICP-AES. Check to be sure all target elements are contained in spike solutions. If not, add them separately from stock solutions. For ICP-MS add 0.25mL of ICP-MS spike, 0.25

UNCONTROLLED COPY - FOR REFERENCE USE ONLY

mL of ICP-MS (Sb, SE, Ag) spike, and 0.25 mL of ICP-MS(Zr) spike(as needed).

13.1.3 Duplicate one sample with each batch of twenty or fewer samples.

13.1.4 Prepare one matrix spike sample (MS) with each batch of twenty or fewer samples. Add 0.25 mL of GCAL-1A, GCAL-2C, and 0.25 mL of ICP (Zr) spike (as needed) for ICP-AES. Check to be sure all target elements are contained in spike solutions. If not, add them separately from stock solutions. Matrix spike duplicates may be performed if required for a specific project. For ICP-MS add 0.25mL of ICP-MS spike, 0.25 mL of ICP-MS (Sb, SE, Ag) spike, and 0.25 mL of ICP-MS(Zr) spike(as needed).

13.1.5 Record the laboratory ID for all standards and reagents in the prep sheet.

13.1.6 Spiked duplicate samples will be used to determine precision and accuracy.

14.0 CALIBRATION

14.1 The micro-pipettors must be calibrated each day of use.

14.2 The analytical balance must be calibrated each day of use.

15.0 CALCULATIONS

15.1 The concentrations determined are to be reported on the basis of the actual weight of the sample. If a dry weight analysis is desired, then the percent solids of the sample must also be provided.

15.2 If percent solid is desired, a separate determination of percent solids must be performed on a homogenous aliquot of the sample.

16.0 REPORTING LIMIT

16.1 Not Applicable.

17.0 CORRECTIVE ACTION

17.1 A corrective action form must be generated if any of the following occur:

17.1.1 If the sample is not analyzed within the holding time

17.1.2 If a sample has been reported with an incorrect result due to entry error/incorrect calculations.

UNCONTROLLED COPY - FOR REFERENCE USE ONLY

17.1.3 If control limits are not met for method blank or LCS repeat. If the control limits still fail then corrective actions must be performed.

18.0 METHOD PERFORMANCE

18.1 Precision - Precision data for EPA Method 3050B is determined by the statistical examination of inter-laboratory test results.

18.2 Accuracy – Accuracy data for EPA Method 3050B is determined by the statistical data for the analytical method.

18.3 GCAL has modified the method by reducing the volume of acid used in digesting samples. When the method specified volume of acid was used calcium, iron and copper contamination was noted in the method blank greater than half the reporting limit. By reducing the volume of acid used during digestion GCAL was able to remove the trace metal contamination from the method blank. Proficiency test sample results and laboratory control samples routinely meet acceptance criteria and are used to document the effectiveness of the modified digestion.

19.0 POLLUTION PREVENTION

19.1 Pollution prevention encompasses any technique that reduces or eliminates the quantity or toxicity of waste at the point of generation.

19.2 Refer to QAPP Section 10.2

20.0 WASTE MANAGEMENT

20.1 All unused samples or sample extracts are discarded according to the Hazardous Waste Disposal SOP, GEN-009.

21.0 REFERENCES

21.1 SW-846 Method 3050B

22.0 TROUBLESHOOTING

22.1 Not Applicable

23.0 TABLES, DIAGRAMS, AND FLOWCHARTS

23.1 Forms are located on the GCAL Intranet Main Menu, under Laboratory, Prep Menu, Metals Forms.

UNCONTROLLED COPY - FOR REFERENCE USE ONLY

APPENDIX 1

UNCONTROLLED COPY - FOR REFERENCE USE ONLY

GLOSSARY

ACCEPTANCE LIMITS – data quality limits specified by the test method or generated by the laboratory. Specified limits placed on an item, process, or service defined in the requirement document.

ACCURACY – a measure of how close a measured value is to a known true value. Accuracy is assessed by means of reference samples and percent recoveries of spiked samples. The degree of agreement between an observed value and an accepted reference value. Accuracy includes combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator.

ALIQUOT – a discrete, measure, or representative portion of a sample taken for analysis.

ANALYTE – the chemical element or compound an analyst seeks to determine; the chemical element of interest.

ANALYTICAL BATCH – the basic unit for analytical quality control, defined as samples that are analyzed together with the same method sequence and the same lots of reagents and with the manipulations common to each sample within the same time period or in continuous sequential time periods. Samples in each batch should be of similar composition (e.g., groundwater, sludge, ash).

ANALYTICAL SAMPLE – any solution or media introduced into an instrument on which an analysis is performed, excluding instrument calibration, initial calibration verification, initial calibration blank, continuing calibration verification, and continuing calibration blank. The following are all analytical samples: undiluted and diluted samples (EPA and non-EPA), predigestion spike samples, duplicate samples, serial dilution samples, analytical spike samples, post digestion spike samples, interference check samples (ICS), CRDL standard for AA(CRA), CRDL standard for ICP(CRI), laboratory control sample(LCS), preparation blank(PB), and linear range analysis sample(LRS).

ANALYST – the designated individual who performs the "hands on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

AREA UNITS – a term used in gas chromatography that indicates the peak area of a compound exiting a chromatographic column. The size or area of the peak is proportional to the amount of analyte in the sample.

ATOMIC ABSORPTION (AA) – a technique for analyzing metal using an element-specific lamp that emits a characteristic light spectrum. A sample is heated in a flame or graphite furnace and the light beam is passed through it. When the sample absorbs light, an energy loss is detected and is translated into a concentration of metal in the sample. This technique detects one metal at a time.

AUDIT – a systematic check to determine the quality of some function or activity. Two basic types are performance audits and system audits. Perform audits involve a quantitative comparison of the laboratory's results to those of a proficiency sample containing known concentration of analytes. A

UNCONTROLLED COPY - FOR REFERENCE USE ONLY

system audit is a qualitative evaluation that normally consists of an onsite review of a lab's quality assurance system and physical facilities.

BACKGROUND CORRECTION – a technique usually employed relative to metals analysis, which compensates for variable background contribution to the instrument signal in the determination of trace elements.

BATCH – environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A batch is composed of a maximum of twenty environmental samples. A preparation batch is composed of environmental sample of the same matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) and/or those samples not requiring preparation, which are analyzed together as a group using the same calibration curve or factor. An analytical batch can include samples originating from various environmental matrices.

BIAS – the deviation of the mean of replicate analytical measurements from a reference analyte concentration. Relative bias is represented by analytical measurement mean minus the reference analyte concentration and the difference divided by the reference analyte concentration. See accuracy and precision.

4-BROMO-FLUOROBENZENE (BFB) – the compound used to check the tuning of the instrument, and is used as a surrogate compound spiked into every sample for volatile analysis. A compound utilized in EPA gas chromatography/mass spectrometry (GC/MS) volatile methods to establish mass spectral instrument performance.

BIOCHEMICAL OXYGEN DEMAND (BOD) – A measure of the amount of oxygen consumed in the biochemical processes that break down organic matter in water. A larger BOD value indicates a greater degree of organic pollution. A related term, BOD5, is the amount of dissolved oxygen consumed in five days.

BIOSEED – the bacterial culture used to inoculate a sample for testing.

BLANK – an artificial sample designed to monitor the introduction of artifacts into the measurement process. For aqueous samples, reagent water is used as a blank matrix. There are several types of blanks, which monitor a variety of processes: 1.)*laboratory blank* is taken through sample preparation and analysis only. It is a test for contamination in sample preparation and analyses. 2.)*storage blank* is stored and analyzed with samples at the laboratory. It is a test for contamination in sample storage as well as sample preparation and analysis. 3.)*trip blank* is shipped to and from the field with the sample containers. It is not opened in the field and, therefore, provides a test for contamination from sample preservation, site conditions, and transport as well as sample storage, preparation, and analysis. It is most commonly used for volatile organics. 4.)*field blank* is opened in the field and tests for contamination from the atmosphere as well as those activities listed under the trip blank.

BNA – base, neutral and acid extractable compounds. The term base, neutral and acid refer to the pH condition of the sample undergoing extraction. Certain compounds extract more efficiently from water under acidic conditions. Such compounds are often referred to as "acid extractables."

UNCONTROLLED COPY - FOR REFERENCE USE ONLY

CALIBRATE – to determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter or other device, or the correct value for each setting of a control knob. The levels of the applied calibration standard should bracket the range of planned or expect sample measurements.

CALIBRATION – The systematic determination of the relationship of the response of the measurement system to the concentration of the analyte of interest. Instrument calibration performed before any samples are analyzed is called the initial calibration. Subsequent checks on the instrument calibration performed throughout analysis are called continuing calibration verification.

CALIBRATION BLANK (CB) – a volume of reagent water in the same matrix as the calibration standards but without the analyte.

CALIBRATION CURVE – the graphical relationship between the known values, such as concentrations, of a series of calibration standards and their analytical response.

CALIBRATION METHOD – a defined technical procedure for performing a calibration.

CALIBRATION STANDARD – a certified material used to calibrate an instrument.

CERTIFIED REFERENCE MATERIAL (CRM) – reference material, one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body. (ISO Guide 30)

CONTINUING CALIBRATION VERIFICATION (CCV) – used to evaluate the performance of the instrument system with respect to a defined set of method criteria. The CCVs are used to verify instrument performance during analysis. The CCV shall be prepared from the same stock standard solution used to prepare the calibration curve.

CHAIN-OF-CUSTODY–Procedures and associated documents designed to trace the custody of a sample from the point of origin to final disposition, with the intent of legally demonstrating that custody remained intact and the tampering or substitutions were precluded.

CHEMICAL OXYGEN DEMAND (COD) – A measure of the oxygen required to oxidize all compounds in water, both organic and inorganic.

COMBINED STANDARD UNCERTAINTY – The standard uncertainty of the analytical measurement result that is the sum in quadrature (square-root-of-the-sum-of-the-squares) of the component standard uncertainties.

CORRECTIVE ACTION – the action taken to eliminate the causes of an existing non-conformity, defect, or other undesirable situation to prevent reoccurrence.

COVERAGE FACTOR – the numerical factor used as a multiplier of the combined standard uncertainty to expand the uncertainty corresponding to a specific level of confidence. The Student's *t*-distribution is used for determining the coverage factor.

DEMONSTRATION OF CAPABILITY (DOC) – a procedure used to establish the ability of the analyst to generate acceptable accuracy.

DEIONIZED WATER (DI) – water from which the majority of ions have been removed. Water that is contaminant free and used in the laboratory, the resistivity should be ≤ 18 mega ohms.

DISSOLVED METALS –- metallic elements determined on a water sample that has been passed through a 0.45-um filter.

DISSOLVED OXYGEN (DO) – the oxygen freely available in water, an indicator of water quality.

DISSOLVED SOLIDS – disintegrated organic and inorganic material contained in water. Excessive amounts make water unfit to drink or use in industrial processes.

DRY WEIGHT – the weight of a sample based on percent solids. The weight of a sample after drying in an oven at a specified temperature.

DUPLICATE MEASUREMENT – a duplicate measurement is a second measurement made on the same or identical sample of material to assist in the evaluation of measurement of variance.

DUPLICATE SAMPLE – two samples taken from the same population and carried through certain stages of sampling and testing. Duplicate sample include field co-located duplicate samples, field-split duplicate samples, and laboratory duplicate subsamples.

EXPANDED UNCERTAINTY – the quantity defining an interval enveloping the analytical measurement that captures a large fraction of the distribution of analyte concentrations that could be attributable to the quantity measured. The combined standard uncertainty is multiplied by the coverage factor to calculate the expanded uncertainty.

EXTERNAL STANDARDS – a method of quantifying chromatographic data in which standards of known concentration are analyzed prior to unknown samples. The chromatographic peak area (or height) of a sample component is compared to a calibration curve of a peak area constructed from the standard data for that component. This comparison allows the concentration of the component in the sample to be determined.

FECAL COLIFORM BACTERIA – bacteria found in mammals' intestinal tracts. Their presence in water or sludge is an indicator of pollution and possible contamination by pathogens.

FLAME IONIZATION DETECTOR (FID) – a gas chromatography detector in which the column effluent gas is mixed with hydrogen and burned in air or oxygen. The ions and electrons produced in the flame generate an electric current proportional to the amount of materials in the detector. The FID responds to nearly all organic compounds, but it does not respond to air and water, which makes it exceptionally suited to environmental analysis.

FLASHPOINT – the lowest temperature at which a flammable liquid gives off sufficient vapor to form an ignitable mixture with air near its surface or within a vessel. Combustion does not continue.

GAS CHROMATOGRAPHY (GC) – a technique for detecting organic compounds by using their physical and chemical properties to separate a mixture. The compounds are identified and quantified

UNCONTROLLED COPY - FOR REFERENCE USE ONLY

with various types of detectors as they exit the chromatograph. Selection of detectors is dependent on the particular compounds of interest.

GAS CHROMATOGRAPHY MASS SPECTROMETRY (GCMS) – a technique in which sample analytes are bombarded with electrons as they exit a gas chromatography column and are fragmented into characteristics ion patterns. The mass spectrometer is the detector. It can determine which fragments are present and therefore the identity of the compounds.

GLUCOSE GLUTAMIC ACID (GGA) – used as a laboratory control standard in BOD procedures.

GRAPHITE FURNACE – a technique used for the analysis of metals. An atomic absorption spectrophotometer heats the sample within a graphite tube using an electrical current. It is also commonly called a flameless furnace and generally provides greater sensitivity for certain metals than flame or inductively coupled argon plasma techniques.

GRAVIMETRIC - analyses based on the direct or indirect weighing of the analyte in question. This technique usually requires the use of an analytical balance with a sensitivity of 0.1 mg or better.

HALL ELECTROLYTIC CONDUCTIVITY DETECTOR – an element-selective gas chromatography detector primarily intended for trace analysis of organic compounds containing chlorine, nitrogen or sulfur. In operation, this detector pyrolyzes the column effluent gas into soluble electrolytes that are dissolved in a stream of deionized liquid. The observed change in electrical conductivity, proportional to the amount of material present, is measured.

HAZARDOUS WASTE – waste regulated under RCRA that can pose a substantial or potential hazard to human health or the environment when improperly managed. Such wastes possess at least one of four characteristics (ignitability, corrosivity, reactivity, or toxicity) or appear on special EPA hazardous waste lists. The term is not interchangeable with hazardous substances or material.

HEADSPACE - Any area in a container not completely filled by the sample in which gases can collect.

HEAVY METALS – metallic elements with high atomic weights, i.e., mercury, chromium, cadmium, arsenic, and lead. They can damage the health of plants and animals at low concentrations and tend to accumulate in the food chain.

HOLDING TIME – the maximum times that samples may be held before analysis and still be considered valid or not compromised. The storage time allowed between sample collection and sample analysis when the designated preservation and storage techniques are employed.

HYDROCARBONS – chemical compounds that consist entirely of carbon and hydrogen.

ICP – Inductively coupled plasma is a type of instrument used for metals analysis. Because the temperature of the plasma is considerable higher (10,000^{o}K) than the temperature of a flame atomic absorption spectrophotometer, it is especially useful for refractory metals. Some instruments are also capable of performing simultaneous multielement analysis.

UNCONTROLLED COPY - FOR REFERENCE USE ONLY

ICP-MS - Inductively coupled plasma mass spectrometry (ICP-MS) is a type of mass spectrometry highly sensitive and capable of the determination of a range of metals and several non-metals at concentrations below one part in 10^{12} (part per trillion). It is based on coupling together an inductively coupled plasma as a method of producing ions with a mass spectrometer as a method of separating and detecting the ions. In trace elemental analysis, the method has advantages of high speed, precision and sensitivity.

IGNITABLE – capable of burning or causing a fire.

INORGANIC CHEMICALS – chemical substances of mineral origin, unlike organic chemicals whose structure relies on carbon atoms.

INITIAL CALIBRATION VERIFICATION (ICV) - also referred to as the Independent Calibration Verification for this laboratory. A standard solution used to verify the calibration curve derived from a source independent of the instrument calibration standard. The ICV is use to quantify second source standard variance and bias.

INSTRUMENT CALIBRATION STANDARD - a reference material used to standardize an analytical instrument.

INSTRUMENT DETECTION LIMIT (IDL) - a term utilized in the EPA Inorganic Contract Laboratory Program. The IDL is three times the standard deviation obtained for the analysis of a standard solution (each analyte in reagent water) at a concentration of three to five times that of the IDL on three nonconsecutive days with seven consecutive measurements per day. The IDL is the concentration equivalent to a signal, due to the analyte of interest, which is the smallest signal that can be distinguished from background noise by a particular instrument. The IDL should always be below the method detection limit, and is not used for compliance data reporting, but may be used for statistical data analysis and comparing the attributes of different instruments.

INSTRUMENT PERFORMANCE CHECK - The analyses of one of the ICSs to verified initial and continuing calibration (CCV). The IPC is used to quantify the instrumental testing repeatability variance and bias.

INSTRUMENT TUNING - a technique used in gas chromatography/mass spectrometry procedures to verify that the instrument is properly calibrated to produce reliable mass spectral information. See 4-Bromofluorobenzene under “B”.

INTERNAL STANDARDS - compounds added to every standard, blank, matrix spike, matrix spike duplicate, sample (for volatile organics), and sample extract (for semivolatiles) at a known concentration, prior to analysis. Internal standards are used as the basis for quantification of the target compound.

IONIZATION - Utilized in mass spectrometry to fragment analyte molecules into smaller segments. These smaller mass segments are then separated and plotted to form a “mass spectrum” which is used to identify the parent molecule. Electron impact is one example of ionization used in mass spectrometry. In more technical terms. Ionization is the process by which neutral atoms or groups of atoms become electrically charged, either positively or negatively, by the loss or gain of electrons.

ISOMERS - chemical compounds with the same molecular weight and atomic composition by differing molecular structure, e.g., n-pentane and 2-methylbutane.

LABORATORY CONTROL SAMPLE (LCS) - a clean-matrix reference sample spiked with a standard with an established analyte concentration. The LCS is carried through the entire chemical preparation and testing procedures. The LCS is used to quantify the variance and bias of the chemical preparation and instrumental testing stages without matrix interference. Also called a Laboratory fortified blank (LFB).

LABORATORY CONTROL SAMPLE DUPLICATE (LCSD) – a duplicate of the laboratory control sample in a clean matrix that is carried through the entire chemical preparation and testing procedures.

LABORATORY DUPLICATE SAMPLE (LAB DUPLICATE) - a portion of the collected sample that is carried through the chemical preparation and testing. The laboratory duplicate subsample is used to quantify the variance of the chemical preparation and instrumental testing stages with matrix interferences.

LEACHATE - a liquid that results from water collecting contaminants as it trickles through wastes, agricultural pesticides or fertilizers. Leaching may occur in farming areas, feedlots, and landfills, and may result in hazardous substances entering surface water, groundwater or soil.

LDEQ – Louisiana Department of Environmental Quality

LIBRARY SEARCH - a technique in which an unknown mass spectrum of a compound is compared to the mass spectra of compounds contained in a computer library in an effort to identify the compound. Compounds identified in this manner are referred to as tentatively identified compounds (TICs).

LIMIT OF DETECTION (LOD) – an estimate of the minimum amount of a substance that an analytical process can reliable detect. An LOD is analyte and matrix specific and may be laboratory dependent.

LIMIT OF QUANTIATION (LOQ) – the minimum levels, concentrations, or quantities of a target variable (e.g. target analyte) that can be reported with a specified degree of confidence..

LIMS – laboratory information management system. Horizons is the LIMS used by GCAL.

LINEAR CALIBRATION RANGE – the concentration range over which the instrument response is linear.

LOG-IN - the receipt and initial management of an environmental sample. It generally includes identifying who sent the sample; maintaining chain-of-custody; checking report and invoice information; recording analysis requested, including methodology and special instructions; and assigning a discreet in-lab identification, usually a number or bar code.

MASS SPECTRUM - a plot of ion mass/charge ratio versus intensity. A fragmentation pattern results from the particles whose mass distribution is characteristic of the parent molecule. Qualitative information is provided by a mass spectrum.

MATERIAL SAFETY DATA SHEET (MSDS) - a compilation of information required under the OSHA Communication Standard on the identity of hazardous chemicals and their associated health and physical hazards, exposure limits and precautions.

MATRIX - The physical characteristics or state of a sample – e.g., water, soil, sludge.

MATRIX INTERFERENCE - the influence of the sample matrix or sample components upon the ability of qualitatively identifies and quantitatively measures compounds in environmental samples.

MATRIX MODIFIERS - chemicals added to samples for metals analysis, which are used to lessen the effects of chemical interference, viscosity and surface tension.

MATRIX SPIKE (MS) – aliquot of a sample fortified (spiked) with known quantities of specific compounds and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for the matrix by measuring recovery of the spike. Matrix spiked samples are used to quantify the variance and bias of the chemical preparation and testing stages with matrix interference.

MATRIX SPIKE DUPLICATE (MSD) - a second aliquot of the same matrix as the matrix spike that is spiked to determine the precision of the method.

METHOD DETECTION LIMIT (MDL) - the minimum concentration of compound that can be measured and reported within 99% confidence that the value is above zero and is determined from analysis of a sample in a given matrix containing the analyte.

MUST – denotes a mandatory requirement.

NARRATIVE - in an analytical report, a descriptive documentation of any problems encountered in processing the samples, along with corrective action taken and problem resolution.

NUTRIENT - any substance assimilated by living things that promote growth. The term is generally applied to nitrogen and phosphorus in wastewater, but is also applied to other essential and trace elements.

ORGANIC - generally, any compound that contains carbon bonded to a hydrogen or halogen atom.

OXIDATION - the process in chemistry whereby electrons are removed from a molecule.

PCBs - Polychlorinated biphenyl, a group of toxic persistent chemicals used in transformers and capacitors for insulating purposes and in gas pipeline systems as a lubricant. Sale of PCBs for new uses was banned by law in 1979.

PERCENT RECOVERY - a measure of accuracy that is calculated as the measured value relative to the true value expressed as a percent.

PERFORMANCE AUDIT - a quantitative evaluation of a measurement system that involves the analysis of standard reference samples or materials which are certified as to their chemical composition or physical characteristics.

UNCONTROLLED COPY - FOR REFERENCE USE ONLY

PROFICIENCY TEST (PT) SAMPLE - a sample of known composition (unknown to the laboratory), provided by an external source, which is used to evaluate lab performance. For certification purposes the PT sample is purchased from an approved provider.

pH - a numerical designation of relative acidity and alkalinity. A pH of 7.0 indicates precise neutrality. Progressively higher values indicate increasing alkalinity and lower values increasing acidity.

POLLUTANT - generally, any substance introduced into the environment that adversely affects the usefulness of a resource.

PRACTICAL QUANTITATION LIMIT (PQL) - the lowest level that can be reliable achieved within specified limits of precision and accuracy routine laboratory operating conditions. The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value.

PRECISION - a measure of the ability to reproduce analytical results. It is generally determined through the analysis of duplicate samples. The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range in either absolute or relative terms.

PRESERVATIVE - a chemical or reagent added to a sample to prevent or slow decomposition or degradation of a target analyte or a physical process. Physical and chemical preservation may be used in tandem to prevent sample deterioration.

PURGE AND TRAP - a technique used in the analysis of volatile organic where analytes are purged from a sample by means of an inert gas and trapped on a sorbent column. The sorbent is then flashheated and the analytes are transferred onto a gas chromatographic column for separation and identification.

PURGEABLE ORGANIC - an organic compound that is generally less than 20% soluble in water and has a boiling point at or below 200°C. A volatile organic. An organic compound is generally considered to be purgeable if it can be removed from water using the purging process.

QC BASED NESTED APPROACH - a procedure for estimating the uncertainty of measurement using quality control data. The procedure is described in SOP QA-013.

QUALITY ASSURANCE (QA) - all those planned and systematic actions necessary to provide adequate confidence in laboratory results. An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets the defined standards of quality with a stated level of confidence.

QUALITY ASSURANCE PROGRAM PLAN - a written assembly of management policies, objectives, principle and general procedures that outlines how the laboratory intends to generate data of known and accepted quality.

QUALITY CONTROL (QC) – the overall system of technical activities whose purpose to measure and control the quality of a product or service so that it meets the needs of the users.

UNCONTROLLED COPY - FOR REFERENCE USE ONLY

QUALITY CONTROL CHART - a graph of analytical measurement results for a specific QC standard plotted sequentially with upper and lower control limits (±3SD). A central line that is the best estimate of the average variable plotted, and upper and lower marginal exceedence limits (±4SD) are usually included in the Quality Control Chart. The chart may also include upper and lower warning limits (±2SD).

QUALITY SYSTEM – a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items) and services. The quality system provides the framework for planning, implement and assessing work performed by the organization and for carrying out required QA and QC.

r^2 – Correlation Coefficient Squared – paramet6er used to evaluate the fit of linear or quadratic regression curve fit of initial calibration data.

RAW DATA – any original information from a measurement activity or study recorded in a laboratory note book, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfilm copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments.

REACTIVITY - the tendency of a chemical to explode under normal management conditions, to react violently when mixed with water, or to generate toxic gases.

REAGENT WATER - water in which an interference is not observed at or above the minimum quantitation limit of interest.

REFERENCE MATERIAL - a traceable standard with an established analyte concentration. Material or substance whose property values are sufficiently homogenous, stable and well established to be used for the calibration of an apparatus, the assessment of a measurement method or for assigning values to materials (ISO Guide 30)

REFERENCE METHOD – a method of known and documented accuracy and precision issued by an organization recognized as competent to do so.

RELATIVE RETENTION TIME – a measure of the shift in retention time of an analyte when referenced to an internal standard.

RELATIVE RESPONSE FACTOR (RRF) - a measure of the relative mass spectral response of an analyte compared to its internal standard. RRFs are determined by analysis of standards and are used in the calculation of concentrations of analytes in samples.

REPLICATE ANALYSES - two or more results representing the same sample parameter. Replicate analyses are used to quantify the analytical measurement repeatability precision.

RPD – Relative Percent Difference, a relative difference between two analyses calculated by dividing the absolute difference of those two results by the average of their two values, then multiplying by 100.

UNCONTROLLED COPY - FOR REFERENCE USE ONLY

RESOLUTION - the degree of separation between peaks eluting from a chromatographic column. Sufficient resolution between peaks is required for proper quantitation of unknown analytes.

RETENTION TIME - a term used in gas and liquid chromatography describing the time elapsed from the sample injection until the specific compound elutes or exits the chromatographic column at the detector. Each compound has a characteristics retention time on a specific column; therefore, this information is used to qualitatively identify the compounds in the sample.

SAMPLE – portion of material collect for chemical analysis, identified by a unique number assigned by the LIMS.

SHALL – denotes a requirement that is mandatory whenever the criterion for conformance with the specification requires that there be no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled.

SHOULD – denotes a guideline or recommendation whenever noncompliance with the specification is permissible.

SOLID WASTE – non-liquid, non-soluble materials, ranging from municipal garbage to industrial waste, that contain complex, and sometimes hazardous, substances. Solid wastes include sewage sludge, agricultural refuse, demolition wastes, mining residues, and even liquids and gases in containers.

SOLVENT - a substance, usually liquid, capable of dissolving or dispersing one or more other substances.

SPIKE – a known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

STANDARD CURVE - a curve that plots concentrations of known analyte standards versus the instrument response to the analyte. Calibration standards are prepared by diluting the stock analyte solution in graduated amounts that cover the expected range of the samples being analyzed. The calibration standards must be prepared by using the same type of acid or solvent at the same concentration as for the samples following sample preparation. This is applicable to organic and inorganic chemical analyses.

STANDARD OPERATING PROCEDURE - a detailed written description of how a laboratory executes a particular procedure or method intended to standardize its performance.

STANDARDIZED REFERENCE MATERIAL (SRM) – a certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical method.

STANDARD UNCERTAINTY - the analytical measurement uncertainty expressed as a standard deviation. The relative standard deviation represents the relative standard uncertainty.

SURROGATE - an organic compound similar to the analyte of interest in chemical composition, extraction and chromatography, but not normally found in environmental samples. Primarily used in chromatography techniques, the surrogate is spiked into quality control blanks, calibration and check

UNCONTROLLED COPY - FOR REFERENCE USE ONLY

standards, samples (including duplicated and QC reference samples) and spiked samples before analysis. A percent recovery is calculated for each surrogate.

SUSPENDED SOLIDS - small pollutant particles that float on the surface of, or are suspended in, sewage or other liquids. They resist removal by conventional means.

TARGET COMPOUND - specific compounds that are to be quantified in a sample based on a standard list of potential compounds.

TENTATIVELY IDENTIFIED COMPOUNDS (TICs) - compounds detected in samples that are not target compounds, internal standards, system monitoring compounds or surrogates. TICs usually consist of up to 30 peaks that are greater than 10% of the peak areas, or heights, of the nearest internal standard. They are subjected to mass spectral library searches for tentative identification. A client may specify the number of unknown peaks in its samples it wishes the laboratory to tentatively identify.

TOTAL METALS - metallic elements that have been digested prior to analysis.

TYPE A EVALUATION UNCERTAINTY - the method of evaluation of uncertainty by the statistical analysis of a series of test results.

TYPE B EVALUATION OF UNCERTAINTY - the method of evaluation of uncertainty by means other than statistical analysis.

UNCERTAINTY - the parameter associated with the analytical measurement results that characterizes the dispersion of the values that could be reasonable attributed to the quantity measured.

UNCERTAINTY INTERVAL - the range of analyte concentrations that an analytical measurement could represent at a specified level of confidence. The relative standard deviation is used to represent the relative standard uncertainty in the QC-based Nested Approach.

VALIDATION –the process for evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual specifications. It essentially evaluates performance against predetermined specifications.

VOA - volatile organic analysis

VOA BOTTLE - a vial used to contain samples for volatile organic analysis.

VOLATILE COMPOUNDS - compounds amendable to analysis by purge and trap. Synonymous with purgeable compounds.

VOLATILE ORGANIC COMPOUND (VOC) - any organic compound that participates in atmospheric photochemical reactions, except for those designated by the EPA Administrator as having negligible photochemical reactivity.

WET CHEMISTRY - procedures that involve distillations, colorimetric determinations and titrimetric measurements. Examples are chloride, nitrates, sulfates and biochemical oxygen demand.

UNCONTROLLED COPY - FOR REFERENCE USE ONLY

GULF COAST ANALYTICAL LABS
METALS
STANDARD OPERATING PROCEDURE

PROCEDURE: MET-006
PAGE: 1 OF 6
EFFECTIVE DATE: 05/19/10
APPROVED BY:
QA/QC APPROVED:

SUBJECT — SCOPE AND APPLICATION

These digestion procedures are used for the preparation of aqueous samples, TCLP extracts, EPTOX extracts, soils, solids, and domestic and industrial wastes for mercury analysis.

MATRIX — Water and Solid

REFERENCES — EPA-245.1/245.2
SW846-7470A/7471B

PRESERVATION & HOLDING TIME

Aqueous Samples:
Dissolved Hg - Filtered, HNO_3 to pH <2, 28 days
Total Hg - HNO_3 to pH <2, 28 days

TCLP/EPTOX Hg - 4°C, 28 days from field collection to extraction, 28 days from digestion to analysis

Solid Samples - 4°C, 28days

SAMPLE COLLECTION — Samples may be collected and stored in plastic or glass containers.

DEFINITIONS — See SOP GEN-016

SAFETY — Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards, and all associated protective wear and spill clean-up procedures PRIOR TO the use of any chemical. In all cases, the applicable material safety data sheet (MSDS) and your supervisor or safety officer should be consulted. The bottle labels also provide important information that must be noted. Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. In particular, approved gloves, safety glasses, and lab coats must be worn. In addition to other measures prescribed by the division, solvents and chemicals must be handled in ventilated hoods.

REAGENTS AND STANDARDS

Deionized water - monitored daily
Concentrated Sulfuric Acid (H_2SO_4) - trace metals grade
Concentrated Nitric Acid (HNO_3) - trace metals grade
Concentrated Hydrochloric Acid (HCl)
Aqua Regia: Prepare immediately before use by carefully adding three volumes of concentrated Hydrochloric acid to one volume of Nitric acid.
5% Potassium Permanganate - dissolve 5g of Potassium Permanganate in 100mL of DI water
5% Potassium Persulfate - dissolve 5g of Potassium Persulfate in 100mL of DI water
1 mg/L Hg working standard - prepared by the metals laboratory monthly
0.1 mg/L Mercury working standard - prepared by the metals laboratory daily

APPARATUS

70 mL Digestion tubes
Mechanical pipette - clear, plastic pipette tips, accuracy of 2%
50 mL graduated cylinder
CPI Mod Block - Digestion block
Electronic balance capable of weighing to 0.01g
Teflon boiling beads (or equivalent)

PROCEDURE

Aqueous, TCLP extracts, EPTOX extracts (except organic samples)

1. Prepare a page in the metals preparation sheet. Record sample ID's.
2. Label each digestion tube with sample ID, date, and matrix.
3. Shake sample well and measure 20 mL of homogenized sample in the digestion tube. Prepare all QC samples as listed in the Quality Control Section.
4. Add 1.0 mL of H_2SO_4 and 0.5 mL concentrated HNO_3 mixing after each addition.
5. Add 3 mL of 5% Potassium Permanganate solution. Shake and let stand for 15 minutes to ensure the purple color persists. Add additional Potassium Permanganate solution if necessary and record additional volume on prep log.
6. Add 2 mL Potassium Persulfate solution and heat at 95°C for 2 hours.
7. Perform steps #1-#6 for 20 mL aliquots of a blank (deionized water), 10 µg/L, 5 µg/L, 2 µg/L, 0.5 µg/L, and 0.2 µg/L calibration standards and a 5

µg/L independent calibration verification standard. Calibration standards are prepared using a 0.1 ppm stock solution which is prepared fresh on the day the calibration curve is digested.

The mercury calibration curve is prepared as follows:

	0.2 µg/L	: 40 µL	0.1 ppm calibration standard
	0.5 µg/L	: 100 µL	0.1 ppm calibration standard
	2.0 µg/L	: 400 µL	0.1 ppm calibration standard
	5.0 µg/L	: 1000 µL	0.1 ppm calibration standard
	10.0 µg/L	: 2000 µL	0.1 ppm calibration standard
ICV	5.0 µg/L	: 1000 µL	0.1 ppm independent standard

Dilute these solutions to 20 mL with deionized water.
Multiple aliquots of each standard may be prepared.

8. Release sample to the metals laboratory. Sodium Chloride-hydroxylamine sulfate will be added in the analytical laboratory.

Solids, Soils, Domestic and Industrial Wastes (except organic samples)

1. Prepare a page in the metals preparation sheet. Record sample ID's.
2. Label each digestion tube with sample ID, date and matrix.
3. Homogenize sample by pouring the contents of the sample onto a piece of butcher paper, chop and mix with a tongue depressor or spatula. Remove any foreign object such as sticks, leaves, or rocks. Weigh 0.50g - 0.60g of the homogenized sample and place in the digestion tube. A minimum weight may be required to meet the project required detection limit. Check with the metals supervisor or project manager to determine if a minimum weight is required. Record the weight to the nearest 0.01 g in the prep sheet. Prepare QC samples as listed in the quality control section.
4. Add 5 mL of DI water and add 5 mL of Aqua Regia. Cap digestion tube and use a small knife to cut a slit in the cap.
5. Heat the sample at 95°C for 2 minutes.
6. Cool and add 30 mL DI water and 15 mL 5% Potassium Permanganate solution, mix thoroughly. Add

additional Potassium Permanganate as needed to maintain purple color. Record additional volume added on prep sheet.

7. Digest the sample for 30 minutes at 95°C.
8. Perform steps 4-7 for 30 mL aliquots of blank (deionized water), 10 µg/L, 5 µg/L, 2 µg/L, 0.5 µg/L, and 0.2 µg/L calibration standards and a 5µg/L independent calibration verification standard. Calibration standards are prepared using a 0.1 ppm solution which is prepared fresh on the day the calibration curve is digested.

   The mercury calculation curve is prepared as follows:

	0.2 µg/L	: 60 µL	0.1 ppm calibration standard
	0.5 µg/L	: 150 µL	0.1 ppm calibration standard
	2.0 µg/L	: 600 µL	0.1 ppm calibration standard
	5.0 µg/L	:1500 µL	0.1 ppm calibration standard
	10.0 µg/L	:3000 µL	0.1 ppm calibration standard
ICV	5.0 µg/L	:1500 µL	0.1 ppm independent standard

   Dilute these solutions to 30 mL with deionized water. Multiple aliquots of each standard may be prepared.

9. Release samples to the metals laboratory. Sodium Chloride-hydroxylamine sulfate will be added in the analytical laboratory.

Organic samples including TCLP Liquid extracts and UTS Liquid extracts: The procedure has been modified to more thoroughly digest samples of this matrix type.

1. Prepare a page in the metals preparation sheet. Record sample ID's.
2. Label each digestion tube with sample ID, date, and matrix.
3. Weigh 0.5 - 0.6g (Total Hg), 0.5 mL (TCLP or UTS Hg) of well-mixed sample and place in digestion tube. Record sample weight to the nearest 0.01g in prep sheet. Prepare QC samples as listed in the Quality Control Section.
4. Add 5 mL of concentrated HNO_3 and 5 mL of concentrated HCl. Cap digestion tube and use a small knife to cut a slit in the cap.
5. Heat in the Mod Block until the fumes are clear or unchanging. Additional acid may be added to complete the digestion.

6. Add 30 mL of deionized water.
7. Add 15 mL Potassium Permanganate solution and mix thoroughly.
8. Digest 30 minutes at 95°C.
9. Remove from the digestion block and allow to cool.
10. These will be analyzed using calibration standards prepared by the solid digestion procedure.
11. Release sample to the metals laboratory. Sodium Chloride-hydroxylamine sulfate will be added in the analytical laboratory.

QUALITY CONTROL

1. Batches will be defined by sample matrix:
   Aqueous
   TCLP extracts
   EPTOX extracts
   Soils/Sludges
   Oily wastes
   Client specific batch

2. Prepare a reagent blank with each batch of samples (20 or fewer samples). A method blank using filtered deionized water (liquid TCLP) or the appropriate extraction fluid is used for extracts. Reagent blanks for solids prepare by weighing approximately 0.6 g of Teflon boiling beads. Document the exact weight.

3. Prepare a matrix duplicate for every 20 samples.

4. Prepare a matrix spike (MS) for every 20 samples. A matrix spike duplicate (MSD) will be prepared if required for the project.

   Aqueous/extracts - add 100 µL of the 1 mg/L Hg standard (5 µg/L)

   Non-Aqueous - add 150 µL of the 1 mg/L Hg standard (5 µg/L in solution)

5. Prepare a laboratory control standard (LCS) with every 20 samples. A laboratory control standard duplicate (LCSD) will be prepared if required for the project or if insufficient sample is available for a matrix duplicate or MS/MSD.

   Aqueous/extracts
   Add 100 µL of the 1 mg/L working standard (5

μg/L)

A LCS prepared with filtered deionized water or the appropriate extraction fluid is used for extracts.

Non-aqueous

Weigh approximately 0.6 g of Teflon boiling beads, document exact weight on prep sheet. Add 150 μL of the 1 mg/L working standard (5 μg/L in solution)

6. Record the laboratory ID of the standard and reagents in the prep sheet.

METHOD PERFORMANCE

1) In a single laboratory (SEWL), using distilled water standards at concentrations of 0.5, 1.0, 2.0, 5.0, 10.0 and 20.0 μg Hg/L, the standard deviations were ±0.04, ±0.07, ±0.09, ±0.020, ±0.40 and ±0.84 μg/L, respectively.

2) In a single laboratory (SEWL), using surface water samples spiked with ten organic mercurials at the 10 μg/L level, recoveries ranged from 87 to 117%. Recoveries of the same ten organic mercurials in distilled water at the 10 μg/L level, ranged from 92% to 125%.

3) The following standard deviations on replicate sediment samples were recorded at the indicated levels; 0.29 μg/G ±0.02 and 0.82 μg/G ±0.03. Recovery of mercury at these levels, added as methyl mercuric chloride, was 97% and 94%, respectively.

POLLUTION PREVENTION See QAPP Section 10.2

WASTE MANAGEMENT See SOP GEN-009

STANDARD OPERATING PROCEDURE FOR MERCURY ANALYSIS OF DIGESTATES BY CVAA	REVISION NO. 18

GCAL
METALS
STANDARD OPERATING PROCEDURE

PROCEDURE: MET-008
PAGE: 1 OF 8
EFFECTIVE DATE: 10/26/2012
APPROVED BY:
QA/QC APPROVED:

SUBJECT SCOPE AND APPLICATION

This procedure is used for the determination of dissolved or total mercury in aqueous samples, TCLP extracts, Industrial Hygiene samples, soils, solids, and domestic and industrial waste by the cold vapor atomic absorption technique. A digestion procedure is required for all samples and standards.

A prepared sample enters the system and is mixed with a reducing agent (stannous chloride) to form elemental mercury vapor. The mixture flows into a liquid-gas separator where argon is introduced to carry the Mercury vapor through the PTFE-Membrane Filter for water vapor removal. The dry vapor enters the optical cell. The mercury lamp delivers a stable source of emission at 253.7 nm. Absorbance by the mercury cold vapor is measured using a photocell detector with a wide dynamic range.

MATRIX Water and Solids

REFERENCES
EPA Method 245.2
SW846 Methods 7470A and 7471B
Perkin Elmer FIMS 400 Instrument Manual
Sample digestion is described in GCAL SOP MET-006

PRESERVATION & HOLDING TIME

Aqueous Samples:
Dissolved Hg – Filtered, HNO_3 to pH < 2, 28 days
Total Hg – HNO_3 to pH < 2, 28 days

TCLP/Hg – ≤ 6 ^{0}C, 28 days from field collection to extraction, 28 days from digestion to analysis

Solid Samples – $\leq 6\ ^{0}C$, 28 days

SAMPLE COLLECTION Samples may be collected and stored in plastic or glass containers.

DEFINITIONS See Appendix 1

SAFETY

1. Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards and all associated protective wear and spill clean-up procedures PRIOR TO the use of any chemical. Employees must review the applicable material safety data sheet (MSDS) before using any chemical. The chemical bottle labels provide important information that must be reviewed when handling the chemical.

2. Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. Therefore, exposure to these materials must be reduced to the lowest level possible.

3. Standard clothing (lab coat), eye covering (safety glasses or goggles) and gloves shall be worn when handling samples.

4. Solvents and chemicals should be handled in ventilated hoods.

APPARATUS

De-ionized water polisher, monitored daily

Perkin Elmer FIMS 400 Mercury Analyzer with computer and printer

Perkin Elmer AS 90 auto–sampler

Fias Pump tubing of various sizes

Auto–sampler standard cups and sample tubes

100 mL volumetric flasks

Mechanical pipettes with clear plastic pipette tips, accuracy to 2%, verified daily

INTERFERENCES

1. Interferences from concentrations as high as 20 mg/L sulfide are eliminated by adding potassium permanganate.

2. Copper can interfere at concentrations above 10 mg/L.

3. High chloride concentrations in seawaters, brines, and industrial effluents require additional permanganate. During the oxidation step, free chlorine is formed and absorbs radiation at 253.7 nm.

4. Certain volatile organic materials absorb at 253.7 nm. Additional permanganate may help to reduce the interference. A smaller sample size may be digested.

REAGENTS AND STANDARDS

1. 10% HCl for rinse bath. Expiration date will be 1 month from date prepared or manufacturer's expiration date whichever occurs first.

   Note: Perkin Elmer recommends using HCl for the sample diluent and carrier solution. Perkin Elmer recommended conditions may be found in Appendix 2.

2. Stannous chloride – In a 2 L volumetric flask add 20 g stannous chloride in 5% HCl (trace metal grade) diluted to 2 liter for a 1% solution. Mix well to dissolve the stannous chloride. Prepare fresh daily.

3. Sodium chloride – hydroxylamine sulfate solution: In a 1 L volumetric flask, dissolve 120 g of sodium chloride and 120 g of hydroxylamine sulfate in deionized water and dilute to 1 liter. Expiration date will be 1 month from the date prepared or manufacturer's expiration date whichever occurs first.

4. 3% HCl solution for carrier, expiration date will be 1 month from

date prepared or manufacturer's expiration date whichever occurs first.

Note: This is based on Perkin Elmer recommendations found in Appendix 2.

5. 1000 mg/L stock standard (commercially prepared). The stock standard will be stored according to manufacturer's requirements and the expiration date will be the manufacturer's expiration date.

In house Stock Standards for Metals Prep.

1. 1 mg/L mercury working standard – Add 50 µL of the stock standard to a 50 mL volumetric flask. Dilute to volume with 2% HNO_3. Record this information in the standard preparation logbook. Expiration date will be 2 weeks from the date prepared or manufacturer's expiration date whichever occurs first.

2. Second source stock standard (commercially obtained) is used to prepare a 1 mg/L standard for independent verification of the calibration standard (ICV). Add 50 µL of the stock standard to a 50 mL volumetric flask. Dilute to volume with 2% HNO_3. Expiration date will be 2 weeks from the date prepared or manufacturer's expiration date whichever occurs first.

PROCEDURE

1. Open the FIMS 400 software by double clicking on the AAWINLAB icon. Turn Hg lamp on. Allow the lamp to warm up for at least 30 minutes.

2. Check pump tubing on the motor. Change sample reductant, carrier, and waste tubing daily when in use.

3. Wash and acid rinse the rinse bath and fill with 10% HCl as needed.

4. Place reductant tubing into the container of stannous chloride.

5. Place the carrier tubing into the container of 3% HCl.

6. Change the filter on the liquid gas separator daily when in use.

7. Adjust the argon flow to 80 – 100 psi.

8. Prepare a bench sheet – record the laboratory ID for the calibration standard, the ICV, the stannous chloride, the sodium chloride-hydroxylamine solution, the carrier acid and the Hg acid rinse.

9. Prepare digested standards and samples for analysis by adding sodium chloride–hydroxylamine sulfate solution to reduce the excess permanganate (decolorize). For waters add 4 mL and for solids add 8 mL.

10. Add standards to the standards rack. See auto–sampler layout diagram for positions. Standards and their positions are: (blank) – 1; 0.2 µg/L – 2; 0.5 µg/L – 3; 2.0 µg/L – 4; 5.0 µg/L – 5; 10.0 µg/L – 6.

11. Fill sample tubes with the following quality control samples:

Position	Standard
9	5 µg/L – Independent Source (ICV)
1	0.0 (ICB)
5	CCV
1	CCB

12. Fill sample tubes with samples (2 – 3 inches from top) and place in the position in the rack corresponding to their positions on the bench sheet.

13 To type in sample descriptions for analysis, bring up the sample information file. Type in the sample ID next to the corresponding auto-sampler location, weight, volume, and dilution information. In the remarks field enter instrument Id, analyst and batch number. Auto-sampler positions available for the Perkin Elmer AS-90 are 17 to 106. Save the sample information file, and then close this window.

14. Open the automated analysis window and select the mercury method to be used. Type in the auto–sampler locations to be analyzed and select the result data set to be used.

15. Select the analyze tab at the bottom of the automated analysis window. Click on analyze all to calibrate and then run samples.

SHUT DOWN PROCEDURE

1. Let instrument run for a few minutes after the last sample is completed.

2. Turn off the lamp.

3. Dispose of the standard and sample remaining in the tubing. Pour in the metals waste container.

QUALITY CONTROL

1. The correlation coefficient must be ≥ 0.9995. If the calibration is unacceptable, re-run the standards to verify results. Prepare new calibration standards if necessary. When acceptable results are achieved, accept the calibration.

2. The ICV recovery must be 90–110% .

3. The CCV and CCB will be analyzed at the beginning of the analysis and every 10 samples. For EPA 245.2, the CCV recovery must be 95–105% for the initial check. Every subsequent CCV must have a recovery of 90-110%. For SW-846 methods 7470A and 7471B, the CCV recovery must be 90-110%. For DOD samples the CCV recovery must be 80–120% for methods 7470A and 7471B. If a CCV is outside control limits, the previous ten samples must be re-analyzed. The CCB must be less than ½ the reporting limit and ≥ -2X the reporting limit. In addition CCBs may be reported with a narrative if samples in-solution concentration is greater than 10X the CCB concentration or non-detect. High failures in the CCV may be reported with a narrative if the associated samples do not have a hit.

4. A Laboratory Control Sample (LCS) is prepped with each batch of 20 samples. A Laboratory Control Sample Duplicate (LCSD) is prepped if required for the project or if insufficient sample is available for a duplicate or MS/MSD. The recovery must be 85 – 115% for EPA 245.2 or 80 – 120% for SW–846 methods 7470A and

7471B. The LCS/LCSD RPD criterion is ≤ 20%. If the recovery is outside the control limits, all samples in the batch must be re-digested and re-analyzed. High failures maybe reported with a narrative if the associated samples are non-detect.

5. A matrix duplicate is prepped with every 20 samples. The RPD for duplicates should be ≤ 20% unless the sample concentrations are less than five times the detection limit or the sample matrix is nonhomogeneous.

6. Matrix spike (MS) and matrix spike duplicate (MSD if required for the project) recoveries must be 80 –120% for SW-846 method 7470A and 7471B, and 70-130% for EPA 245.2. For DOD projects, the MS control limits are the same as the LCS control limit for each applicable method. The MS/MSD RPD criterion is ≤ 20%. If the recovery is outside these limits, the data should be flagged. A spike is not applicable if the sample concentration is greater than 4 times the spike level. If a TCLP extract spike recovery for a regulated metal is < 50% and the sample concentration is within 20% of the regulatory level the sample must be re-analyzed by the method of standard additions. Dilutions may be performed to eliminate an interference that may cause unacceptable spike recoveries. If recoveries are improved by the dilution, the original sample must also be diluted. It may also be necessary to re-digest a diluted aliquot of the sample.

7. A method blank (MB) is prepped with each batch of 20 samples. Results must be less than reporting limit. For DOD projects, method blanks must be less than ½ the reporting limit. Failures can be reported with a narrative if the associated samples are non-detect or if the in-solution sample concentration is greater than 10x the method blank concentration. If the method blank is not acceptable, it should be re-run once with affected samples. If it is still unacceptable samples should be re-digested and re-analyzed.

8. If the apparent concentration of a sample is greater than the highest calibration standard, the sample should be diluted and rerun.

9. Dilution Test - Perform a 5X dilution on one sample per batch, generally on the sample used for the MS. For the test to be applicable, the concentration should be greater than 50 times the MDL. For DOD projects, the dilution test is only applicable for sample concentrations 50x LOD. The neat sample concentrations and five times the diluted sample concentration should agree within 10%. If not, a chemical or physical interference should be suspected.

10. Additional project specific criteria may apply to projects and may be more stringent. See SOP GEN-019, and check with the project manager for additional guidance.

11. MDLs will be determined annually. LOD/LOQ checks are preformed quarterly.

MAINTENANCE

1. Change reductant and drain tubing as needed.

2. Replace mercury lamp as needed based on performance checks. If absorbance for the blank corrected signal in the 10 ppb standard falls under 0.2, and working with the sample introduction system does not increase the absorbance; a weak lamp should be suspected, and the lamp replaced.

3. Clean the optical cell and lenses as needed. Relative absorbance of standards may differ significantly from previous calibrations when the cell is dirty.

4. Replace the liquid gas separator every 1–3 years.

5 Record all maintenance in the instrument maintenance logbook.

6. Call Perkin Elmer Service Department for specific troubleshooting guidelines that may require specialized maintenance.

CALCULATIONS

1. For Waters or TCLP extracts:

Sample Concentration in ug/L = instrument reading x d
Sample Concentration in mg/L = A x d
A = ug/L analyte in processed sample/1000
d = dilution factor (if required)

The unit of measure is µg/L – divide by 1000 to convert to mg/L.

2. For Solids:

$$\text{Sample Concentration in mg/kg} = 30 \times \frac{A \times d}{W}$$

A = mg/L analyte in processed sample
W= initial weight of sample (g)
d = dilution factor (if required)
30 = final volume (prep)

The unit of measure is µg/L – divide by 1000 to convert to mg/L.

3. Sample concentration – Industrial Hygiene Samples

Total ug analyte in sample = A x 50 mL x d

A = µg/mL (mg/L) analyte in processed sample
50mL = final volume of sample
d = dilution factor (if required)

4. Matrix spike recovery

$$\text{\% Recovery} = \frac{(SSR - SR)}{SA} \times 100$$

5. Matrix Duplicate Relative Percent Difference (RPD)

$$RPD = \frac{|SR - SDR|}{\frac{(SR+SDR)}{2}} \times 100$$

SR = Sample result
SDR = sample duplicate result

SOFTWARE TROUBLESHOOTING

The Perkin Elmer FIMS 400 Mercury Analyzer utilizes Perkin Elmer software WINLAB32 version 6.0.0.0065 to control the instrument and perform all data calculations. In the event of software malfunction, please contact Perkin Elmer technical support or GCAL's IT Director for troubleshooting help.

REPORTING LIMITS

Waters: 0.0002 mg/L
Solids: 0.01 mg/kg

METHOD PERFORMANCE

Method performance for this laboratory is based on precision and accuracy calculated using LCS and LCSD results.

POLLUTION PREVENTION

See QAPP Section 10.2

WASTE MANAGEMENT

See SOP GEN-009

FORMS

Standard ID form

Metals Standards Prep Logbook

Mercury Instrument Maintenance Logbook

Perkin Elmer Recommended Conditions

Glossary

GCAL

Mercury

BY METHODS EPA 245.2/7470A/7471B

Date: _____ Instrument ID: _____
Analyst: _____ HBN: _____
Batch: _____

Hg CCV Standard _____ Exp. Date _____
Hg ICV Standard _____ Exp. Date _____
Hg Acid Rinse (10% HCl) _____ Exp. Date _____
Carrier Acid (3% HCl) _____ Exp. Date _____
SnCl2 _____ Exp. Date _____
NaCl2/(NH2OH)2 _____ Exp. Date _____
Calibration ID _____
(Date Std. was Prepared)

R Value _____
R ≥ 0.9995

QC Limits:

	GCAL Limits	DOD Limits
ICV (7470A/7471B/245.2)	90-110%	90-110%
CCV (7470A/7471B)	90-110%	90-110%
CCV (1st – 245.2)	95-105%	N/A
Continuing CCV (245.2)	90-110%	N/A
LCS/LCSD (7470A/7471B)	80-120%	80/120%
LCS/LCSD (245.2)	85-115%	N/A
MS/MSD (7470A/7471B)	80-120%	80/120%
MS/MSD (245.2)	70-130%	N/A

Reviewer/Date:_____

Revision 000: 10/24/2012

GCAL

STANDARD PREPARATION LOGBOOK

STANDARD NAME	STD#	STOCK STD	SUPPLIER	LOT# EXP DATE	WT/VOL g/ml	FINAL VOL(mL)	FINAL CONC	SOLVENT/ LOT#	INITIAL	DATE PREP	EXP DATE	VERIFIED

Revision 002: 10/24/2012

1

GCAL

Department:	Metals		
Instrument:	Mercury Analyzer	Date of Receipt:	01/97
Serial Number:	4515	Model Number:	FIMS 400
Service Name:	Perkin Elmer	Telephone Number:	1-800-762-4002

Date	Description of Maintenance/Service	Initials

Rev 001: 10/11/2012

APPENDIX 1

GLOSSARY

ACCEPTANCE LIMITS – data quality limits specified by the test method or generated by the laboratory. Specified limits placed on an item, process, or service defined in the requirement document.

ACCURACY – a measure of how close a measured value is to a known true value. Accuracy is assessed by means of reference samples and percent recoveries of spiked samples. The degree of agreement between an observed value and an accepted reference value. Accuracy includes combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator.

ALIQUOT – a discrete, measure, or representative portion of a sample taken for analysis.

ANALYTE – the chemical element or compound an analyst seeks to determine; the chemical element of interest.

ANALYTICAL BATCH – the basic unit for analytical quality control, defined as samples that are analyzed together with the same method sequence and the same lots of reagents and with the manipulations common to each sample within the same time period or in continuous sequential time periods. Samples in each batch should be of similar composition (e.g., groundwater, sludge, ash).

ANALYTICAL SAMPLE – any solution or media introduced into an instrument on which an analysis is performed, excluding instrument calibration, initial calibration verification, initial calibration blank, continuing calibration verification, and continuing calibration blank. The following are all analytical samples: undiluted and diluted samples (EPA and non-EPA), predigestion spike samples, duplicate samples, serial dilution samples, analytical spike samples, post digestion spike samples, interference check samples (ICS), CRDL standard for AA(CRA), CRDL standard for ICP(CRI), laboratory control sample(LCS), preparation blank(PB), and linear range analysis sample(LRS).

ANALYST – the designated individual who performs the “hands on” analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

AREA UNITS – a term used in gas chromatography that indicates the peak area of a compound exiting a chromatographic column. The size or area of the peak is proportional to the amount of analyte in the sample.

ATOMIC ABSORPTION (AA) – a technique for analyzing metal using an element-specific lamp that emits a characteristic light spectrum. A sample is heated in a flame or graphite furnace and the light

beam is passed through it. When the sample absorbs light, an energy loss is detected and is translated into a concentration of metal in the sample. This technique detects one metal at a time.

AUDIT – a systematic check to determine the quality of some function or activity. Two basic types are performance audits and system audits. Perform audits involve a quantitative comparison of the laboratory's results to those of a proficiency sample containing known concentration of analytes. A system audit is a qualitative evaluation that normally consists of an onsite review of a lab's quality assurance system and physical facilities.

BACKGROUND CORRECTION – a technique usually employed relative to metals analysis, which compensates for variable background contribution to the instrument signal in the determination of trace elements.

BATCH – environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A batch is composed of a maximum of twenty environmental samples. A preparation batch is composed of environmental sample of the same matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) and/or those samples not requiring preparation, which are analyzed together as a group using the same calibration curve or factor. An analytical batch can include samples originating from various environmental matrices.

BIAS – the deviation of the mean of replicate analytical measurements from a reference analyte concentration. Relative bias is represented by analytical measurement mean minus the reference analyte concentration and the difference divided by the reference analyte concentration. See accuracy and precision.

4-BROMO-FLUOROBENZENE (BFB) – the compound used to check the tuning of the instrument, and is used as a surrogate compound spiked into every sample for volatile analysis. A compound utilized in EPA gas chromatography/mass spectrometry (GC/MS) volatile methods to establish mass spectral instrument performance.

BIOCHEMICAL OXYGEN DEMAND (BOD) – A measure of the amount of oxygen consumed in the biochemical processes that break down organic matter in water. A larger BOD value indicates a greater degree of organic pollution. A related term, BOD5, is the amount of dissolved oxygen consumed in five days.

BIOSEED – the bacterial culture used to inoculate a sample for testing.

BLANK – an artificial sample designed to monitor the introduction of artifacts into the measurement process. For aqueous samples, reagent water is used as a blank matrix. There are several types of

blanks, which monitor a variety of processes: 1.)*laboratory blank* is taken through sample preparation and analysis only. It is a test for contamination in sample preparation and analyses. 2.)*storage blank* is stored and analyzed with samples at the laboratory. It is a test for contamination in sample storage as well as sample preparation and analysis. 3.)*trip blank* is shipped to and from the field with the sample containers. It is not opened in the field and, therefore, provides a test for contamination from sample preservation, site conditions, and transport as well as sample storage, preparation, and analysis. It is most commonly used for volatile organics. 4.)*field blank* is opened in the field and tests for contamination from the atmosphere as well as those activities listed under the trip blank.

BNA – base, neutral and acid extractable compounds. The term base, neutral and acid refer to the pH condition of the sample undergoing extraction. Certain compounds extract more efficiently from water under acidic conditions. Such compounds are often referred to as "acid extractables."

CALIBRATE – to determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter or other device, or the correct value for each setting of a control knob. The levels of the applied calibration standard should bracket the range of planned or expect sample measurements.

CALIBRATION – The systematic determination of the relationship of the response of the measurement system to the concentration of the analyte of interest. Instrument calibration performed before any samples are analyzed is called the initial calibration. Subsequent checks on the instrument calibration performed throughout analysis are called continuing calibration verification.

CALIBRATION BLANK (CB) – a volume of reagent water in the same matrix as the calibration standards but without the analyte.

CALIBRATION CURVE – the graphical relationship between the known values, such as concentrations, of a series of calibration standards and their analytical response.

CALIBRATION METHOD – a defined technical procedure for performing a calibration.

CALIBRATION STANDARD – a certified material used to calibrate an instrument.

CERTIFIED REFERENCE MATERIAL (CRM) – reference material, one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body. (ISO Guide 30)

CONTINUING CALIBRATION VERIFICATION (CCV) – used to evaluate the performance of the instrument system with respect to a defined set of method criteria. The CCVs are used to verify instrument performance during analysis. The CCV shall be prepared from the same stock standard solution used to prepare the calibration curve.

CHAIN-OF-CUSTODY–Procedures and associated documents designed to trace the custody of a sample from the point of origin to final disposition, with the intent of legally demonstrating that custody remained intact and the tampering or substitutions were precluded.

CHEMICAL OXYGEN DEMAND (COD) – A measure of the oxygen required to oxidize all compounds in water, both organic and inorganic.

COMBINED STANDARD UNCERTAINTY – The standard uncertainty of the analytical measurement result that is the sum in quadrature (square-root-of-the-sum-of-the-squares) of the component standard uncertainties.

CORRECTIVE ACTION – the action taken to eliminate the causes of an existing non-conformity, defect, or other undesirable situation to prevent reoccurrence.

COVERAGE FACTOR – the numerical factor used as a multiplier of the combined standard uncertainty to expand the uncertainty corresponding to a specific level of confidence. The Student's *t*-distribution is used for determining the coverage factor.

DEMONSTRATION OF CAPABILITY (DOC) – a procedure used to establish the ability of the analyst to generate acceptable accuracy.

DEIONIZED WATER (DI) – water from which the majority of ions have been removed. Water that is contaminant free and used in the laboratory, the resistivity should be ≤ 18 mega ohms.

DISSOLVED METALS –- metallic elements determined on a water sample that has been passed through a 0.45-um filter.

DISSOLVED OXYGEN (DO) – the oxygen freely available in water, an indicator of water quality.

DISSOLVED SOLIDS – disintegrated organic and inorganic material contained in water. Excessive amounts make water unfit to drink or use in industrial processes.

DRY WEIGHT – the weight of a sample based on percent solids. The weight of a sample after drying in an oven at a specified temperature.

DUPLICATE MEASUREMENT – a duplicate measurement is a second measurement made on the same or identical sample of material to assist in the evaluation of measurement of variance.

DUPLICATE SAMPLE – two samples taken from the same population and carried through certain stages of sampling and testing. Duplicate sample include field co-located duplicate samples, field-split duplicate samples, and laboratory duplicate subsamples.

EXPANDED UNCERTAINTY – the quantity defining an interval enveloping the analytical measurement that captures a large fraction of the distribution of analyte concentrations that could be attributable to the quantity measured. The combined standard uncertainty is multiplied by the coverage factor to calculate the expanded uncertainty.

EXTERNAL STANDARDS – a method of quantifying chromatographic data in which standards of known concentration are analyzed prior to unknown samples. The chromatographic peak area (or height) of a sample component is compared to a calibration curve of a peak area constructed from the standard data for that component. This comparison allows the concentration of the component in the sample to be determined.

FECAL COLIFORM BACTERIA – bacteria found in mammals' intestinal tracts. Their presence in water or sludge is an indicator of pollution and possible contamination by pathogens.

FLAME IONIZATION DETECTOR (FID) – a gas chromatography detector in which the column effluent gas is mixed with hydrogen and burned in air or oxygen. The ions and electrons produced in the flame generate an electric current proportional to the amount of materials in the detector. The FID responds to nearly all organic compounds, but it does not respond to air and water, which makes it exceptionally suited to environmental analysis.

FLASHPOINT – the lowest temperature at which a flammable liquid gives off sufficient vapor to form an ignitable mixture with air near its surface or within a vessel. Combustion does not continue.

GAS CHROMATOGRAPHY (GC) – a technique for detecting organic compounds by using their physical and chemical properties to separate a mixture. The compounds are identified and quantified with various types of detectors as they exit the chromatograph. Selection of detectors is dependent on the particular compounds of interest.

GAS CHROMATOGRAPHY MASS SPECTROMETRY (GCMS) – a technique in which sample analytes are bombarded with electrons as they exit a gas chromatography column and are fragmented into characteristics ion patterns. The mass spectrometer is the detector. It can determine which fragments are present and therefore the identity of the compounds.

GLUCOSE GLUTAMIC ACID (GGA) – used as a laboratory control standard in BOD procedures.

GRAPHITE FURNACE – a technique used for the analysis of metals. An atomic absorption spectrophotometer heats the sample within a graphite tube using an electrical current. It is also

commonly called a flameless furnace and generally provides greater sensitivity for certain metals than flame or inductively coupled argon plasma techniques.

GRAVIMETRIC - analyses based on the direct or indirect weighing of the analyte in question. This technique usually requires the use of an analytical balance with a sensitivity of 0.1 mg or better.

HALL ELECTROLYTIC CONDUCTIVITY DETECTOR – an element-selective gas chromatography detector primarily intended for trace analysis of organic compounds containing chlorine, nitrogen or sulfur. In operation, this detector pyrolyzes the column effluent gas into soluble electrolytes that are dissolved in a stream of deionized liquid. The observed change in electrical conductivity, proportional to the amount of material present, is measured.

HAZARDOUS WASTE – waste regulated under RCRA that can pose a substantial or potential hazard to human health or the environment when improperly managed. Such wastes possess at least one of four characteristics (ignitability, corrosivity, reactivity, or toxicity) or appear on special EPA hazardous waste lists. The term is not interchangeable with hazardous substances or material.

HEADSPACE - Any area in a container not completely filled by the sample in which gases can collect.

HEAVY METALS – metallic elements with high atomic weights, i.e., mercury, chromium, cadmium, arsenic, and lead. They can damage the health of plants and animals at low concentrations and tend to accumulate in the food chain.

HOLDING TIME – the maximum times that samples may be held before analysis and still be considered valid or not compromised. The storage time allowed between sample collection and sample analysis when the designated preservation and storage techniques are employed.

HYDROCARBONS – chemical compounds that consist entirely of carbon and hydrogen.

ICP – Inductively coupled plasma is a type of instrument used for metals analysis. Because the temperature of the plasma is considerable higher (10,000^{o}K) than the temperature of a flame atomic absorption spectrophotometer, it is especially useful for refractory metals. Some instruments are also capable of performing simultaneous multielement analysis.

ICP-MS - Inductively coupled plasma mass spectrometry (ICP-MS) is a type of mass spectrometry highly sensitive and capable of the determination of a range of metals and several non-metals at concentrations below one part in 10^{12} (part per trillion). It is based on coupling together an inductively coupled plasma as a method of producing ions with a mass spectrometer as a method of separating and detecting the ions. In trace elemental analysis, the method has advantages of high speed, precision and sensitivity.

IGNITABLE – capable of burning or causing a fire.

INORGANIC CHEMICALS – chemical substances of mineral origin, unlike organic chemicals whose structure relies on carbon atoms.

INITIAL CALIBRATION VERIFICATION (ICV) - also referred to as the Independent Calibration Verification for this laboratory. A standard solution used to verify the calibration curve derived from a source independent of the instrument calibration standard. The ICV is use to quantify second source standard variance and bias.

INSTRUMENT CALIBRATION STANDARD - a reference material used to standardize an analytical instrument.

INSTRUMENT DETECTION LIMIT (IDL) - a term utilized in the EPA Inorganic Contract Laboratory Program. The IDL is three times the standard deviation obtained for the analysis of a standard solution (each analyte in reagent water) at a concentration of three to five times that of the IDL on three nonconsecutive days with seven consecutive measurements per day. The IDL is the concentration equivalent to a signal, due to the analyte of interest, which is the smallest signal that can be distinguished from background noise by a particular instrument. The IDL should always be below the method detection limit, and is not used for compliance data reporting, but may be used for statistical data analysis and comparing the attributes of different instruments.

INSTRUMENT PERFORMANCE CHECK - The analyses of one of the ICSs to verified initial and continuing calibration (CCV). The IPC is used to quantify the instrumental testing repeatability variance and bias.

INSTRUMENT TUNING - a technique used in gas chromatography/mass spectrometry procedures to verify that the instrument is properly calibrated to produce reliable mass spectral information. See 4-Bromofluorobenzene under “B”.

INTERNAL STANDARDS - compounds added to every standard, blank, matrix spike, matrix spike duplicate, sample (for volatile organics), and sample extract (for semivolatiles) at a known concentration, prior to analysis. Internal standards are used as the basis for quantification of the target compound.

IONIZATION - Utilized in mass spectrometry to fragment analyte molecules into smaller segments. These smaller mass segments are then separated and plotted to form a “mass spectrum” which is used to identify the parent molecule. Electron impact is one example of ionization used in mass spectrometry. In more technical terms. Ionization is the process by which neutral atoms or groups of atoms become electrically charged, either positively or negatively, by the loss or gain of electrons.

ISOMERS - chemical compounds with the same molecular weight and atomic composition by differing molecular structure, e.g., n-pentane and 2-methylbutane.

LABORATORY CONTROL SAMPLE (LCS) - a clean-matrix reference sample spiked with a standard with an established analyte concentration. The LCS is carried through the entire chemical preparation and testing procedures. The LCS is used to quantify the variance and bias of the chemical preparation and instrumental testing stages without matrix interference. Also called a Laboratory fortified blank (LFB).

LABORATORY CONTROL SAMPLE DUPLICATE (LCSD) – a duplicate of the laboratory control sample in a clean matrix that is carried through the entire chemical preparation and testing procedures.

LABORATORY DUPLICATE SAMPLE (LAB DUPLICATE) - a portion of the collected sample that is carried through the chemical preparation and testing. The laboratory duplicate subsample is used to quantify the variance of the chemical preparation and instrumental testing stages with matrix interferences.

LEACHATE - a liquid that results from water collecting contaminants as it trickles through wastes, agricultural pesticides or fertilizers. Leaching may occur in farming areas, feedlots, and landfills, and may result in hazardous substances entering surface water, groundwater or soil.

LDEQ – Louisiana Department of Environmental Quality

LIBRARY SEARCH - a technique in which an unknown mass spectrum of a compound is compared to the mass spectra of compounds contained in a computer library in an effort to identify the compound. Compounds identified in this manner are referred to as tentatively identified compounds (TICs).

LIMIT OF DETECTION (LOD) – an estimate of the minimum amount of a substance that an analytical process can reliable detect. An LOD is analyte and matrix specific and may be laboratory dependent.

LIMIT OF QUANTIATION (LOQ) – the minimum levels, concentrations, or quantities of a target variable (e.g. target analyte) that can be reported with a specified degree of confidence..

LIMS – laboratory information management system. Horizons is the LIMS used by GCAL.

LINEAR CALIBRATION RANGE – the concentration range over which the instrument response is linear.

LOG-IN - the receipt and initial management of an environmental sample. It generally includes identifying who sent the sample; maintaining chain-of-custody; checking report and invoice

information; recording analysis requested, including methodology and special instructions; and assigning a discreet in-lab identification, usually a number or bar code.

MASS SPECTRUM - a plot of ion mass/charge ratio versus intensity. A fragmentation pattern results from the particles whose mass distribution is characteristic of the parent molecule. Qualitative information is provided by a mass spectrum.

MATERIAL SAFETY DATA SHEET (MSDS) - a compilation of information required under the OSHA Communication Standard on the identity of hazardous chemicals and their associated health and physical hazards, exposure limits and precautions.

MATRIX - The physical characteristics or state of a sample – e.g., water, soil, sludge.

MATRIX INTERFERENCE - the influence of the sample matrix or sample components upon the ability of qualitatively identifies and quantitatively measures compounds in environmental samples.

MATRIX MODIFIERS - chemicals added to samples for metals analysis, which are used to lessen the effects of chemical interference, viscosity and surface tension.

MATRIX SPIKE (MS) – aliquot of a sample fortified (spiked) with known quantities of specific compounds and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for the matrix by measuring recovery of the spike. Matrix spiked samples are used to quantify the variance and bias of the chemical preparation and testing stages with matrix interference.

MATRIX SPIKE DUPLICATE (MSD) - a second aliquot of the same matrix as the matrix spike that is spiked to determine the precision of the method.

METHOD DETECTION LIMIT (MDL) - the minimum concentration of compound that can be measured and reported within 99% confidence that the value is above zero and is determined from analysis of a sample in a given matrix containing the analyte.

MUST – denotes a mandatory requirement.

NARRATIVE - in an analytical report, a descriptive documentation of any problems encountered in processing the samples, along with corrective action taken and problem resolution.

NUTRIENT - any substance assimilated by living things that promote growth. The term is generally applied to nitrogen and phosphorus in wastewater, but is also applied to other essential and trace elements.

ORGANIC - generally, any compound that contains carbon bonded to a hydrogen or halogen atom.

OXIDATION - the process in chemistry whereby electrons are removed from a molecule.

PCBs - Polychlorinated biphenyl, a group of toxic persistent chemicals used in transformers and capacitors for insulating purposes and in gas pipeline systems as a lubricant. Sale of PCBs for new uses was banned by law in 1979.

PERCENT RECOVERY - a measure of accuracy that is calculated as the measured value relative to the true value expressed as a percent.

PERFORMANCE AUDIT - a quantitative evaluation of a measurement system that involves the analysis of standard reference samples or materials which are certified as to their chemical composition or physical characteristics.

PROFICIENCY TEST (PT) SAMPLE - a sample of known composition (unknown to the laboratory), provided by an external source, which is used to evaluate lab performance. For certification purposes the PT sample is purchased from an approved provider.

pH - a numerical designation of relative acidity and alkalinity. A pH of 7.0 indicates precise neutrality. Progressively higher values indicate increasing alkalinity and lower values increasing acidity.

POLLUTANT - generally, any substance introduced into the environment that adversely affects the usefulness of a resource.

PRACTICAL QUANTITATION LIMIT (PQL) - the lowest level that can be reliable achieved within specified limits of precision and accuracy routine laboratory operating conditions. The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value.

PRECISION - a measure of the ability to reproduce analytical results. It is generally determined through the analysis of duplicate samples. The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range in either absolute or relative terms.

PRESERVATIVE - a chemical or reagent added to a sample to prevent or slow decomposition or degradation of a target analyte or a physical process. Physical and chemical preservation may be used in tandem to prevent sample deterioration.

PURGE AND TRAP - a technique used in the analysis of volatile organic where analytes are purged from a sample by means of an inert gas and trapped on a sorbent column. The sorbent is then

flashheated and the analytes are transferred onto a gas chromatographic column for separation and identification.

PURGEABLE ORGANIC - an organic compound that is generally less than 20% soluble in water and has a boiling point at or below 200°C. A volatile organic. An organic compound is generally considered to be purgeable if it can be removed from water using the purging process.

QC BASED NESTED APPROACH - a procedure for estimating the uncertainty of measurement using quality control data. The procedure is described in SOP QA-013.

QUALITY ASSURANCE (QA) - all those planned and systematic actions necessary to provide adequate confidence in laboratory results. An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets the defined standards of quality with a stated level of confidence.

QUALITY ASSURANCE PROGRAM PLAN - a written assembly of management policies, objectives, principle and general procedures that outlines how the laboratory intends to generate data of known and accepted quality.

QUALITY CONTROL (QC) – the overall system of technical activities whose purpose to measure and control the quality of a product or service so that it meets the needs of the users.

QUALITY CONTROL CHART - a graph of analytical measurement results for a specific QC standard plotted sequentially with upper and lower control limits (±3SD). A central line that is the best estimate of the average variable plotted, and upper and lower marginal exceedence limits (±4SD) are usually included in the Quality Control Chart. The chart may also include upper and lower warning limits (±2SD).

QUALITY SYSTEM – a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items) and services. The quality system provides the framework for planning, implement and assessing work performed by the organization and for carrying out required QA and QC.

r^2 – Correlation Coefficient Squared – paramet6er used to evaluate the fit of linear or quadratic regression curve fit of initial calibration data.

RAW DATA – any original information from a measurement activity or study recorded in a laboratory note book, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography,

microfilm or microfilm copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments.

REACTIVITY - the tendency of a chemical to explode under normal management conditions, to react violently when mixed with water, or to generate toxic gases.

REAGENT WATER - water in which an interference is not observed at or above the minimum quantitation limit of interest.

REFERENCE MATERIAL - a traceable standard with an established analyte concentration. Material or substance whose property values are sufficiently homogenous, stable and well established to be used for the calibration of an apparatus, the assessment of a measurement method or for assigning values to materials (ISO Guide 30)

REFERENCE METHOD – a method of known and documented accuracy and precision issued by an organization recognized as competent to do so.

RELATIVE RETENTION TIME – a measure of the shift in retention time of an analyte when referenced to an internal standard.

RELATIVE RESPONSE FACTOR (RRF) - a measure of the relative mass spectral response of an analyte compared to its internal standard. RRFs are determined by analysis of standards and are used in the calculation of concentrations of analytes in samples.

REPLICATE ANALYSES - two or more results representing the same sample parameter. Replicate analyses are used to quantify the analytical measurement repeatability precision.

RPD – Relative Percent Difference, a relative difference between two analyses calculated by dividing the absolute difference of those two results by the average of their two values, then multiplying by 100.

RESOLUTION - the degree of separation between peaks eluting from a chromatographic column. Sufficient resolution between peaks is required for proper quantitation of unknown analytes.

RETENTION TIME - a term used in gas and liquid chromatography describing the time elapsed from the sample injection until the specific compound elutes or exits the chromatographic column at the detector. Each compound has a characteristics retention time on a specific column; therefore, this information is used to qualitatively identify the compounds in the sample.

SAMPLE – portion of material collect for chemical analysis, identified by a unique number assigned by the LIMS.

SHALL – denotes a requirement that is mandatory whenever the criterion for conformance with the specification requires that there be no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled.

SHOULD – denotes a guideline or recommendation whenever noncompliance with the specification is permissible.

SOLID WASTE – non-liquid, non-soluble materials, ranging from municipal garbage to industrial waste, that contain complex, and sometimes hazardous, substances. Solid wastes include sewage sludge, agricultural refuse, demolition wastes, mining residues, and even liquids and gases in containers.

SOLVENT - a substance, usually liquid, capable of dissolving or dispersing one or more other substances.

SPIKE – a known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

STANDARD CURVE - a curve that plots concentrations of known analyte standards versus the instrument response to the analyte. Calibration standards are prepared by diluting the stock analyte solution in graduated amounts that cover the expected range of the samples being analyzed. The calibration standards must be prepared by using the same type of acid or solvent at the same concentration as for the samples following sample preparation. This is applicable to organic and inorganic chemical analyses.

STANDARD OPERATING PROCEDURE - a detailed written description of how a laboratory executes a particular procedure or method intended to standardize its performance.

STANDARDIZED REFERENCE MATERIAL (SRM) – a certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical method.

STANDARD UNCERTAINTY - the analytical measurement uncertainty expressed as a standard deviation. The relative standard deviation represents the relative standard uncertainty.

SURROGATE - an organic compound similar to the analyte of interest in chemical composition, extraction and chromatography, but not normally found in environmental samples. Primarily used in chromatography techniques, the surrogate is spiked into quality control blanks, calibration and check standards, samples (including duplicated and QC reference samples) and spiked samples before analysis. A percent recovery is calculated for each surrogate.

SUSPENDED SOLIDS - small pollutant particles that float on the surface of, or are suspended in, sewage or other liquids. They resist removal by conventional means.

TARGET COMPOUND - specific compounds that are to be quantified in a sample based on a standard list of potential compounds.

TENTATIVELY IDENTIFIED COMPOUNDS (TICs) - compounds detected in samples that are not target compounds, internal standards, system monitoring compounds or surrogates. TICs usually consist of up to 30 peaks that are greater than 10% of the peak areas, or heights, of the nearest internal standard. They are subjected to mass spectral library searches for tentative identification. A client may specify the number of unknown peaks in its samples it wishes the laboratory to tentatively identify.

TOTAL METALS - metallic elements that have been digested prior to analysis.

TYPE A EVALUATION UNCERTAINTY - the method of evaluation of uncertainty by the statistical analysis of a series of test results.

TYPE B EVALUATION OF UNCERTAINTY - the method of evaluation of uncertainty by means other than statistical analysis.

UNCERTAINTY - the parameter associated with the analytical measurement results that characterizes the dispersion of the values that could be reasonable attributed to the quantity measured.

UNCERTAINTY INTERVAL - the range of analyte concentrations that an analytical measurement could represent at a specified level of confidence. The relative standard deviation is used to represent the relative standard uncertainty in the QC-based Nested Approach.

VALIDATION –the process for evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual specifications. It essentially evaluates performance against predetermined specifications.

VOA - volatile organic analysis

VOA BOTTLE - a vial used to contain samples for volatile organic analysis.

VOLATILE COMPOUNDS - compounds amendable to analysis by purge and trap. Synonymous with purgeable compounds.

VOLATILE ORGANIC COMPOUND (VOC) - any organic compound that participates in atmospheric photochemical reactions, except for those designated by the EPA Administrator as having negligible photochemical reactivity.

WET CHEMISTRY - procedures that involve distillations, colorimetric determinations and titrimetric measurements. Examples are chloride, nitrates, sulfates and biochemical oxygen demand.

GULF COAST ANALYTICAL LABORATORIES, INC
METALS
STANDARD OPERATING PROCEDURE

PROCEDURE: MET-021
PAGE: 1 of 14
EFFECTIVE DATE: 08/24/2012
APPROVED BY:
QA/QC APPROVED:

SUBJECT — SCOPE AND APPLICATION

This method covers the operation of the Agilent 7700 ICP-MS for analysis of low-level concentrations of metals in water samples, waste extracts, or digests. The procedure is applicable for the analysis of aqueous samples, soils, solids, and domestic or industrial wastes for Total metals, after preparation by the appropriate EPA or SW846, procedure. Dissolved metals, filtered and acid preserved prior to analysis may be analyzed without digestion. Elements currently analyzed using these methods are listed in Table I.

MATRIX — Water and Solid

REFERENCES — EPA 200.8 - Determination of Trace Elements in Waters and Wastes by Inductively Coupled Plasma - Mass Spectrometry, Revision 5.4 (EMMC Version)

SW846 6020A
Agilent Instrument Manuals
Software Guide

SAMPLE COLLECTION — Samples may be collected and stored in plastic or glass containers.

HOLDING TIME & PRESERVATION

Dissolved Metals (waters) – Filtered through a 0.45 um membrane filter then HNO_3 to pH < 2; for 200.8 adjust the pH to less than 2 with HNO_3 then hold for a minimum of 16 hours.

Total Metals (waters) - HNO_3 to pH < 2; for 200.8 adjust the pH to less than 2 with HNO_3 then hold for a minimum of 16 hours. Digestion required (SOP MET-005)–6 months;

Total Metals (solids) – Cool 4°C; Digestion required (SOP MET-004, MET-018)–6 months

DEFINITIONS — See SOP GEN-016

SAFETY — Each employee is directly responsible for complete awareness of all health hazards associated with every

chemical that he/she uses. The employee must be aware of these hazards and all associated protective wear and spill clean-up procedures PRIOR TO the use of any chemical. In all cases, the applicable material safety data sheet (MSDS) and your supervisor or safety officer should be consulted. The bottle labels also provide important information that must be noted. Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. In particular, approved gloves, safety glasses, and lab coats must be worn. In addition to other measures prescribed by the division, solvents must be handled in ventilated hoods.

INTERFERENCES

Several interferences are possible. These include:

1. Isobaric elemental interference caused by isotopes of different elements which form singly or doubly charged ions of the same nominal mass-to-charge ratio and cannot be resolved or corrected for by the mass spectrometer in use. These interferences are addressed by the instrument operating conditions, correction equations, and careful selection and monitoring of mass-to-charge ratios. In general, all direct isobaric interferences are avoided by choosing an interference-free isotope. In some cases this may result in a loss in sensitivity.
2. Physical Interferences are generally considered to be effects associated with the sample nebulization and transport processes. Properties such as change in viscosity and surface tension can cause significant inaccuracies especially in samples that may contain high dissolved solids or acid concentrations. If these types of interferences are present, they must be reduced by diluting the sample. Dissolved solids greater than 0.2% w/v causes interferences and clogging of the pump. Internal standards are used to identify this type of interference.
3. Isobaric polyatomic ion interferences are caused by ions consisting of more than one atom with the same nominal charge-to-mass ratio of the ions of interest. Proper tuning of the plasma and torch conditions to reduce the formation of oxides reduces this interference. In addition the use of a collision cell reduces or eliminates this interference in most matrices.
4. Signals from relatively abundant isotopes can coalesce at the wings of relatively less abundant isotopes leading to loss of resolution and poor quantitation.
5. Memory interferences of isotopes from previous sample runs.

APPARATUS

Agilent 7700 ICP-MS
Agilent ASX-500 Autosampler
Edwards Vacuum Pump Model E2M18
Peristaltic pump and tubing
Autosampler tubes
Mechanical pipets and pipet tips
Volumetric Flasks - Class A
Graduated centrifuge tubes
Eppendorfs
Argon and Helium supply with pressure controls
Compressed air

REAGENTS AND STANDARDS

1. Deionized water - monitored each day of use for resistivity. Must be 10MΩ-cm or greater.

2. Concentrated Nitric acid - Trace metals grade, label with date opened and enter into reagent logbook

3. Concentrated hydrochloric acid – Trace metals grade, label with date opened and enter into reagent logbook

4. 5% Nitric Acid/2% Hydrochloric Acid - prepared from the Trace metals grade concentrate

5. 2% Nitric Acid/0.5% Hydrochloric Acid – Calibration Blank

6. Stock standard metals solutions (1000 mg/L) - commercially prepared, label with date opened.

7. Custom mixed standards – commercially prepared, label with date opened.

8. Calibration standards: A custom made solution for calibrations standards is used. See Table I for the elements included and concentration. Prepare all standards in the 2% Nitric Acid/0.5% Hydrochloric Acid.

9. Continuing Calibration Verification (CCV) standard – is prepared using the calibration standard. The CCV includes equal aliquots of the calibration standard and 2% Nitric Acid/0.5% Hydrochloric Acid.

10. Second Source Stock Standards – Two, multi-element custom solutions-commercially prepared.

11. Initial Calibration Verification (ICV) standard and QCS

standard - Dilute the appropriate amount of the second source multi-element stock solution to volume with 2% Nitric Acid/0.5% Hydrochloric Acid. The concentration of the elements in the stock solutions vary in concentration, therefore the analyst should prepare this solution such that the majority of the elements are in the middle of the calibration range. This solution must be prepared at least quarterly or more frequently if precipitation is noted. Trace metals must be spiked at ≤ 100ug/L. The QCS is prepped in the same manner of samples and is used for the demonstration of capability.

12. Interference solution stock standards - available commercially.

13. Interferent Calibration Solution A (ICSA) - Pipet 50uL of the interferent stock Agilent ICS-A into a 50mL graduated centrifuge tube and dilute to volume with 2% Nitric Acid/0.5% Hydrochloric Acid. Final concentrations are: Ca-3000ug/L, Fe and Na-2500ug/L, Mg, Al, and K-1000ug/L, and Ti and Mo-20ug/L.

14. Interferent Calibration Solution B (ICSAB) - Pipet 50uL of the interferent stock Agilent ICS-A, and 50uL of interferent stock Agilent ICS-B into a 50mL graduated centrifuge tube and dilute to volume with 2% Nitric Acid/0.5% Hydrochloric Acid. Final concentrations of interferents are as in (13) above; concentrations of minor elements are 20, 10, or 5ug/L. Check solution frequently for signs of precipitation and take corrective action when noted.

15. Internal Standard – 1ug/mL of ^{45}Sc, ^{103}Rh, ^{115}In, ^{159}Tb, ^{175}Lu, and ^{209}Bi

16. Low-level Calibration Verification Standard analyzed at 0.5ug/L of trace elements.

17. All solutions are prepared in labeled, graduated centrifuge tube.

18. All reagents used must be entered in the reagent logbook, except for water, which is monitored by the QA/QC Department. Standards prepped are entered into the standard prep logbook. See SOP GEN-006 for additional information and documentation requirements.

19. Argon >99.99% purity

20. Helium

INSTRUMENT SET-UP

1. Check Argon, Helium, and compressed air supply.

2. Check wash solution in autosampler flush container. Fill if necessary (2% Nitric Acid, 0.5% Hydrochloric Acid).

3. Check drain bottle below instrument. Empty if necessary.

4. Connect the peristaltic pump tubing between the posts on the pump (Sample pump and internal standard pump). Close the platens.

5. Start the computer. Select the ICP-MS Top icon on the Windows Desktop.

6. Select the Plasma ICON. Select "ON" button. Allow Plasma to warm up 45 minutes.

7. Set up sequence by filling in the positions with the samples to be analyzed. Include the standard identification numbers for the tune, calibration standards, ICV, ICSA, and ICSAB on the bench sheet (Attachment 1). Print sequence.

8. Load the autosampler by filling the tubes (10 mL will suffice) and inserting them into the positions corresponding to those on the bench sheet. Verify all blank, standard and QC sample tubes are filled.

9. Save sequence using the date as YYMMDD.

10. Select Load and Run sequence in the ICP-MS window.

CALIBRATION AND SAMPLE ANALYSIS

1. The instrument must first pass the mass calibration, resolution, and stability checks or tune check. The mass calibration cannot drift by more than 0.1 amu from the true value. The resolution must be verified to be less than 0.75 amu full width at 5% peak height. A minimum of five replicates are acquired with an RSD of ≤5%. If these criteria are not achieved, perform instrument maintenance and/or tuning. Calibration and sample analysis cannot begin until acceptable mass calibration and resolution are demonstrated.

2. After verifying that tune passes, continue with initial calibration. Instrument will calibrate and continue with QC and sample analysis. The calibration is a multi-point calibration (minimum of three points) with a blank. It is verified with an ICSA, ICSAB, ICV, LLICV, CCV, LLCCV and CCB. Once data is collected, and instrument QC is evaluated, the data can be posted. This is performed by direct upload of data to the intranet ICP-MS uploader. In ICP Data Analysis window and select tools. Upload selected samples as a csv file.
3. Document all runs on a batch log using the ICP file maker program available on the metals workstation. On each batch sheet document the analyst, date, time, standard identification, dilutions, and reviews. An example sheet is attached.
4. Go to the intranet ICPMS uploader and browse for specific CSV file. Enter the HBN and select import. Select samples to be posted and select export.
5. SHUT DOWN - If an additional run will not be performed add a TERM block and an ERRTERM block at the end of the sequence.
6. Samples are diluted if the detected concentration is ≥90% of the high-level standard as described in QC section of this SOP for E200.8 or above the high-level standard for samples analyzed by SW6020A.
7. Three replicates are determined for all sample, calibration, and QC analysis. If the RSD of the replicates is more than 5%, each replicate is evaluated. Note that an RSD of >5% may be typical for low concentrations and data should not be rejected based solely on the RSD. The average of the three replicates is reported.
8. Rinse for a minimum of one minute between sample analyses.

REPORTING LIMITS

The following charts indicate typical reporting limits for EPA 200.8, and SW-846 6020A. Lower limits may be achievable. Limits may also be adjusted higher if they meet the clients requirements due to LLCCV or LOQ performance.

EPA 200.8:

ANALTYE	WATER (ug/L)
Aluminum	10
Antimony	0.5
Arsenic	0.5

Barium	0.5
Beryllium	0.5
Cadmium	0.5
Chromium	0.5
Cobalt	0.5
Copper	0.5
Lead	0.5
Manganese	0.5
Molybdenum	0.5
Nickel	0.5
Selenium	1.0
Silver	0.5
Thallium	0.5
Vanadium	0.5
Zinc	10.0

SW-846, 6020A:

ANALTYE	WATER (ug/L)	SOLID (ug/kg)
Aluminum	10	400
Antimony	0.5	20
Arsenic	0.5	20
Barium	0.5	20
Beryllium	0.5	20
Cadmium	0.5	20
Calcium	50	2000
Chromium	0.5	20
Cobalt	0.5	20
Copper	0.5	20
Iron	50	2000
Lead	0.5	20
Magnesium	50	2000
Manganese	0.5	20
Molybdenum	0.5	20
Nickel	0.5	20
Potassium	50	2000
Selenium	1	40
Silver	0.5	20
Sodium	50	2000
Strontium	0.5	20
Thallium	0.5	20
Tin	0.5	NA
Titanium	0.5	20
Vanadium	0.5	20
Zinc	10	400
Zirconium	0.5	20

QUALITY CONTROL &
DATA ACCEPTANCE CRITERIA

1. The initial calibration consists of the initial calibration blank and a minimum of three contiguous non-zero points. The lowest non-zero point for each analyte must be at or less than the LOQ. To be considered acceptable the correlation coefficient (r) must be ≥0.998 for each analyte. Additional points may be analyzed to better define the linear range and the lower limit of quantitation. In addition the high or low points may be removed from a multi-point curve as long as a minimum of three points remain and the reporting limit is adjusted if the low point is removed. Silver is not calibrated above 100ug/L.
2. The Initial Calibration Verification (ICV) standard recoveries must be 90-110%. This is performed daily following the initial calibration. The ICV standard should be prepared from an independent (second source) material at or near the mid-range of the calibration curve.
3. The Initial Calibration Blank (ICB) is used to verify all concentrations are below the client defined reporting limit. The concentration must be ≤ ± the reporting limit. For DOD projects, concentrations must be less than the LOD. Additional requirements may apply and may be more stringent. See SOP GEN-019. The internal standard response from the ICB is used to calculate drift for all samples in the analytical batch. An ICB cannot be reanalyzed after the calibration to "re-set" the internal standard responses. If for any reason the ICB must be reanalyzed, it must be followed by an ICAL.
4. Analyze a Low-level Initial Calibration Verification (LLICV) prepared at or below the project required reporting limit. The recovery for this check standard must be 70-130% for 6020A. Project specific limits may be required, see SOP GEN-019.
5. The ICSA solution is used to monitor correction factors for the common interferents. This solution will be used to evaluate elements that are not spiked in the ICSAB. The concentration for these elements must be ≤ ± the reporting limit. The ICSA

concentration must be less than or equal the reporting limit and greater than or equal to -2X the reporting limit. The ICSA is analyzed before sample analysis or every 12 hours, whichever is more frequent. Additional requirements may apply and may be more stringent. See SOP GEN-019.

6. All elements in the ICSAB solution should have recoveries of 80-120%. Results falling outside these limits may indicate the need for re-evaluation of correction equations. The ICSAB is analyzed before sample analysis or every 12 hours, whichever is more frequent.

7. Continuing Calibration Verification standards (CCV), Continuing Calibration Blanks (CCB), and for 6020A Low-level Continuing Calibration Verification (LLCCV) are run every 10 samples and at the end of the analytical run. The CCV recovery must be 90-110%. For 6020A, the recovery for the LLCCV must be 70-130% for all analytes. The RSD between the replicates should not be greater than 5%. If this is exceeded evaluate the replicates to determine if re-analysis is necessary. The CCB concentration should never exceed the reporting limit. If a CCV, LLCCV, and/or CCB is outside control limits, re-analyze one time (additional runs are acceptable if a documented reason for the failure is available) and if the values are still outside the control limits, recalibrate and re-run the previous 10 samples. Results are reportable with a narrative if the CCB fails and there are no hits in the associated samples. Additional requirements may apply and may be more stringent. See SOP GEN-019.

8. Method Blank – one Method Blank is prepped with each batch of 20 or fewer samples. The concentration of each element should never exceed the reporting limit for all associated samples. Detected levels of elements in the method blank must be less than 10% of the regulatory limit or the sample concentrations for the data to be reported. For DOD projects, the method blank should be less than ½ the reporting limit. If the data is reported make a note of the problem in the case narrative. Find the source of the problem and correct and re-analyze if possible. Additional requirements may apply and may be more stringent. See SOP GEN-019.

9. A Laboratory Control Sample (LCS) and Laboratory Control Sample Duplicate (LCSD-if required for project or if insufficient sample if available for a

matrix duplicate or MS/MSD) is prepped with each batch of 20 or fewer samples. The recovery must be 85-115% for 200.8 and 80-120% for 6020A. The LCS/LCSD RPD should be ≤ 20%. If the LCS recovery is outside the control limits, the sample batch must be re-prepped. Samples may be reported if the LCS fails high with no hits in associated samples. Report with a narrative describing the failure.

10. A low-level quality control sample (LOQ) is prepped at the same level as the LLICV with initial set-up and quarterly. The sample recovery must be within 70-130% of the true value. If this sample does not fall within these criteria, evaluate the reason for the failure, perform recalibration and maintenance as necessary and reprep the sample. If the sample continues to fall outside of acceptance criteria it may be necessary to increase the reporting limit to a level that falls within this criteria.

11. The Relative Percent Difference (RPD) for matrix duplicates must be ≤ 20%, unless the sample concentration is less than five times the detection limit or the sample matrix is determined to be heterogeneous. Additional requirements may apply and may be more stringent. See SOP GEN-019.

12. Matrix Spike (MS) and Matrix Spike Duplicate (MSD) recoveries must be 75 - 125% for 6020A water and solids, 70-130% for 200.8. The MS/MSD RPD should be ≤ 20%. For DOD projects, the MS control limits are the same as the applicable LCS limits. MSD's are prepped and analyzed if there is sufficient sample. If the recovery is outside these limits, the data should be flagged. A spike is not applicable if the spike amount is less than 30% of the concentration in the native sample. MS/MSD is performed at a minimum of 10% (1 in 10) of samples.

13. For solid samples that require Antimony analysis – If the MS and MSD recovery for Antimony are outside of the control limits of 75-125%, the data should be flagged. In addition, if the recovery for Antimony is <10%, the samples should be reprepped for Antimony only, using the optional procedure for Antimony found in SOP MET-004. Also, if historical data for a particular sample indicates low recoveries for Antimony, the analyst should proceed directly to the optional steps.

14. Interference checks to be performed for 6020A if the MS/MSD fails for any target compound or if requested

by the client:

A. Post-Digestion Spike –A post-digestion spike is performed on all samples with MS/MSD recoveries outside control limits. A spike is added to a portion of digested sample or its dilution and should be recovered at 80-120% of the known value. If the recovery is outside control limits perform the dilution test.

B. Dilution Test - Perform a 5x dilution on one sample per batch. The concentrations of the elements in the sample to be diluted should be greater than 50 times the MDL. The neat sample concentration and five times the diluted sample concentration should agree within 10%. If not, a chemical or physical interference should be suspected.

15. Samples with interferent or analyte concentrations ≥ 90% of the high level ICAL standard will be diluted and reanalyzed for samples reported by E200.8. Samples reported by SW6020A shall be diluted for any compound greater than the high level calibration standard. Dilute so that the expected concentration is approximately in the mid-level of the curve. Report multiple dilutions if requested by the client.

16. Review the internal standard drift as compared to the calibration blank. The absolute value of any one internal standard must not deviate by more than 70-120% of the original response in the calibration blank. Determine if high or low recoveries are due to instrument drift by reviewing the internal standard recoveries for CCV's and CCB's. This will eliminate performing unnecessary dilutions if the sample is reanalyzed. High recoveries may be the result of a clogged sample uptake tube or an empty sample vial. Extremely high recoveries can result from the presence of the internal standard element in the original sample. If this is suspected, re-analyze using a different IS. If the analyst determines the recovery is outside the control limits due to matrix interference, then the sample must be reanalyzed diluted.

17. Determine linear ranges semi-annually. Spike at historical values. Each metal must be recovered at 90-110%.

18. Determine MDLs annually using the requirements of SOP QA-009. MDL's shall be determined more frequently if there is a change to the method or

instrumentation that may alter the sensitivity of the measurement. An MDL study is performed for each instrument. MDLs should be less than ½ the reporting limit, but cannot be higher than the reporting limit.

19. Determine IDLs annually.

MAINTENANCE

1. Clean the nebulizer periodically in a 2% Nitric acid solution. Sonication of the nebulizer in this solution is also helpful in removing deposits or particulate matter.
2. Clean the torch periodically by soaking in 2% HNO_3.
3. Sample pump tubing should be inspected every day and changed when showing signs of wear.
4. Clean sample cone and/or skimmer cone periodically.
5. Check the water level in the chiller.
6. An Agilent service engineer performs scheduled periodic maintenance every six months.
7. All other maintenance shall be documented in the instrument maintenance log. If a particular problem occurs, document the problem and the solution. For additional information on instrument maintenance and documentation requirements see GCAL SOP GEN-012.

CALCULATIONS

1. Sample Concentration –

$$\text{mg/L or mg/kg analyte in sample} = A \frac{Vf}{Vi} \times d$$

A = mg/L analyte in processed sample
Vf = final volume of sample (mL)
Vi = initial volume (mL) or weight (g) of sample
d = dilution factor (if required)

The units may be converted to ug/L or ug/kg

2. Matrix spike and Matrix Spike Duplicate Recovery

$$\% \text{ Recovery} = \frac{(SSR - SR)}{SA} \times 100$$

SSR = spiked sample result
SR = sample result
SA = spike added

3. Matrix Duplicate Relative Percent Difference (RPD)

$$RPD = \frac{SR - SDR}{\frac{(SR+SDR)}{2}} \times 100$$

SR = Sample result
SDR = sample duplicate result
$\frac{(SR+SDR)}{2}$ = average of SR and SDR

TABLE I

ELEMENT	Selected Isotope	Type	Assigned ISTD
Ag	107	Target	115
Al	27	Target	45
As	75	Target	45
Ba	137	Target	103
Be	9	Target	45
Bi	209	INST	
Ca	44	Target	45
Cd	111	Target	103
Co	59	Target	45
Cr	52	Target	45
Cu	63	Target	45
Fe	57	Target	45
In	115	INST	
K	39	Target	45
Li	6	INST	
Lu	175	INST	
Mg	24	Target	45
Mn	55	Target	45
Mo	95	Target	103
Na	23	Target	45
Ni	60	Target	45

ELEMENT	Selected Isotope	Type	Assigned ISTD
Pb	208	Target	209
Rh	103	INST	
Sb	121	Target	159
Sc	45	INST	
Se	78	Target	45
Sn	120	Target	115
Sr	88	Target	103
Tb	159	INST	
Ti	47	Target	45
Tl	205	Target	209
V	51	Target	45
Zn	66	Target	45
Zr	90	Target	103

SOFTWARE TROUBLESHOOTING

The ICP-MS uses Mass Hunter to control the instrument and perform all data calculations. In the event of software malfunction, please contact Agilent technical support or GCAL's IT Director for troubleshooting help.

METHOD PERFORMANCE (METHOD 6020A)

1) Method Performance is described in Section 13.0 of SW-846 6020A. This includes descriptions of a multi-laboratory study for aqueous and solid matrices. Results of the study are summarized in the reference method Table 3 and Table 4.

METHOD PERFORMANCE (METHOD 200.8)

1) Method Performance is described in Section 13.0 of EPA 200.8 Revision 5.4 (EMMC Version). Method performance including typical IDLs, MDLs, method precision and bias is described and detailed in the referenced Tables for total and dissolved metal determinations for each matrix.

POLLUTION PREVENTION

See QAPP Section 10.2

WASTE MANAGEMENT See SOP GEN-009

APPENDIX 1

GLOSSARY

ACCEPTANCE LIMITS – data quality limits specified by the test method or generated by the laboratory. Specified limits placed on an item, process, or service defined in the requirement document.

ACCURACY – a measure of how close a measured value is to a known true value. Accuracy is assessed by means of reference samples and percent recoveries of spiked samples. The degree of agreement between an observed value and an accepted reference value. Accuracy includes combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator.

ALIQUOT – a discrete, measure, or representative portion of a sample taken for analysis.

ANALYTE – the chemical element or compound an analyst seeks to determine; the chemical element of interest.

ANALYTICAL BATCH – the basic unit for analytical quality control, defined as samples that are analyzed together with the same method sequence and the same lots of reagents and with the manipulations common to each sample within the same time period or in continuous sequential time periods. Samples in each batch should be of similar composition (e.g., groundwater, sludge, ash).

ANALYTICAL SAMPLE – any solution or media introduced into an instrument on which an analysis is performed, excluding instrument calibration, initial calibration verification, initial calibration blank, continuing calibration verification, and continuing calibration blank. The following are all analytical samples: undiluted and diluted samples (EPA and non-EPA), predigestion spike samples, duplicate samples, serial dilution samples, analytical spike samples, post digestion spike samples, interference check samples (ICS), CRDL standard for AA(CRA), CRDL standard for ICP(CRI), laboratory control sample(LCS), preparation blank(PB), and linear range analysis sample(LRS).

ANALYST – the designated individual who performs the "hands on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

AREA UNITS – a term used in gas chromatography that indicates the peak area of a compound exiting a chromatographic column. The size or area of the peak is proportional to the amount of analyte in the sample.

ATOMIC ABSORPTION (AA) – a technique for analyzing metal using an element-specific lamp that emits a characteristic light spectrum. A sample is heated in a flame or graphite furnace and the light beam is passed through it. When the sample absorbs light, an energy loss is detected and is translated into a concentration of metal in the sample. This technique detects one metal at a time.

AUDIT – a systematic check to determine the quality of some function or activity. Two basic types are performance audits and system audits. Perform audits involve a quantitative comparison of the laboratory's results to those of a proficiency sample containing known concentration of analytes. A

system audit is a qualitative evaluation that normally consists of an onsite review of a lab's quality assurance system and physical facilities.

BACKGROUND CORRECTION – a technique usually employed relative to metals analysis, which compensates for variable background contribution to the instrument signal in the determination of trace elements.

BATCH – environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A batch is composed of a maximum of twenty environmental samples. A preparation batch is composed of environmental sample of the same matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) and/or those samples not requiring preparation, which are analyzed together as a group using the same calibration curve or factor. An analytical batch can include samples originating from various environmental matrices.

BIAS – the deviation of the mean of replicate analytical measurements from a reference analyte concentration. Relative bias is represented by analytical measurement mean minus the reference analyte concentration and the difference divided by the reference analyte concentration. See accuracy and precision.

4-BROMO-FLUOROBENZENE (BFB) – the compound used to check the tuning of the instrument, and is used as a surrogate compound spiked into every sample for volatile analysis. A compound utilized in EPA gas chromatography/mass spectrometry (GC/MS) volatile methods to establish mass spectral instrument performance.

BIOCHEMICAL OXYGEN DEMAND (BOD) – A measure of the amount of oxygen consumed in the biochemical processes that break down organic matter in water. A larger BOD value indicates a greater degree of organic pollution. A related term, BOD5, is the amount of dissolved oxygen consumed in five days.

BIOSEED – the bacterial culture used to inoculate a sample for testing.

BLANK – an artificial sample designed to monitor the introduction of artifacts into the measurement process. For aqueous samples, reagent water is used as a blank matrix. There are several types of blanks, which monitor a variety of processes: 1.)*laboratory blank* is taken through sample preparation and analysis only. It is a test for contamination in sample preparation and analyses. 2.)*storage blank* is stored and analyzed with samples at the laboratory. It is a test for contamination in sample storage as well as sample preparation and analysis. 3.)*trip blank* is shipped to and from the field with the sample containers. It is not opened in the field and, therefore, provides a test for contamination from sample preservation, site conditions, and transport as well as sample storage, preparation, and analysis. It is most commonly used for volatile organics. 4.)*field blank* is opened in the field and tests for contamination from the atmosphere as well as those activities listed under the trip blank.

BNA – base, neutral and acid extractable compounds. The term base, neutral and acid refer to the pH condition of the sample undergoing extraction. Certain compounds extract more efficiently from water under acidic conditions. Such compounds are often referred to as "acid extractables."

CALIBRATE – to determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter or other device, or the correct value for each setting of a control knob. The levels of the applied calibration standard should bracket the range of planned or expect sample measurements.

CALIBRATION – The systematic determination of the relationship of the response of the measurement system to the concentration of the analyte of interest. Instrument calibration performed before any samples are analyzed is called the initial calibration. Subsequent checks on the instrument calibration performed throughout analysis are called continuing calibration verification.

CALIBRATION BLANK (CB) – a volume of reagent water in the same matrix as the calibration standards but without the analyte.

CALIBRATION CURVE – the graphical relationship between the known values, such as concentrations, of a series of calibration standards and their analytical response.

CALIBRATION METHOD – a defined technical procedure for performing a calibration.

CALIBRATION STANDARD – a certified material used to calibrate an instrument.

CERTIFIED REFERENCE MATERIAL (CRM) – reference material, one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body. (ISO Guide 30)

CONTINUING CALIBRATION VERIFICATION (CCV) – used to evaluate the performance of the instrument system with respect to a defined set of method criteria. The CCVs are used to verify instrument performance during analysis. The CCV shall be prepared from the same stock standard solution used to prepare the calibration curve.

CHAIN-OF-CUSTODY–Procedures and associated documents designed to trace the custody of a sample from the point of origin to final disposition, with the intent of legally demonstrating that custody remained intact and the tampering or substitutions were precluded.

CHEMICAL OXYGEN DEMAND (COD) – A measure of the oxygen required to oxidize all compounds in water, both organic and inorganic.

COMBINED STANDARD UNCERTAINTY – The standard uncertainty of the analytical measurement result that is the sum in quadrature (square-root-of-the-sum-of-the-squares) of the component standard uncertainties.

CORRECTIVE ACTION – the action taken to eliminate the causes of an existing non-conformity, defect, or other undesirable situation to prevent reoccurrence.

COVERAGE FACTOR – the numerical factor used as a multiplier of the combined standard uncertainty to expand the uncertainty corresponding to a specific level of confidence. The Student's *t*-distribution is used for determining the coverage factor.

DEMONSTRATION OF CAPABILITY (DOC) – a procedure used to establish the ability of the analyst to generate acceptable accuracy.

DEIONIZED WATER (DI) – water from which the majority of ions have been removed. Water that is contaminant free and used in the laboratory, the resistivity should be ≤ 18 mega ohms.

DISSOLVED METALS –- metallic elements determined on a water sample that has been passed through a 0.45-um filter.

DISSOLVED OXYGEN (DO) – the oxygen freely available in water, an indicator of water quality.

DISSOLVED SOLIDS – disintegrated organic and inorganic material contained in water. Excessive amounts make water unfit to drink or use in industrial processes.

DRY WEIGHT – the weight of a sample based on percent solids. The weight of a sample after drying in an oven at a specified temperature.

DUPLICATE MEASUREMENT – a duplicate measurement is a second measurement made on the same or identical sample of material to assist in the evaluation of measurement of variance.

DUPLICATE SAMPLE – two samples taken from the same population and carried through certain stages of sampling and testing. Duplicate sample include field co-located duplicate samples, field-split duplicate samples, and laboratory duplicate subsamples.

EXPANDED UNCERTAINTY – the quantity defining an interval enveloping the analytical measurement that captures a large fraction of the distribution of analyte concentrations that could be attributable to the quantity measured. The combined standard uncertainty is multiplied by the coverage factor to calculate the expanded uncertainty.

EXTERNAL STANDARDS – a method of quantifying chromatographic data in which standards of known concentration are analyzed prior to unknown samples. The chromatographic peak area (or height) of a sample component is compared to a calibration curve of a peak area constructed from the standard data for that component. This comparison allows the concentration of the component in the sample to be determined.

FECAL COLIFORM BACTERIA – bacteria found in mammals' intestinal tracts. Their presence in water or sludge is an indicator of pollution and possible contamination by pathogens.

FLAME IONIZATION DETECTOR (FID) – a gas chromatography detector in which the column effluent gas is mixed with hydrogen and burned in air or oxygen. The ions and electrons produced in the flame generate an electric current proportional to the amount of materials in the detector. The FID responds to nearly all organic compounds, but it does not respond to air and water, which makes it exceptionally suited to environmental analysis.

FLASHPOINT – the lowest temperature at which a flammable liquid gives off sufficient vapor to form an ignitable mixture with air near its surface or within a vessel. Combustion does not continue.

GAS CHROMATOGRAPHY (GC) – a technique for detecting organic compounds by using their physical and chemical properties to separate a mixture. The compounds are identified and quantified

with various types of detectors as they exit the chromatograph. Selection of detectors is dependent on the particular compounds of interest.

GAS CHROMATOGRAPHY MASS SPECTROMETRY (GCMS) – a technique in which sample analytes are bombarded with electrons as they exit a gas chromatography column and are fragmented into characteristics ion patterns. The mass spectrometer is the detector. It can determine which fragments are present and therefore the identity of the compounds.

GLUCOSE GLUTAMIC ACID (GGA) – used as a laboratory control standard in BOD procedures.

GRAPHITE FURNACE – a technique used for the analysis of metals. An atomic absorption spectrophotometer heats the sample within a graphite tube using an electrical current. It is also commonly called a flameless furnace and generally provides greater sensitivity for certain metals than flame or inductively coupled argon plasma techniques.

GRAVIMETRIC - analyses based on the direct or indirect weighing of the analyte in question. This technique usually requires the use of an analytical balance with a sensitivity of 0.1 mg or better.

HALL ELECTROLYTIC CONDUCTIVITY DETECTOR – an element-selective gas chromatography detector primarily intended for trace analysis of organic compounds containing chlorine, nitrogen or sulfur. In operation, this detector pyrolyzes the column effluent gas into soluble electrolytes that are dissolved in a stream of deionized liquid. The observed change in electrical conductivity, proportional to the amount of material present, is measured.

HAZARDOUS WASTE – waste regulated under RCRA that can pose a substantial or potential hazard to human health or the environment when improperly managed. Such wastes possess at least one of four characteristics (ignitability, corrosivity, reactivity, or toxicity) or appear on special EPA hazardous waste lists. The term is not interchangeable with hazardous substances or material.

HEADSPACE - Any area in a container not completely filled by the sample in which gases can collect.

HEAVY METALS – metallic elements with high atomic weights, i.e., mercury, chromium, cadmium, arsenic, and lead. They can damage the health of plants and animals at low concentrations and tend to accumulate in the food chain.

HOLDING TIME – the maximum times that samples may be held before analysis and still be considered valid or not compromised. The storage time allowed between sample collection and sample analysis when the designated preservation and storage techniques are employed.

HYDROCARBONS – chemical compounds that consist entirely of carbon and hydrogen.

ICP – Inductively coupled plasma is a type of instrument used for metals analysis. Because the temperature of the plasma is considerable higher (10,000^{o}K) than the temperature of a flame atomic absorption spectrophotometer, it is especially useful for refractory metals. Some instruments are also capable of performing simultaneous multielement analysis.

ICP-MS - Inductively coupled plasma mass spectrometry (ICP-MS) is a type of mass spectrometry highly sensitive and capable of the determination of a range of metals and several non-metals at concentrations below one part in 10^{12} (part per trillion). It is based on coupling together an inductively coupled plasma as a method of producing ions with a mass spectrometer as a method of separating and detecting the ions. In trace elemental analysis, the method has advantages of high speed, precision and sensitivity.

IGNITABLE – capable of burning or causing a fire.

INORGANIC CHEMICALS – chemical substances of mineral origin, unlike organic chemicals whose structure relies on carbon atoms.

INITIAL CALIBRATION VERIFICATION (ICV) - also referred to as the Independent Calibration Verification for this laboratory. A standard solution used to verify the calibration curve derived from a source independent of the instrument calibration standard. The ICV is use to quantify second source standard variance and bias.

INSTRUMENT CALIBRATION STANDARD - a reference material used to standardize an analytical instrument.

INSTRUMENT DETECTION LIMIT (IDL) - a term utilized in the EPA Inorganic Contract Laboratory Program. The IDL is three times the standard deviation obtained for the analysis of a standard solution (each analyte in reagent water) at a concentration of three to five times that of the IDL on three nonconsecutive days with seven consecutive measurements per day. The IDL is the concentration equivalent to a signal, due to the analyte of interest, which is the smallest signal that can be distinguished from background noise by a particular instrument. The IDL should always be below the method detection limit, and is not used for compliance data reporting, but may be used for statistical data analysis and comparing the attributes of different instruments.

INSTRUMENT PERFORMANCE CHECK - The analyses of one of the ICSs to verified initial and continuing calibration (CCV). The IPC is used to quantify the instrumental testing repeatability variance and bias.

INSTRUMENT TUNING - a technique used in gas chromatography/mass spectrometry procedures to verify that the instrument is properly calibrated to produce reliable mass spectral information. See 4-Bromofluorobenzene under “B”.

INTERNAL STANDARDS - compounds added to every standard, blank, matrix spike, matrix spike duplicate, sample (for volatile organics), and sample extract (for semivolatiles) at a known concentration, prior to analysis. Internal standards are used as the basis for quantification of the target compound.

IONIZATION - Utilized in mass spectrometry to fragment analyte molecules into smaller segments. These smaller mass segments are then separated and plotted to form a “mass spectrum” which is used to identify the parent molecule. Electron impact is one example of ionization used in mass spectrometry. In more technical terms. Ionization is the process by which neutral atoms or groups of atoms become electrically charged, either positively or negatively, by the loss or gain of electrons.

ISOMERS - chemical compounds with the same molecular weight and atomic composition by differing molecular structure, e.g., n-pentane and 2-methylbutane.

LABORATORY CONTROL SAMPLE (LCS) - a clean-matrix reference sample spiked with a standard with an established analyte concentration. The LCS is carried through the entire chemical preparation and testing procedures. The LCS is used to quantify the variance and bias of the chemical preparation and instrumental testing stages without matrix interference. Also called a Laboratory fortified blank (LFB).

LABORATORY CONTROL SAMPLE DUPLICATE (LCSD) – a duplicate of the laboratory control sample in a clean matrix that is carried through the entire chemical preparation and testing procedures.

LABORATORY DUPLICATE SAMPLE (LAB DUPLICATE) - a portion of the collected sample that is carried through the chemical preparation and testing. The laboratory duplicate subsample is used to quantify the variance of the chemical preparation and instrumental testing stages with matrix interferences.

LEACHATE - a liquid that results from water collecting contaminants as it trickles through wastes, agricultural pesticides or fertilizers. Leaching may occur in farming areas, feedlots, and landfills, and may result in hazardous substances entering surface water, groundwater or soil.

LDEQ – Louisiana Department of Environmental Quality

LIBRARY SEARCH - a technique in which an unknown mass spectrum of a compound is compared to the mass spectra of compounds contained in a computer library in an effort to identify the compound. Compounds identified in this manner are referred to as tentatively identified compounds (TICs).

LIMIT OF DETECTION (LOD) – an estimate of the minimum amount of a substance that an analytical process can reliable detect. An LOD is analyte and matrix specific and may be laboratory dependent.

LIMIT OF QUANTIATION (LOQ) – the minimum levels, concentrations, or quantities of a target variable (e.g. target analyte) that can be reported with a specified degree of confidence..

LIMS – laboratory information management system. Horizons is the LIMS used by GCAL.

LINEAR CALIBRATION RANGE – the concentration range over which the instrument response is linear.

LOG-IN - the receipt and initial management of an environmental sample. It generally includes identifying who sent the sample; maintaining chain-of-custody; checking report and invoice information; recording analysis requested, including methodology and special instructions; and assigning a discreet in-lab identification, usually a number or bar code.

MASS SPECTRUM - a plot of ion mass/charge ratio versus intensity. A fragmentation pattern results from the particles whose mass distribution is characteristic of the parent molecule. Qualitative information is provided by a mass spectrum.

MATERIAL SAFETY DATA SHEET (MSDS) - a compilation of information required under the OSHA Communication Standard on the identity of hazardous chemicals and their associated health and physical hazards, exposure limits and precautions.

MATRIX - The physical characteristics or state of a sample – e.g., water, soil, sludge.

MATRIX INTERFERENCE - the influence of the sample matrix or sample components upon the ability of qualitatively identifies and quantitatively measures compounds in environmental samples.

MATRIX MODIFIERS - chemicals added to samples for metals analysis, which are used to lessen the effects of chemical interference, viscosity and surface tension.

MATRIX SPIKE (MS) – aliquot of a sample fortified (spiked) with known quantities of specific compounds and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for the matrix by measuring recovery of the spike. Matrix spiked samples are used to quantify the variance and bias of the chemical preparation and testing stages with matrix interference.

MATRIX SPIKE DUPLICATE (MSD) - a second aliquot of the same matrix as the matrix spike that is spiked to determine the precision of the method.

METHOD DETECTION LIMIT (MDL) - the minimum concentration of compound that can be measured and reported within 99% confidence that the value is above zero and is determined from analysis of a sample in a given matrix containing the analyte.

MUST – denotes a mandatory requirement.

NARRATIVE - in an analytical report, a descriptive documentation of any problems encountered in processing the samples, along with corrective action taken and problem resolution.

NUTRIENT - any substance assimilated by living things that promote growth. The term is generally applied to nitrogen and phosphorus in wastewater, but is also applied to other essential and trace elements.

ORGANIC - generally, any compound that contains carbon bonded to a hydrogen or halogen atom.

OXIDATION - the process in chemistry whereby electrons are removed from a molecule.

PCBs - Polychlorinated biphenyl, a group of toxic persistent chemicals used in transformers and capacitors for insulating purposes and in gas pipeline systems as a lubricant. Sale of PCBs for new uses was banned by law in 1979.

PERCENT RECOVERY - a measure of accuracy that is calculated as the measured value relative to the true value expressed as a percent.

PERFORMANCE AUDIT - a quantitative evaluation of a measurement system that involves the analysis of standard reference samples or materials which are certified as to their chemical composition or physical characteristics.

PROFICIENCY TEST (PT) SAMPLE - a sample of known composition (unknown to the laboratory), provided by an external source, which is used to evaluate lab performance. For certification purposes the PT sample is purchased from an approved provider.

pH - a numerical designation of relative acidity and alkalinity. A pH of 7.0 indicates precise neutrality. Progressively higher values indicate increasing alkalinity and lower values increasing acidity.

POLLUTANT - generally, any substance introduced into the environment that adversely affects the usefulness of a resource.

PRACTICAL QUANTITATION LIMIT (PQL) - the lowest level that can be reliable achieved within specified limits of precision and accuracy routine laboratory operating conditions. The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value.

PRECISION - a measure of the ability to reproduce analytical results. It is generally determined through the analysis of duplicate samples. The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range in either absolute or relative terms.

PRESERVATIVE - a chemical or reagent added to a sample to prevent or slow decomposition or degradation of a target analyte or a physical process. Physical and chemical preservation may be used in tandem to prevent sample deterioration.

PURGE AND TRAP - a technique used in the analysis of volatile organic where analytes are purged from a sample by means of an inert gas and trapped on a sorbent column. The sorbent is then flashheated and the analytes are transferred onto a gas chromatographic column for separation and identification.

PURGEABLE ORGANIC - an organic compound that is generally less than 20% soluble in water and has a boiling point at or below 200°C. A volatile organic. An organic compound is generally considered to be purgeable if it can be removed from water using the purging process.

QC BASED NESTED APPROACH - a procedure for estimating the uncertainty of measurement using quality control data. The procedure is described in SOP QA-013.

QUALITY ASSURANCE (QA) - all those planned and systematic actions necessary to provide adequate confidence in laboratory results. An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets the defined standards of quality with a stated level of confidence.

QUALITY ASSURANCE PROGRAM PLAN - a written assembly of management policies, objectives, principle and general procedures that outlines how the laboratory intends to generate data of known and accepted quality.

QUALITY CONTROL (QC) – the overall system of technical activities whose purpose to measure and control the quality of a product or service so that it meets the needs of the users.

QUALITY CONTROL CHART - a graph of analytical measurement results for a specific QC standard plotted sequentially with upper and lower control limits (±3SD). A central line that is the best estimate of the average variable plotted, and upper and lower marginal exceedence limits (±4SD) are usually included in the Quality Control Chart. The chart may also include upper and lower warning limits (±2SD).

QUALITY SYSTEM – a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items) and services. The quality system provides the framework for planning, implement and assessing work performed by the organization and for carrying out required QA and QC.

r^2 – Correlation Coefficient Squared – paramet6er used to evaluate the fit of linear or quadratic regression curve fit of initial calibration data.

RAW DATA – any original information from a measurement activity or study recorded in a laboratory note book, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfilm copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments.

REACTIVITY - the tendency of a chemical to explode under normal management conditions, to react violently when mixed with water, or to generate toxic gases.

REAGENT WATER - water in which an interference is not observed at or above the minimum quantitation limit of interest.

REFERENCE MATERIAL - a traceable standard with an established analyte concentration. Material or substance whose property values are sufficiently homogenous, stable and well established to be used for the calibration of an apparatus, the assessment of a measurement method or for assigning values to materials (ISO Guide 30)

REFERENCE METHOD – a method of known and documented accuracy and precision issued by an organization recognized as competent to do so.

RELATIVE RETENTION TIME – a measure of the shift in retention time of an analyte when referenced to an internal standard.

RELATIVE RESPONSE FACTOR (RRF) - a measure of the relative mass spectral response of an analyte compared to its internal standard. RRFs are determined by analysis of standards and are used in the calculation of concentrations of analytes in samples.

REPLICATE ANALYSES - two or more results representing the same sample parameter. Replicate analyses are used to quantify the analytical measurement repeatability precision.

RPD – Relative Percent Difference, a relative difference between two analyses calculated by dividing the absolute difference of those two results by the average of their two values, then multiplying by 100.

RESOLUTION - the degree of separation between peaks eluting from a chromatographic column. Sufficient resolution between peaks is required for proper quantitation of unknown analytes.

RETENTION TIME - a term used in gas and liquid chromatography describing the time elapsed from the sample injection until the specific compound elutes or exits the chromatographic column at the detector. Each compound has a characteristics retention time on a specific column; therefore, this information is used to qualitatively identify the compounds in the sample.

SAMPLE – portion of material collect for chemical analysis, identified by a unique number assigned by the LIMS.

SHALL – denotes a requirement that is mandatory whenever the criterion for conformance with the specification requires that there be no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled.

SHOULD – denotes a guideline or recommendation whenever noncompliance with the specification is permissible.

SOLID WASTE – non-liquid, non-soluble materials, ranging from municipal garbage to industrial waste, that contain complex, and sometimes hazardous, substances. Solid wastes include sewage sludge, agricultural refuse, demolition wastes, mining residues, and even liquids and gases in containers.

SOLVENT - a substance, usually liquid, capable of dissolving or dispersing one or more other substances.

SPIKE – a known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

STANDARD CURVE - a curve that plots concentrations of known analyte standards versus the instrument response to the analyte. Calibration standards are prepared by diluting the stock analyte solution in graduated amounts that cover the expected range of the samples being analyzed. The calibration standards must be prepared by using the same type of acid or solvent at the same concentration as for the samples following sample preparation. This is applicable to organic and inorganic chemical analyses.

STANDARD OPERATING PROCEDURE - a detailed written description of how a laboratory executes a particular procedure or method intended to standardize its performance.

STANDARDIZED REFERENCE MATERIAL (SRM) – a certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical method.

STANDARD UNCERTAINTY - the analytical measurement uncertainty expressed as a standard deviation. The relative standard deviation represents the relative standard uncertainty.

SURROGATE - an organic compound similar to the analyte of interest in chemical composition, extraction and chromatography, but not normally found in environmental samples. Primarily used in chromatography techniques, the surrogate is spiked into quality control blanks, calibration and check

standards, samples (including duplicated and QC reference samples) and spiked samples before analysis. A percent recovery is calculated for each surrogate.

SUSPENDED SOLIDS - small pollutant particles that float on the surface of, or are suspended in, sewage or other liquids. They resist removal by conventional means.

TARGET COMPOUND - specific compounds that are to be quantified in a sample based on a standard list of potential compounds.

TENTATIVELY IDENTIFIED COMPOUNDS (TICs) - compounds detected in samples that are not target compounds, internal standards, system monitoring compounds or surrogates. TICs usually consist of up to 30 peaks that are greater than 10% of the peak areas, or heights, of the nearest internal standard. They are subjected to mass spectral library searches for tentative identification. A client may specify the number of unknown peaks in its samples it wishes the laboratory to tentatively identify.

TOTAL METALS - metallic elements that have been digested prior to analysis.

TYPE A EVALUATION UNCERTAINTY - the method of evaluation of uncertainty by the statistical analysis of a series of test results.

TYPE B EVALUATION OF UNCERTAINTY - the method of evaluation of uncertainty by means other than statistical analysis.

UNCERTAINTY - the parameter associated with the analytical measurement results that characterizes the dispersion of the values that could be reasonable attributed to the quantity measured.

UNCERTAINTY INTERVAL - the range of analyte concentrations that an analytical measurement could represent at a specified level of confidence. The relative standard deviation is used to represent the relative standard uncertainty in the QC-based Nested Approach.

VALIDATION –the process for evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual specifications. It essentially evaluates performance against predetermined specifications.

VOA - volatile organic analysis

VOA BOTTLE - a vial used to contain samples for volatile organic analysis.

VOLATILE COMPOUNDS - compounds amendable to analysis by purge and trap. Synonymous with purgeable compounds.

VOLATILE ORGANIC COMPOUND (VOC) - any organic compound that participates in atmospheric photochemical reactions, except for those designated by the EPA Administrator as having negligible photochemical reactivity.

WET CHEMISTRY - procedures that involve distillations, colorimetric determinations and titrimetric measurements. Examples are chloride, nitrates, sulfates and biochemical oxygen demand.