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

14 MAR 1995

MEMORANDUM FOR NEW MEXICO ENVIRONMENT DEPARTMENT
Groundwater Protection & Remediation Bureau
Attn: David Morgan
1190 St Francis Dr
Santa Fe, NM 87502

XIII

1995 RECEIVED HAZARDOUS WASTE PROGRAM

FROM: 49 CES/CEV
550 Tabosa Avenue
Holloman AFB, NM 88330-8458

SUBJECT: Review of Remediation Work Plans

Why Are These NOT SWMUs?

1. Attached please find work plans pertaining to Installation Restoration Program (IRP) Sites SS-06, the Fuel Line Spill Site #2, SD-15, the Refrigeration/Heat Shop Washrack, AOC-BBMS, the Bare Base Mobility Squadron Area of Concern, and AOC-RR, the Railroad Area of Concern. These work plans require your review prior to initiation of field work, which is scheduled for late March. Therefore, an expedient review is requested in order to maintain the accelerated restoration schedule established last year.

2. Review comments are requested no later than 24 March 1995. If you have any further questions regarding the enclosed work plans, please contact Warren Neff at (505) 475-5395.

Howard E. Moffitt
HOWARD E. MOFFITT
Deputy Base Civil Engineer

Attachment:
Work Plans

cc: w/Atch

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Dallas, TX 75202-2733

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*Headquarters, Air Combat Command*
*Langley Air Force Base,*
*Virginia*

# *CHEMICAL DATA ACQUISITION PLAN*

## *PRELIMINARY ASSESSMENTS/SITE INVESTIGATIONS AT WASTE SITES SS-06, SD-15, AOC-BBMS, AND AOC-RR*

## *VOLUME I - FIELD SAMPLING PLAN*

*February 1995*

*49 CES/CEV*
*Holloman Air Force Base,*
*New Mexico*

# DRAFT FINAL
# CHEMICAL DATA ACQUISITION PLAN
# PRELIMINARY ASSESSMENTS/SITE INVESTIGATIONS
# AT WASTE SITES
# SS-06, SD-15, AOC-BBMS, AND AOC-RR
# HOLLOMAN AIR FORCE BASE, NEW MEXICO

## VOLUME I - FIELD SAMPLING PLAN

Prepared for:

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Holloman Air Force Base, NM

and

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U.S. Army Corps of Engineers
Omaha District
Omaha, Nebraska

February 1995

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## LIST OF ACRONYMS

| | |
|---|---|
| AFB | Air Force Base |
| AOC | Area of Concern |
| ASTM | American Society for Testing and Materials |
| BBMS | Bare Base Mobility Squadron |
| BEC | Base Environmental Coordinator |
| BTEX | Benzene, Toluene, Ethylbenzene, and Xylenes |
| CDAP | Chemical Data Acquisition Plan |
| CERCLA | Comprehensive Environmental Response, Compensation and Liability Act of 1980 |
| DOT | Department of Transportation |
| DPT | Direct Push Technology |
| DTW | Depth to Water |
| DQCR | Daily Quality Control Report |
| EDMS | Electronic Data Management System |
| EPA | Environmental Protection Agency |
| FID | Flame Ionization Detector |
| FSDR | Field Sampling Data Report |
| ft | Feet |
| FSP | Field Sampling Plan |

## LIST OF ACRONYMS (CONTINUED)

| | |
|---|---|
| GC | Gas Chromatograph |
| gpm | Gallons Per Minute |
| GPS | Global Positioning System |
| HARF | Hazardous Assessment Rating Form |
| HBL | Health-Based Level |
| HSA | Hollow-Stem Auger |
| IATA | International Air Transport Association |
| ID | Identification |
| IDW | Investigation-Derived Waste |
| IRP | Installation Restoration Program |
| IRPIMS | Installation Restoration Program Information Management System |
| LEL | Lower Explosive Limit |
| LNAPL | Light Non-Aqueous Phase Liquids |
| mg/kg | Milligrams per Kilogram |
| mg/L | Milligrams per Liter |
| MRD | Missouri River Division |
| MS | Matrix Spike |
| MSD | Matrix Spike Duplicate |
| NMED | New Mexico Environment Department |
| NTU | Nephelometric Turbidity Units |

## LIST OF ACRONYMS (CONTINUED)

| | |
|---|---|
| PA/SI | Preliminary Assessment/Site Investigation |
| PID | Photoionization Detector |
| POL | Petroleum, Oils, and Lubricants |
| ppb | parts per billion |
| PPE | Personal Protection Equipment |
| ppm | parts per million |
| PVC | Poly Vinyl Chloride |
| QA/QC | Quality Assurance/Quality Control |
| QAPP | Quality Assurance Project Plan |
| RCRA | Resource, Conservation and Recovery Act of 1976 |
| RFI | RCRA Facility Investigation |
| RI | Remedial Investigation |
| RR | Railroad |
| SSHP | Site Safety and Health Plan |
| SOP | Standard Operating Procedures |
| SOS | Scope of Services |
| SWMU | Solid Waste Management Unit |
| TAL | Target Analyte List |
| TB | Trip Blank |

## LIST OF ACRONYMS (CONTINUED)

| | |
|---|---|
| TCLP | Toxicity Characteristic Leaching Procedure |
| TDS | Total Dissolved Solids |
| TPH | Total Petroleum Hydrocarbons |
| ug/L | Micrograms per Liter |
| USACE | United States Army Corps of Engineers |
| USCS | Unified Soils Classification System |
| UST | Underground Storage Tank |
| USTB | Underground Storage Tank Bureau |
| VOA | Volatile Organic Analysis |
| VOC | Volatile Organic Compounds |
| WQCC | Water Quality Control Commission |
| WMP | Waste Management Plan |

# 1.0 INTRODUCTION

This Chemical Data Acquisition Plan (CDAP) has been prepared as part of the work plan to perform Preliminary Assessments and Site Investigations (PA/SI) at four Installation Restoration Program (IRP) sites at Holloman Air Force Base (AFB), New Mexico (Figure 1-1). The CDAP is separated into two volumes: a Field Sampling Plan (FSP) (Volume I) and a Quality Assurance Project Plan (QAPP) (Volume II). The FSP (this volume) is comprised of site-specific sampling plans, field investigative procedures, a waste management plan, and a data management plan. The QAPP provides guidance to the contractor's laboratories on the expected analytical and quality assurance and quality control (QA/QC) procedures required for the project.

The purpose of this CDAP is twofold: (1) to ensure that data collected during these activities are of adequate quality for the purpose of assessing and defining the nature and extent of potential impacts to the subsurface; and (2) to adequately characterize investigation - derived wastes (IDW) for proper disposal. This CDAP addresses the quality assurance elements required by *General Chemistry Supplement to the Scope of Services*, (U.S. Army Corp of Engineers [USACE], Omaha District, December 1993). Field investigation procedures have been prepared in accordance with the *General Geology Supplement to the Scope of Services*, (USACE, May 1992).

The IRP sites to be investigated are:

- Site SS-06: JP-4 Fuel Line Spill Site No. 2 (Area of Concern (AOC)-R);
- Site SD-15: Refrigeration/Heat Shop Washrack (Solid Waste Management Unit [SWMU-82]);
- AOC-BBMS: Bare Base Mobility Squadron/generator run-up area; and
- AOC-RR: Building 80 - former locomotive repair shop.

Site visits for the PAs were conducted at Sites AOC-BBMS and AOC-RR in November 1994. SIs will be conducted at all four sites. Site locations are shown in Figure 1-2.

## 1.1 Document Organization

The remainder of this document is organized as follows. The remainder of this section presents the project objectives and technical approach. Regulatory action levels are also identified. A sampling plan for each site is provided in Section 2.0. Investigation methods, including sample locations and the rationale for those locations is presented in Section 3.0. Section 4.0 is the project-specific waste management plan. Section 5.0 describes the project-specified data management plan. Section 6.0 presents the proposed project schedule. Section 7.0 provides all document references. Standard Operating Procedures (SOPs) for all field procedures are provided in Appendix A. Project forms are provided in Appendix B.

## 1.2 Project Objective

The objective of the PAs will be to conduct historical literature searches, personnel interviews, and site reconnaissances at Sites AOC-BBMS and AOC-RR to evaluate conditions at these sites. The collected information will be used to distinguish between sites that pose little or no threat to human health and the environment and sites that require further investigation.

The objective of the SIs is to assess the potential for soil or groundwater contamination from past site activities. If an impact has occurred, the SI will define nature and extent of contamination. This data will be used to assess whether no further action is required, or if remedial actions are warranted.

## 1.3 Technical Approach

### *1.3.1 Preliminary Assessments*

PAs will be conducted for Sites AOC-BBMS and AOC-RR, which have not had a PA previously performed. The PAs will be conducted prior to initiation of the site investigation activities. The purpose of the PA is to collect information about the environmental conditions at AOC-BBMS and AOC-RR so that the potential threat to human health and the environment may be assessed, and so the proposed SI activities can be focussed. The PA will

include review of available field and file information, a site reconnaissance, and comprehensive receptor identification. The research will include interviews with Base personnel with knowledge of the prospective releases and review of site plans and drawings.

### *1.3.2 Site Investigations*

SIs will be conducted at all four IRP sites. The SIs will be conducted in two phases of work which will be completed in a single field mobilization. Phase I will determine if a release has occurred to the subsurface. This phase will be conducted using a mobile laboratory, using real-time analytical results to focus investigative activities. If Phase I results confirm that a release has impacted subsurface materials in excess of screening levels identified in this CDAP, Phase II activities will define the nature and extent of contamination. This approach is designed to expedite site characterization efforts by completing site characterization and related reporting. Phase I activities will be conducted at all four sites. However, it is assumed that no Phase II activities will be conducted at Site SS-06, due to the nature of the release and the known initial abatement activities.

*1.3.2.1* ***Phase I site investigations.*** Phase I activities consist of a soil gas survey at those sites where volatile compounds are suspected and collection of soil and groundwater samples using a direct push technology (DPT) sampling rig. A soil gas survey will be performed at Sites SS-06, AOC-BBMS, and AOC-RR. Positioning of the sampling points takes into account surface topography and drainage, groundwater flow direction, and other possible site constraints. Soil gas survey results will be used to locate the soil and groundwater sample locations. The number of soil and groundwater samples and their locations are specified in Section 2.0. The primary contamination concerns in all the areas to be investigated are petroleum hydrocarbons. Therefore, a field laboratory will be used to analyze 100% of the samples collected for organic compounds using the following methods:

- Total Petroleum Hydrocarbons (TPH) (via modified EPA Method 8015); and
- Volatile Organic Compounds (VOC) (via EPA Method 8240).

The chosen laboratory will be capable of producing Level III data quality for the field sample results. Therefore, no fixed laboratory analyses will be required for these samples. An off-site fixed laboratory will be used to analyze Target Analyte List (TAL) metals using EPA Methods 6010 and 7000 series.

*1.3.2.2* ***Regulatory action levels.*** Regulatory action levels applicable to Holloman AFB, as established by the New Mexico Environmental Department (NMED) are:

- For petroleum-contaminated soil: TPH > 1,000 milligrams per kilogram (mg/kg) and benzene > 25 mg/kg; and
- Removal of light non-aqueous phase liquids (LNAPL).

Due to the high total dissolved solids (TDS) concentration in groundwater at the Base (>10,000 parts per million [ppm]), there are no applicable dissolved-phase groundwater standards; however, the EPA and the NMED require Holloman AFB to delineate the nature and extent of sorbed and dissolved-phase compounds present in the subsurface above established background levels or risk-based levels.

Applicable regulatory action levels are summarized in Table 1-1. These levels are derived from three primary sources:

1) Various NMED correspondences to Holloman AFB confirming negotiated remediation standards for Holloman AFB (e.g. TPH in soil standard);

2) The Basewide Background Study for Holloman AFB (Radian, 1993); and

3) EPA Region III, Risk-Based Concentrations (EPA Region III, November 8, 1994).

Analytical results obtained in the Phase I SI will be compared to the values specified in Table 1-1 to determine if Phase II activities are necessary. If the results from the field analyses show that contamination is not present above Phase I screening levels, then no additional investigation will be performed.

**TABLE 1-1: PHASE I ACTION LEVELS APPLICABLE AT HOLLOMAN AFB**

| METHOD | PARAMETER | SOIL CONCENTRATION (mg/kg) | GROUNDWATER CONCENTRATION (mg/L) |
|---|---|---|---|
| Modified EPA 8015 | TPH | > 1,000[1] | Removal of LNAPL[2] |
| EPA Method 8240: Volatile Organic Compounds | Acetone | 100,000[4] | 3,700[4] |
| | Benzene | 25[2] | 0.01[5] |
| | Bromodichloromethane | 46[4] | 0.00017[4] |
| | Bromomethane | 1,400[4] | 0.0087[4] |
| | Carbon disulfide | 100,000[4] | 0.021[4] |
| | Carbon tetrachloride | 22[4] | 0.00016[4]/0.01[5] |
| | Chlorobenzene | 20,000[4] | 0.039[4] |
| | Chloroethane | 410,000[4] | 8.6[4] |
| | 2-Chloroethyl vinyl ether | 26,000[4] | 0.150[4] |
| | Chloroform | 470[4] | 0.00015[4]/0.1[5] |
| | Chloromethane | 220[4] | 0.0014[4] |
| | Dibromochloromethane | 34[4] | 0.00013[4] |
| | 1,2-Dichlorobenzene | 92,000[4] | 0.370[4] |
| | 1,3-Dichlorobenzene | 91,000[4] | 0.540[4] |
| | 1,4-Dichlorobenzene | 120[4] | 0.00044[4] |
| | 1,2-Dichloroethane (EDC) | 31[4] | 0.00012[4]/0.01[5] |
| | cis-1,2-Dichloroethene | 10,000[4] | 0.061[4] |
| | trans-1,2-Dichloroethene | 20,000[4] | 0.120[4] |
| | 1,1-Dichloroethane | 100,000[4] | 0.810[4]/0.025[5] |
| | 1,1-Dichloroethene (1,1-DCE) | 4.8[4] | 0.000044[4]/0.005[5] |
| | 1,2-Dichloropropane | 42[2] | 0.00016[4] |
| | cis-1,3 Dichloropropene | 16[4] | 0.000077[4] |
| | trans-1,3-Dichloropropene | NA[6] | NA[6] |
| | Ethyl benzene | 100,000[4] | 1.3[4]/0.75[5] |
| | 2-Hexanone | NA[6] | NA[6] |

**TABLE 1-1: PHASE I ACTION LEVELS APPLICABLE AT HOLLOMAN AFB (Cont.)**

| METHOD | PARAMETER | SOIL CONCENTRATION (mg/kg) | GROUNDWATER CONCENTRATION (mg/L) |
|---|---|---|---|
| EPA Method 8240: Volatile Organic Compounds (Continued) | Methylene chloride | 380[4] | 0.0041[4]/0.1[5] |
| | 2-Butanone (methyl ethyl ketone) | 610,000[4] | 1.9[4] |
| | 4-Methyl-2-pentanone (methy lisobutyl ketone) | 82,000[4] | 2.9[4] |
| | Styrene | 200,000[4] | 1.6[4] |
| | 1,1,2,2-Tetrachloroethane | 14[4] | 0.000052[4]/0.01[5] |
| | Tetrachloroethene (PCE) | 55[4] | 0.0011[4]/0.02[5] |
| | Toluene | 200,000[4] | 0.750[5] |
| | Tribromomethane (Bromoform) | 360[4] | 0.0024[4] |
| | 1,1,1-Trichloroethane | 92,000[4] | 1.3[4]/0.06[5] |
| | 1,1,2-Trichloroethane (1,1,2-TCA) | 50[4] | 0.01[5] |
| | Trichloroethene (TCE) | 260[4] | 0.0016[4] |
| | Vinyl acetate | 1,000,000[4] | 37[4] |
| | Vinyl chloride | 1.5[4] | 0.000019[4]/0.0001[5] |
| | Xylenes (total) | 1,000,000[4] | 1.4[4]/0.62[5] |
| EPA 6010/7000 series Target Analyte List (TAL) Metals | Aluminum | 8,764.4972[3] | 5.0[5] |
| | Antimony | 7.2844[3] | 0.0896[3] |
| | Arsenic | 6.8833[3] | 0.0723[3]/0.1[5] |
| | Barium | 84.3632[3] | 0.52[3]/1.0[5] |
| | Beryllium | 0.4000[3] | 0.0038[3] |
| | Cadmium | 1.0359[3] | 0.0083[3]/0.01[5] |
| | Chromium (total) | 6.6049[3] | 0.2340[3]/0.05[5] |
| | Cobalt | 2.4852[3] | 0.0200[3]/0.05[5] |
| | Copper | 4.8438[3] | 0.0386[3]/1.0[5] |
| | Cyanide | NA | 0.2[5] |
| | Iron | 6,361.6519[3] | 1.0[5] |

**TABLE 1-1: PHASE I ACTION LEVELS APPLICABLE AT HOLLOMAN AFB (Cont.)**

| METHOD | PARAMETER | SOIL CONCENTRATION (mg/kg) | GROUNDWATER CONCENTRATION (mg/L) |
|---|---|---|---|
| EPA 6010/7000 series Target Analyte List (TAL) Metals (Continued) | Lead | 2.3221[3] | 0.0199[3]/0.05[5] |
| | Magnesium | 14,656.3132[3] | NA |
| | Manganese | 146.9104[3] | 0.2[5] |
| | Mercury | 0.0006[3] | 0.00003[3]/0.002[5] |
| | Nickel | 5.6125[3] | 0.0436[3]/0.2[5] |
| | Potassium | 2,501.3873[3] | NA |
| | Silver | 0.7342[3] | 0.0073[3]/0.05[5] |
| | Sodium | 5,000.0000[3] | NA |
| | Thallium | 11.3153[3] | 0.0050[3] |
| | Vanadium | 15.4597[3] | 0.4344[3] |
| | Zinc | 20.2464[3] | 0.2534[3]/10.0[5] |
| SW 9040/9045 | pH | 6 to 9[3] | 6 to 9[5] |

[1] NMED USTB Correspondence to Holloman AFB, dated November 2, 1992

[2] NMED USTB Correspondence to Holloman AFB, dated January 25, 1993.

[3] *Basewide Background Study for Holloman AFB* (Radian, 1993).

[4] EPA Region III, Risk-Based Concentrations (EPA Region III, November 8, 1994).

[5] New Mexico Water Quality Control Commission (WQCC) Regulations, August 18, 1991, Standards For Groundwater of 10,000 mg/L TDS Concentration Or Less.

[6] NA - Not applicable, no action level established.

mg/kg milligrams per kilogram.

mg/l milligrams per liter.

*1.3.2.3* ***Phase II site investigations.*** Phase II activities may be comprised of additional soil and groundwater sampling using a DPT rig and installation of groundwater monitoring wells. Sample and well locations will be based on the results of the Phase I SI. All groundwater samples collected using DPT techniques will be analyzed for TPH by modified EPA Method 8015 and VOCs by EPA Method 8240 using a mobile laboratory capable of providing Level III data quality. Metal analyses will be conducted at an off-site fixed laboratory via EPA Method 6010/7000 series. All soil samples and monitoring well groundwater samples will be submitted to an off-site fixed laboratory. These samples will also be analyzed to Level III data quality objectives. The samples will be analyzed for the laboratory methods defined above in Section 1.3.2.1. If Phase I results show that certain contaminants are not present, the analytes will be restricted to only those contaminants detected in the Phase I activities.

## 1.4 Health and Safety

All investigative activities at Holloman AFB will be conducted in accordance with the Site Safety and Health Plan (SSHP) prepared for this project. The SSHP is an independent document which outlines the health and safety procedures which will govern site activities. All contractor and subcontractor employees will review and sign the plan before conducting any on-site activities.

# 2.0 SITE DESCRIPTION AND SAMPLING PLAN

## 2.1 Site SS-06 - JP-4 Fuel Line Spill Site No. 2

### *2.1.1 Site Description*

Site SS-06 is located along the eastern boundary of the Base, in the main Base area near Building 1254. The site is situated approximately 200 feet south of the petroleum, oils, and lubricants (POL) storage area. The location of the site is illustrated in Figure 1-2. Relevant site features are shown in Figure 2-1.

In 1979, a Base road grader operating in the area ruptured the JP-4 fuel line which services the POL storage area. Approximately 8,000 gallons of JP-4 spilled onto the ground before the fuel flow could be stopped. Clean-up operations were initiated immediately and the majority of the fuel was reportedly recovered. The spill was situated approximately 500 feet from both the Base boundary and from the nearest drainage ditch.

A PA was conducted for the site in 1983. The site was not considered to present a significant concern or adverse effect on human health or the environment. No other investigative work has been performed at the site.

### *2.1.2 Sampling Plan*

As discussed in Section 1.3.2, it is assumed that only Phase I SI activities will be conducted at Site SS-06. The following activities will be conducted at this site: a soil gas survey and soil and groundwater sampling using a DPT rig. Locations of the soil and groundwater samples will be determined on the basis of known site conditions and the results of the soil gas survey. In addition, all sample locations shall be approved by the USACE project geologist. The proposed layout of the soil gas survey is depicted in Figure 2-1. Soil and groundwater samples will be collected to assess the potential for JP-4 fuel contamination. Samples will be analyzed for TPH, metals, and VOCs. The proposed Phase I sampling plan is summarized in Table 2-1.

Depth to groundwater is assumed to be 8 feet below grade. Target sample collection depths will be adjusted by the field task manager, dependent on actual depth to groundwater at the site.

All chemical analyses for organic hydrocarbons (i.e., EPA Methods 8015 and 8240) will be conducted by a mobile field laboratory capable of producing data of Level III data quality. Soil and groundwater samples will be submitted to an off-site fixed laboratory for TAL metals analyses. The following quality assurance/quality control (QA/QC) samples will be collected: one duplicate/split sample for each analytical method will be analyzed at the contractor's laboratories; and one duplicate sample will be sent to the USACE Missouri River Division (MRD) Laboratory. Sufficient aliquots of sample will also be collected for use as matrix spike (MS) and matrix spike duplicate (MSD) samples. These samples will be determined by the field task manager. All samples collected for geotechnical laboratory analyses will be sent to an off-site fixed laboratory. A summary of all the soil and groundwater samples to be collected at Site SS-06 are presented in Table 2-2.

**TABLE 2-1: PHASE I SITE INVESTIGATION SAMPLING PLAN, SITE SS-06, HOLLOMAN AFB, NM**

| SOIL GAS SURVEY | | | | |
|---|---|---|---|---|
| AREA | NO. OF SURVEY LOCATIONS | TARGET DEPTH (ft below grade) | TARGET COMPOUNDS | ANALYTICAL METHOD |
| 150 FT X 400 FT | 36 | 4-6 | TPH/BTEX | 8015 |
| **SOIL SAMPLE COLLECTION** | | | | |
| NO. OF SAMPLE LOCATIONS | NO. OF SAMPLES COLLECTED AND ANALYZED PER LOCATION | TARGET DEPTHS (ft below grade) | TARGET COMPOUNDS | ANALYTICAL METHOD |
| 6 | 3 | 0.5 - 2.5<br>3 - 5<br>6 - 8 | Total VOCs in Headspace | Organic vapor in headspace (SOP A-7, Appendix A) |
| | 2 | 2 samples with highest VOC concentration per boring, if no readings, then shallow and deep samples selected | TPH | modified EPA Method 8015 |
| | 2 | Same as above | VOCs | EPA Method 8240 |
| | 2 | Same as above | TAL Metals | EPA Method 6010/7000 Series |
| | 1 | 6 - 8 (just above water table) and from other representative lithologies | Grain size | ASTM Standard D421-85 and D422-63 |
| | 0-1 | Same as above | Atterberg Limits | ASTM Standard D4318-93 |
| | 1 | Same as above | Moisture Content | ASTM Standard D2216-80 |
| **GROUNDWATER SAMPLES** | | | | |
| NO. OF SAMPLE LOCATIONS | NO. OF SAMPLES COLLECTED AND ANALYZED PER LOCATION | TARGET DEPTHS (ft below grade) | TARGET COMPOUNDS | ANALYTICAL METHOD |
| 6 | 1 | 10-12 (2 ft below water table) | VOCs | EPA Method 8240 |
| | 1 | Same as above | TAL Metals | EPA Method 6010/7000 Series |

**TABLE 2-2: SUMMARY OF SOIL AND GROUNDWATER ANALYSES, PHASE I SITE INVESTIGATION SITE SS-06, HOLLOMAN AFB, NM**

| TYPE OF LABORATORY | PARAMETER/ANALYTICAL METHOD | NO. OF FIELD SAMPLES | QUALITY CONTROL SAMPLES | QUALITY ASSURANCE SAMPLES |
|---|---|---|---|---|
| **SOIL SAMPLES** | | | | |
| Mobile | TPH (modified EPA Method 8015) | 12 | 1 duplicate | 1 duplicate |
| Mobile | VOC (EPA Method 8240) | 12 | 1 duplicate | 1 duplicate |
| Fixed | TAL Metals (EPA Methods 6010 & 7000) | 12 | 1 duplicate | 1 duplicate |
| Fixed | Grain Size (ASTM Standards D421-85 and D422-63) | 6 | 0 | 0 |
| Fixed | Atterberg (ASTM Standard D4318-93) | 6 | 0 | 0 |
| Fixed | Moisture Content (ASTM Standard D2216-80) | 6 | 0 | 0 |
| **GROUNDWATER SAMPLES** | | | | |
| Mobile | VOC (EPA Method 8240) | 6 | 1 duplicate | 1 duplicate |
| Fixed | TAL Metals (EPA Methods 6010/7000 series) | 6 | 1 duplicate | 1 duplicate |

## 2.2 Site SD-15 - Refrigeration/Heat Shop Washrack

### *2.2.1 Site Description*

Site SD-15, the Refrigeration/Heat Shop Washrack, is located in the Civil Engineering Complex (Figure 2-2). From 1971 to 1981, a sulfuric acid solution was utilized to de-scale cooling equipment. The rinsewater was discharged to a septic tank drainfield source. The washrack is located 2,200 feet from the Base boundary and less than 25 feet from the nearest surface drainage ditch. Site SD-15 is also identified as SWMU 82.

A PA was conducted for the site in 1983. No other investigative work has been performed at the site. However, the oil-water separator at the Refrigeration/Heat Shop is being investigated as part of the Table 3 Resource Conservation and Recovery Act of 1976 (RCRA) Facility Investigation (RFI). No investigation results were available at the time of plan preparation. If results are available prior to initiation of the proposed fieldwork, this data will be used to focus field activities.

### *2.2.2 Sampling Plan*

The purpose of the SI at SD-15 will be to assess the potential for soil and groundwater contamination from descaling solutions used during shop activities. Sulfuric acid is the primary constituent of concern. It is anticipated that both Phase I and Phase II investigative activities will be conducted at Site SD-15. Specific investigative techniques to be conducted at this site during Phase I are soil sampling and groundwater sampling using a DPT rig. Proposed soil and groundwater sample locations are depicted in Figure 2-2. All sample locations shall be approved by the USACE project geologist. Soil and groundwater samples will be analyzed for metals, pH, VOCs, and TPH.

The Phase II activities will only be conducted if the real-time laboratory results from Phase I indicate contaminants are present above Phase I response levels (Table 1-1). Phase II investigative activities will be initiated to characterize and define the extent of the contamination. If warranted, additional soil and groundwater samples will be

collected using a DPT rig and four groundwater monitoring wells will be installed and sampled.

Details concerning the proposed Phase I and Phase II sampling activities are summarized in Table 2-3. Sample target depths assume depth to groundwater is 6 feet below grade. Sample depths will be adjusted if groundwater is encountered at a different depth.

The following QA/QC samples will be collected: one duplicate/split sample will be collected for each analytical method for analysis at the contractor's laboratory, and one duplicate/split sample will be collected for each analytical method for analysis at the USACE MRD Laboratory. One trip blank will be prepared and analyzed for VOCs with the groundwater samples collected from the monitoring wells. A summary of soil and groundwater sample analyses planned for the Phase I and II SI at Site SD-15 is presented in Table 2-4.

During the Phase I sampling activities, soil and groundwater chemical analyses for VOCs, TPH, and pH will be conducted by a mobile laboratory. Metals analyses will be conducted in an off-site fixed laboratory. During Phase II activities, VOC, TPH, and pH analyses of the groundwater samples collected using a DPT rig will be analyzed in the mobile laboratory. The metals analyses for the groundwater samples, all soil samples, and the water samples collected from the monitoring wells will be analyzed at an off-site fixed laboratory.

Geotechnical samples will only be collected during the Phase I sampling activities. These samples will be submitted to an off-site fixed laboratory for analysis.

**TABLE 2-3: PHASE I AND II SI SAMPLING PLAN, SITE SD-15, HOLLOMAN AFB, NM**

| PHASE I SITE INVESTIGATION | | | | |
|---|---|---|---|---|
| **SOIL SAMPLE COLLECTION** | | | | |
| **NO. OF SAMPLE LOCATIONS** | **NO. OF SAMPLES COLLECTED AND ANALYZED PER LOCATION** | **TARGET DEPTHS (ft below grade)** | **TARGET COMPOUNDS** | **ANALYTICAL METHOD** |
| 6 | 2 | 1 - 3<br>4 - 6 | Total VOCs in Headspace | Organic vapor in headspace (SOP A-7, Appendix A) |
| | 2 | Same as above | TPH | modified EPA Method 8015 |
| | 2 | Same as above | VOCs | EPA Method 8240 |
| | 2 | Same as above | TAL Metals | EPA Method 6010/7000 Series |
| | 1 | 4 - 6 (just above water table) and from other representative lithologies | Grain size | ASTM Standard D421-85 and D422-63 |
| | 0-1 | Same as above | Atterberg Limits | ASTM Standard D4318-93 |
| | 1 | Same as above | Moisture Content | ASTM Standard D2216-80 |
| **GROUNDWATER SAMPLES** | | | | |
| **NO. OF SAMPLE LOCATIONS** | **NO. OF SAMPLES COLLECTED AND ANALYZED PER LOCATION** | **TARGET DEPTHS (ft below grade)** | **TARGET COMPOUNDS** | **ANALYTICAL METHOD** |
| 6 | 1 | 8-10 (2 ft below water table) | VOCs | EPA Method 8240 |
| | 1 | Same as above | pH | SW 9040/9045 |
| | 1 | Same as above | TAL Metals | EPA Method 6010/7000 Series |

**TABLE 2-3: PHASE I AND II SI SAMPLING PLAN, SITE SD-15, HOLLOMAN AFB, NM (cont.)**

| PHASE II SITE INVESTIGATION | | | | |
|---|---|---|---|---|
| **SOIL SAMPLE COLLECTION** | | | | |
| **NO. OF SAMPLE LOCATIONS** | **NO. OF SAMPLES COLLECTED AND ANALYZED PER LOCATION** | **TARGET DEPTHS (ft below grade)** | **TARGET COMPOUNDS** | **ANALYTICAL METHOD** |
| 5 | 2 | 1 - 3<br>4 - 6 | Total VOCs in Headspace | Organic vapor in headspace (SOP A-7, Appendix A) |
| | 2 | Same as above | TPH | modified EPA Method 8015 |
| | 2 | Same as above | VOCs | EPA Method 8240 |
| | 2 | Same as above | TAL Metals | EPA Method 6010/7000 Series |
| **GROUNDWATER SAMPLES (DPT Samples)** | | | | |
| **NO. OF SAMPLE LOCATIONS** | **NO. OF SAMPLES COLLECTED AND ANALYZED PER LOCATION** | **TARGET DEPTHS (ft below grade)** | **TARGET COMPOUNDS** | **ANALYTICAL METHOD** |
| 5 | 1 | 8-10 (2 ft below water table) | VOCs | EPA Method 8240 |
| | 1 | Same as above | TAL Metals | EPA Method 6010/7000 Series |
| **MONITORING WELL GROUNDWATER SAMPLES** | | | | |
| **NO. OF SAMPLE LOCATIONS** | **NO. OF SAMPLES COLLECTED AND ANALYZED PER LOCATION** | **TARGET DEPTHS (ft below grade)** | **TARGET COMPOUNDS** | **ANALYTICAL METHOD** |
| 4 | 1 | 8-10 (2 ft below water table) | VOCs | EPA Method 8240 |
| | 1 | Same as above | TAL Metals | EPA Method 6010/7000 Series |

**TABLE 2-4: SUMMARY OF SOIL AND GROUNDWATER ANALYSES, PHASE I AND II SITE INVESTIGATION SITE SD-15, HOLLOMAN AFB, NM**

| TYPE OF LABORATORY | PARAMETER | NO. OF FIELD SAMPLES | QUALITY CONTROL SAMPLES | QUALITY ASSURANCE SAMPLES |
|---|---|---|---|---|
| **PHASE I SITE INVESTIGATION** | | | | |
| **SOIL SAMPLES** | | | | |
| Mobile | TPH (modified EPA Method 8015) | 12 | 1 duplicate | 1 duplicate |
| Mobile | VOC (EPA Method 8240) | 12 | 1 duplicate | 1 duplicate |
| Fixed | TAL Metals (EPA Methods 6010/ 7000 series) | 12 | 1 duplicate | 1 duplicate |
| Mobile | pH (SW 9040/9045) | 12 | 1 duplicate | 0 |
| Fixed | Grain size (D421-85 and D422-63) | 6 | 0 | 0 |
| Fixed | Atterberg (ASTM Standard D4318-84) | 6 | 0 | 0 |
| Fixed | Moisture Content (ASTM Standard D2216-80) | 6 | 0 | 0 |
| **GROUNDWATER SAMPLES (DPT SAMPLES)** | | | | |
| Mobile | VOC (EPA Method 8240) | 6 | 1 duplicate | 1 duplicate |
| Fixed | TAL Metals (EPA Methods 6010/7000 series) | 6 | 1 duplicate | 1 duplicate |
| Mobile | pH (SW 9040/9045) | 6 | 1 duplicate | 0 |
| **PHASE II SITE INVESTIGATION** | | | | |
| **SOIL SAMPLES** | | | | |
| Fixed | TPH (modified EPA Method 8015) | 10 | 1 duplicate | 1 duplicate |
| Fixed | VOC (EPA Method 8240) | 10 | 1 duplicate | 1 duplicate |
| Fixed | TAL Metals (EPA Methods 6010/7000 series) | 10 | 1 duplicate | 1 duplicate |

**TABLE 2-4: SUMMARY OF SOIL AND GROUNDWATER ANALYSES, PHASE I AND II SITE INVESTIGATION SITE SD-15, HOLLOMAN AFB, NM (Cont.)**

| TYPE OF LABORATORY | PARAMETER | NO. OF FIELD SAMPLES | QUALITY CONTROL SAMPLES | QUALITY ASSURANCE SAMPLES |
|---|---|---|---|---|
| GROUNDWATER SAMPLES (DPT SAMPLES) | | | | |
| Mobile | VOC (EPA Method 8240) | 5 | 0 | 0 |
| Fixed | TAL Metals (EPA Methods 6010/7000 series) | 5 | 0 | 0 |
| MONITORING WELL GROUNDWATER SAMPLES | | | | |
| Fixed | VOC (EPA Method 8240) | 4 | 1 duplicate<br>1 trip blank | 1 duplicate |
| Fixed | TAL Metals (EPA Methods 6010/7000 series) | 4 | 1 duplicate | 1 duplicate |

## 2.3 AOC-BBMS - Bare Base Mobility Squadron/Generator Run-up Area

### *2.3.1 Site Description*

AOC-BBMS is located in the southwestern area of the Base. In 1984, a valve at the generator run-up area was inadvertently left open. Approximately 2,000 to 3,000 gallons of JP-4 spilled onto the ground. Reportedly, only 250 to 300 gallons of fuel were recovered. No investigations have been conducted in this area. A PA and a SI will be conducted at this site.

### *2.3.2 Sampling Plan*

AOC-BBMS will be investigated to assess the potential for JP-4 contamination in soil and groundwater. It is anticipated that both Phase I and Phase II investigations will be conducted at this site. The Phase I SI will consist of a soil gas survey and soil and groundwater sampling using a DPT rig. Proposed soil gas survey locations are depicted in Figure 2-3. Soil and groundwater sample locations will be determined using the results of the soil gas survey. All sample locations shall be approved by the USACE project geologist. Soil and groundwater samples will be analyzed for VOCs, metals, and TPH.

The Phase II SI will only be conducted if the real-time laboratory results from Phase I indicate contaminants are present above Phase I response levels (Table 1-1). Phase II investigative activities will be performed to define the nature and extent of contamination. If warranted, additional soil and groundwater samples will be collected using a DPT rig, and four groundwater monitoring wells will be installed and sampled.

The proposed Phase I and Phase II sampling plan is summarized in Table 2-5. Sample target depths assume depth to groundwater is 10 feet below grade. Sample depths will be adjusted if groundwater is encountered at a different depth.

The following QA/QC samples will be collected: one duplicate/split sample will be collected for each analytical method for analysis at the contractor's laboratory, and one duplicate/split

sample will be collected for each analytical method for analysis at the USACE MRD Laboratory. One trip blank will be prepared and analyzed with the groundwater samples collected from the monitoring wells for analysis of VOCs. A summary of soil and groundwater sample analyses planned for the Phase I and II SI at Site AOC-BBMS is presented in Table 2-6.

During the Phase I sampling activities, soil and groundwater chemical analyses for VOCs and TPH will be conducted by a mobile laboratory. Metals analyses will be conducted at an off-site fixed laboratory. During Phase II activities, VOC and TPH analyses of the groundwater samples collected using a DPT rig will be analyzed in the mobile laboratory. The metals analyses for the groundwater samples, all soil samples, and the water samples collected from the monitoring wells will be analyzed at an off-site fixed laboratory.

Geotechnical samples will only be collected during the Phase I sampling activities. These samples will be submitted to an off-site fixed laboratory for analysis.

**TABLE 2-5: PHASE I AND II SITE INVESTIGATION SAMPLING PLAN, AOC-BBMS, HOLLOMAN AFB, NM**

| PHASE I SITE INVESTIGATION | | | | |
|---|---|---|---|---|
| **SOIL GAS SURVEY** | | | | |
| **AREA** | **NO. OF SURVEY LOCATIONS** | **TARGET DEPTH (ft below grade)** | **TARGET COMPOUNDS** | **ANALYTICAL METHOD** |
| 100 FT X 300 FT | 24 | 6-8 | TPH/BTEX | 8015 |
| **SOIL SAMPLE COLLECTION** | | | | |
| **NO. OF SAMPLE LOCATIONS** | **NO. OF SAMPLES COLLECTED AND ANALYZED PER LOCATION** | **TARGET DEPTHS (ft below grade)** | **TARGET COMPOUNDS** | **ANALYTICAL METHOD** |
| 6 | 4 | 0.5 - 2.5<br>3 - 5<br>5.5 - 7.5<br>8 - 10 | Total VOCs in Headspace | Organic vapor in headspace (SOP A-7, Appendix A) |
| | 2 | 2 samples with highest VOC concentration per boring, if no readings then shallow and deep samples selected | TPH | modified EPA Method 8015 |
| | 2 | Same as above | VOCs | EPA Method 8240 |
| | 2 | Same as above | TAL Metals | EPA Method 6010/7000 Series |
| | 1 | 8 - 10 (just above water table) and from other representative lithologies | Grain size | ASTM Standard D421-85 and D422-63 |
| | 0-1 | Same as above | Atterberg Limits | ASTM Standard D4318-93 |
| | 1 | Same as above | Moisture Content | ASTM Standard D2216-80 |
| **GROUNDWATER SAMPLES** | | | | |
| **NO. OF SAMPLE LOCATIONS** | **NO. OF SAMPLES COLLECTED AND ANALYZED PER LOCATION** | **TARGET DEPTHS (ft below grade)** | **TARGET COMPOUNDS** | **ANALYTICAL METHOD** |
| 6 | 1 | 12-14 (2 ft below water table) | VOCs | EPA Method 8240 |
| | 1 | Same as above | TAL Metals | EPA Method 6010/7000 Series |

**TABLE 2-5: PHASE I AND II SITE INVESTIGATION SAMPLING PLAN, AOC-BBMS, HOLLOMAN AFB, NM (Cont.)**

| PHASE II SITE INVESTIGATION | | | | |
|---|---|---|---|---|
| **SOIL SAMPLE COLLECTION** | | | | |
| **NO. OF SAMPLE LOCATIONS** | **NO. OF SAMPLES COLLECTED AND ANALYZED PER LOCATION** | **TARGET DEPTHS (ft below grade)** | **TARGET COMPOUNDS** | **ANALYTICAL METHOD** |
| 5 | 4 | 0.5 - 2.5<br>3 - 5<br>5.5 - 7.5<br>8 - 10 | Total VOCs in Headspace | Organic vapor in headspace (SOP A-7, Appendix A) |
| | 2 | 2 samples with highest VOC concentration per boring, if no readings then shallow and deep samples selected | TPH | modified EPA Method 8015 |
| | 2 | Same as above | VOCs | EPA Method 8240 |
| | 2 | Same as above | TAL Metals | EPA Method 6010/7000 Series |
| **GROUNDWATER SAMPLES (DPT Samples)** | | | | |
| **NO. OF SAMPLE LOCATIONS** | **NO. OF SAMPLES COLLECTED AND ANALYZED PER LOCATION** | **TARGET DEPTHS (ft below grade)** | **TARGET COMPOUNDS** | **ANALYTICAL METHOD** |
| 5 | 1 | 10-12 (2 ft below water table) | VOCs | EPA Method 8240 |
| | 1 | Same as above | TAL Metals | EPA Method 6010/7000 Series |
| **MONITORING WELL GROUNDWATER SAMPLES** | | | | |
| **NO. OF SAMPLE LOCATIONS** | **NO. OF SAMPLES COLLECTED AND ANALYZED PER LOCATION** | **TARGET DEPTHS (ft below grade)** | **TARGET COMPOUNDS** | **ANALYTICAL METHOD** |
| 4 | 1 | 10-12 (2 ft below water table) | VOCs | EPA Method 8240 |
| | 1 | Same as above | TAL Metals | EPA Method 6010/7000 Series |

**TABLE 2-6: SUMMARY OF SOIL AND GROUNDWATER ANALYSES, PHASE I AND II SITE INVESTIGATION, AOC-BBMS, HOLLOMAN AFB, NM**

| TYPE OF LABORATORY | PARAMETER | NO. OF FIELD SAMPLES | QUALITY CONTROL SAMPLES | QUALITY ASSURANCE SAMPLES |
|---|---|---|---|---|
| **PHASE I SITE INVESTIGATION** | | | | |
| **SOIL SAMPLES** | | | | |
| Mobile | TPH (modified EPA Method 8015) | 12 | 1 duplicate | 1 duplicate |
| Mobile | VOC (EPA Method 8240) | 12 | 1 duplicate | 1 duplicate |
| Fixed | TAL Metals (EPA Method 6010 & 7000) | 12 | 1 duplicate | 1 duplicate |
| Fixed | Grain size (D424-85 and D422-63) | 6 | 0 | 0 |
| Fixed | Atterberg (ASTM Standard D4318-93) | 6 | 0 | 0 |
| Fixed | Moisture Content (ASTM Standard D2216-80) | 6 | 0 | 0 |
| **GROUNDWATER SAMPLES** | | | | |
| Mobile | VOC (EPA Method 8240) | 6 | 1 duplicate | 1 duplicate |
| Fixed | TAL Metals (EPA Method 6010 & 7000) | 6 | 1 duplicate | 1 duplicate |
| **PHASE II SITE INVESTIGATION** | | | | |
| **SOIL SAMPLES** | | | | |
| Fixed | TPH (modified EPA Method 8015) | 10 | 1 duplicate | 1 duplicate |
| Fixed | VOC (EPA Method 8240) | 10 | 1 duplicate | 1 duplicate |
| Fixed | TAL Metals (EPA Method 6010 & 7000) | 10 | 1 duplicate | 1 duplicate |
| **GROUNDWATER SAMPLES (DPT SAMPLES)** | | | | |
| Mobile | VOC (EPA Method 8240) | 5 | 1 duplicate | 1 duplicate |
| Fixed | TAL Metals (EPA Methods 6010 & 7000) | 5 | 1 duplicate | 1 duplicate |

**TABLE 2-6: SUMMARY OF SOIL AND GROUNDWATER ANALYSES, PHASE I AND II SITE INVESTIGATION, AOC-BBMS, HOLLOMAN AFB, NM (Cont.)**

| TYPE OF LABORATORY | PARAMETER | NO. OF FIELD SAMPLES | QUALITY CONTROL SAMPLES | QUALITY ASSURANCE SAMPLES |
|---|---|---|---|---|
| MONITORING WELL GROUNDWATER SAMPLES | | | | |
| Fixed | VOC (EPA Method 8240) | 4 | 1 duplicate<br>1 trip blank | 1 duplicate |
| Fixed | TAL Metals (EPA Methods 6010 & 7000) | 4 | 1 duplicate | 1 duplicate |

## 2.4 AOC-RR - Building 80

### *2.4.1 Site Description*

Site AOC-RR is located approximately 50 to 100 feet west of IRP Site SD-08, near the eastern boundary of the Base (Figure 2-4). The site comprises approximately one-half acre which formerly contained three underground storage tanks (USTs) of unknown capacity used for storage of POL. According to Base personnel, in the 1970s and early 1980s the tanks stored "golden bear oil" which was used as a dust suppressant. The tanks were reportedly removed in the mid 1980s; however, available information is inconclusive. Mounded soil is present in the former tank area. Discussions with various Base personnel indicate the material stored in the tanks was not an oil, but a water-soluble dust suppressant. Field inspection of the area in November 1994 revealed two 2-inch diameter steel pipes sticking out of the ground in the mounded area.

Site AOC-RR also consists of Building 80 which has been used as a shop for locomotive repair. A former repair pit that was 52 feet long was located within Building 80. The pit was used to access the bottom of locomotives. The pit was filled and capped with concrete in 1993. Historical drawings of the pit indicate that an open bottom french drain was used to drain fluids that collected at the bottom. No information was provided regarding the liquid wastes generated during the repair of the locomotives (believed to occur from the 1950s to early 1980s).

During the 1991 RI conducted by Radian Corporation at Site SD-08, elevated levels of benzene and ethylbenzene were detected in monitoring well MW-08-01, located upgradient of Site SD-08, and 100 feet downgradient of the former UST area (Radian, 1992). The two areas that comprise AOC-RR are considered potential sources for the detected benzene and ethyl benzene at Site SD-08.

### *2.4.2 Sampling Plan*

AOC-RR will be investigated to assess the potential for POL and other potential contaminants in soil and groundwater. It is anticipated that both Phase I and Phase II investigations will be conducted. The Phase I SI will consist of a soil gas survey and soil and groundwater sampling using a DPT rig. Proposed soil gas survey locations are depicted in Figure 2-4. Soil and groundwater sample locations will be determined using the results of the soil gas survey. All sample locations shall be approved by the USACE project geologist. Soil and groundwater samples will be analyzed for VOCs, metals, and TPH.

The Phase II SI will only be conducted if the real-time laboratory results from Phase I indicate contaminants are present above Phase I response levels (Table 1-1). Phase II investigative activities will be performed to define the nature and extent of contamination. If warranted, additional soil and groundwater samples will be collected using a DPT rig and up to eight groundwater monitoring wells will be installed and sampled.

The proposed Phase I and Phase II sampling plan is summarized in Table 2-7. Sample target depths assume depth to groundwater is 8 feet below grade. Sample depths will be adjusted if groundwater is encountered at a different depth.

The following QA/QC samples will be collected: one duplicate/split sample will be collected for each analytical method for analysis at the contractor's laboratory, and one duplicate/split sample will be collected for each analytical method for analysis at the USACE MRD Laboratory. One trip blank will be prepared and analyzed with the groundwater samples collected from the monitoring wells for analysis of VOCs. A summary of soil and groundwater sample analyses planned for the Phase I and II SI at Site AOC-RR is presented in Table 2-8.

During the Phase I sampling activities, soil and groundwater chemical analyses for VOCs and TPH will be conducted by a mobile laboratory. Metals analyses will be conducted in an off-site fixed laboratory. During Phase II activities, VOC and TPH analyses of the groundwater samples collected using a DPT rig will be analyzed in the mobile laboratory. The metals analyses for the groundwater samples, all soil samples, and the water samples collected from the monitoring wells will be analyzed at an off-site fixed laboratory.

Geotechnical samples will only be collected during the Phase I sampling activities. These samples will be submitted to an off-site fixed laboratory for analysis.

**TABLE 2-7: PHASE I AND II SITE INVESTIGATION SAMPLING PLAN, AOC-RR, HOLLOMAN AFB, NM**

| PHASE I SITE INVESTIGATION | | | | |
|---|---|---|---|---|
| **SOIL GAS SURVEY** | | | | |
| **AREA** | **NO. OF SURVEY LOCATIONS** | **TARGET DEPTH (ft below grade)** | **TARGET COMPOUNDS** | **ANALYTICAL METHOD** |
| 150 FT X 200 FT | 30 | 4-6 | TPH/BTEX | 8015 |
| **SOIL SAMPLE COLLECTION** | | | | |
| **NO. OF SAMPLE LOCATIONS** | **NO. OF SAMPLES COLLECTED AND ANALYZED PER LOCATION** | **TARGET DEPTHS (ft below grade)** | **TARGET COMPOUNDS** | **ANALYTICAL METHOD** |
| 6 | 3 | 0.5 - 2.5<br>3 - 5<br>6 - 8 | Total VOCs in Headspace | Organic vapor in headspace (SOP A-7, Appendix A) |
| | 2 | 2 samples with highest VOC concentration per boring, if no readings then shallow and deep samples selected | TPH | modified EPA Method 8015 |
| | 2 | Same as above | VOCs | EPA Method 8240 |
| | 2 | Same as above | TAL Metals | EPA Method 6010/7000 Series |
| | 1 | 6 - 8 (just above water table) and from other representative lithologies | Grain size | ASTM Standard D421-85 and D422-63 |
| | 0-1 | Same as above | Atterberg Limits | ASTM Standard D4318-93 |
| | 1 | Same as above | Moisture Content | ASTM Standard D2216-80 |
| **GROUNDWATER SAMPLES** | | | | |
| **NO. OF SAMPLE LOCATIONS** | **NO. OF SAMPLES COLLECTED AND ANALYZED PER LOCATION** | **TARGET DEPTHS (ft below grade)** | **TARGET COMPOUNDS** | **ANALYTICAL METHOD** |
| 10 | 1 | 10-12 (2 ft below water table) | VOCs | EPA Method 8240 |
| | 1 | Same as above | TAL Metals | EPA Method 6010/7000 Series |

**TABLE 2-7: PHASE I AND II SITE INVESTIGATION SAMPLING PLAN, AOC-RR, HOLLOMAN AFB, NM (Cont.)**

| PHASE II SITE INVESTIGATION | | | | |
|---|---|---|---|---|
| **SOIL SAMPLE COLLECTION** | | | | |
| **NO. OF SAMPLE LOCATIONS** | **NO. OF SAMPLES COLLECTED AND ANALYZED PER LOCATION** | **TARGET DEPTHS (ft below grade)** | **TARGET COMPOUNDS** | **ANALYTICAL METHOD** |
| 5 | 3 | 0.5 - 2.5<br>3 - 5<br>6 - 8 | Total VOCs in Headspace | Organic vapor in headspace (SOP A-7, Appendix A) |
| | 2 | 2 samples with highest VOC concentration per boring, if no readings then shallow and deep samples selected | TPH | modified EPA Method 8015 |
| | 2 | Same as above | VOCs | EPA Method 8240 |
| | 2 | Same as above | TAL Metals | EPA Method 6010/7000 Series |
| **GROUNDWATER SAMPLES (DPT Samples)** | | | | |
| **NO. OF SAMPLE LOCATIONS** | **NO. OF SAMPLES COLLECTED AND ANALYZED PER LOCATION** | **TARGET DEPTHS (ft below grade)** | **TARGET COMPOUNDS** | **ANALYTICAL METHOD** |
| 5 | 1 | 10-12 (2 ft below water table) | VOCs | EPA Method 8240 |
| | 1 | Same as above | TAL Metals | EPA Method 6010/7000 Series |
| **MONITORING WELL GROUNDWATER SAMPLES** | | | | |
| **NO. OF SAMPLE LOCATIONS** | **NO. OF SAMPLES COLLECTED AND ANALYZED PER LOCATION** | **TARGET DEPTHS (ft below grade)** | **TARGET COMPOUNDS** | **ANALYTICAL METHOD** |
| 8 | 1 | 10-12 (2 ft below water table) | VOCs | EPA Method 8240 |
| | 1 | Same as above | TAL Metals | EPA Method 6010/7000 Series |

**TABLE 2-8: SUMMARY OF SOIL AND GROUNDWATER ANALYSES, PHASE I AND II SITE INVESTIGATION, AOC-RR, HOLLOMAN AFB, NM**

| TYPE OF LABORATORY | PARAMETER | NO. OF FIELD SAMPLES | QUALITY CONTROL SAMPLES | QUALITY ASSURANCE SAMPLES |
|---|---|---|---|---|
| **PHASE I SITE INVESTIGATION** | | | | |
| **SOIL SAMPLES** | | | | |
| Mobile | TPH (modified EPA Method 8015) | 12 | 1 duplicate | 1 duplicate |
| Mobile | VOC (EPA Method 8240) | 12 | 1 duplicate | 1 duplicate |
| Fixed | TAL Metals (EPA Method 6010 & 7000) | 12 | 1 duplicate | 1 duplicate |
| Fixed | Grain size (D424-85 and D422-63) | 6 | 0 | 0 |
| Fixed | Atterberg (ASTM Standard D4318-93) | 6 | 0 | 0 |
| Fixed | Moisture Content (ASTM Standard D2216-80) | 6 | 0 | 0 |
| **GROUNDWATER SAMPLES** | | | | |
| Mobile | VOC (EPA Method 8240) | 6 | 1 duplicate | 1 duplicate |
| Fixed | TAL Metals (EPA Method 6010 & 7000) | 6 | 1 duplicate | 1 duplicate |
| **PHASE II SITE INVESTIGATION** | | | | |
| **SOIL SAMPLES** | | | | |
| Fixed | TPH (modified EPA Method 8015) | 10 | 1 duplicate | 1 duplicate |
| Fixed | VOC (EPA Method 8240) | 10 | 1 duplicate | 1 duplicate |
| Fixed | TAL Metals (EPA Method 6010 & 7000) | 10 | 1 duplicate | 1 duplicate |
| **GROUNDWATER SAMPLES** | | | | |
| Mobile | VOC (EPA Method 8240) | 5 | 1 duplicate | 1 duplicate |
| Fixed | TAL Metals (EPA Methods 6010 & 7000) | 5 | 1 duplicate | 1 duplicate |
| **MONITORING WELL GROUNDWATER SAMPLES** | | | | |
| Fixed | VOC (EPA Method 8240) | 8 | 1 duplicate<br>1 trip blank | 1 duplicate |
| Fixed | TAL Metals (EPA Methods 6010 & 7000) | 8 | 1 duplicate | 1 duplicate |

# 3.0 INVESTIGATION METHODS

This section provides descriptions and guidelines for the field methods and techniques that will be used in the PA/SI. This section also gives an overview of the field sampling program and its components.

In accordance with EPA guidance on performing PA/SIs, the field program was designed and techniques were chosen with the following criteria in mind:

- Ability to yield representative samples;
- Compatibility with analytical considerations;
- Minimal waste generation;
- Practicality;
- Simplicity and ease of operation; and
- Safety.

## 3.1 Sampling Locations and Rationale

Sample locations are specified by site within Section 2 of this FSP. The location and rationale for the soil gas survey, soil sampling, groundwater sampling program, and monitoring well installation program are specified below.

### *3.1.1 Soil Gas Survey*

For those sites where a soil gas survey is planned, the proposed sample grid spacing is 50 by 50 feet, placed over the area of investigation. Sample locations may be modified in the field based on site-specific constraints.

### *3.1.2 Soil Sample Locations*

During the Phase I and II SI, soil samples will be collected at six locations. The soil sample locations will be situated within the anticipated area of contamination as determined by the soil gas survey results, reported spill location, surface topography, and surface drainage. Should results of the real-time laboratory analyses prompt Phase II investigative activities, then an additional five soil sample locations will be selected to define the extent of contamination.

### *3.1.3 GeoProbe Groundwater Samples Collected with DPT Rig*

During Phase I investigative activities, three of the four sites (SS-06, SD-15, and AOC-BBMS) will have a total of six water samples collected in each area. These sampling points are to be installed as follows:

- One point - upgradient for background purposes;
- Two points - within the reported spill area; and
- Three points - located at "various" distances downgradient of the reported release.

The subsurface Phase I investigation at Site AOC-RR will entail collecting 10 groundwater samples. These points will be installed as follows:

- One point - upgradient for background purposes;
- Five points - within the reported spill area; and
- Four points - located at "various" distances downgradient of the reported release.

Orientation of these sample locations are to be determined from the soil gas and soil boring field screening results, and real-time mobile laboratory results of the water samples.

Should results of the real-time laboratory analyses prompt Phase II investigative activities, then an additional five groundwater samples will be collected at locations chosen to define the extent of contamination.

### *3.1.4 Monitoring Wells*

Monitoring wells will be installed during Phase II investigative activities. Should site conditions warrant installation of monitoring wells, four to eight wells will be installed as follows:

- One well - upgradient for background purposes;
- One to three wells - within the reported spill area; and
- Two to four wells - located at "various" distances downgradient of the reported release.

Final positions of these wells will be determined from the real-time laboratory data collected during both Phase I and Phase II activities.

## 3.2 Sample Numbering System

Each environmental sample collected is uniquely identified by both a field and laboratory sample identification number. The field number is assigned by the field task manager using an 11-to 16- character string of letters and numbers. For example, the field sample identification number SS0601SG3-5 represents:

SS06 Site SS-06 (other examples: SD15, AOCBBMS, and AOCRR);

01 for sample location (01, 02, 03, 04 etc.);

SG Method/media (SG = soil gas, SB = soil boring, GW = groundwater, MW = monitoring well, HA = hand auger); and

3-5 Depth in feet below grade.

The laboratory will assign a unique 10-character string of letters and numbers. For example, the laboratory sample identification number W4080001-01 signifies:

W4 for laboratory identifier;

08 for month received by number (08 - August);

0001 sample delivery group number; and

-01 sample number in the sample delivery group.

## 3.3 Sample Handling and Preservation Procedures

Documentation, sample handling, chain-of-custody, preservation, and shipping procedures are discussed in SOP A-1 in Appendix A.

## 3.4 Decontamination

Sample equipment decontamination procedures are discussed in SOP A-2 (Appendix A).

## 3.5 Sampling Methods

Soil and groundwater samples will be collected using DPT methods. DPT has been chosen because it provides an efficient approach to soil and groundwater sampling. The DPT method

entails hydraulically driving a narrow diameter rod to a desired sample depth, where either a soil or water sampling device can then collect the sample. This technology generates no soil cuttings and provides the ability to retrieve undisturbed samples for various chemical analysis. The only IDW associated with direct push sampling originates from excess sample and purge water. A standard hollow-stem auger (HSA) drilling technique will be used for borings that are slated to be converted to monitoring wells.

Before any subsurface sampling activity is conducted, staking and utility clearing will be done as described in SOP A-3 (Appendix A).

The following subsections present an overview of the sampling techniques and outline the procedures for obtaining soil gas, soil, and groundwater samples. For the level of detail necessary to properly complete the sampling, specific methodologies are presented in SOPs A-4 through A-8.

### *3.5.1 Soil Gas Survey*

Soil gas surveys will be conducted at Sites SS-06, AOC-BBMS, and AOC-RR. The soil gas surveys will be conducted using a mobile soil gas survey rig following the procedures discussed below SOP A-4, Appendix A. A clean 3/4- to 1.5-inch drill rod with a detachable sampling drive point will be hydraulically driven to the desired sampling depth. A soil gas sample will then be extracted from the sample point with a vacuum pump via polyethylene tubing. Two to five probe volumes will be evacuated before the sample is collected. Soil gas samples will be extracted from an adaptor at the top of the probe with a 10-milliliter glass syringe and immediately analyzed for total volatile hydrocarbons. Total petroleum hydrocarbons will be analyzed using gas chromatography with a photoionization detector or flame ionization detector. Results will be used to focus the soil sampling and groundwater sampling activities. Potential problems with an active soil gas survey may include the inability to extract sufficient soil gas due to decreased soil permeability following precipitation events or due to a shallow groundwater table in the low-permeability soil at Holloman AFB. If necessary, heated head-space analysis will be performed on soil samples collected with hand augers or through direct-push technology. Soil gas survey points will be surveyed with respect to locations (Appendix

A, SOP A-16), and the results will be utilized to locate soil and groundwater sample locations according to the rationale outlined in Subsections 3.2.1 and 3.13, respectively.

### *3.5.2 Soil Sampling*

Soil sampling will be completed with a DPT rig equipped with either a tube or split-spoon sampler. Both types of devices are attached to the drive rods and are hydraulically advanced to a desired sampling depth. The conical drive point is then retracted and the sampler is advanced through the target interval. The soil core is retrieved for logging and sampling by removing the drive rods and sampler.

The DPT procedure and specific soil sampling requirements are described in detail in SOPs A-5, A-6, A-7, and A-8.

### *3.5.3 Groundwater Sampling*

Using a DPT rig, water is collected directly from the aquifer after releasing the drive point and partially retracting the rods. Either a bailer or a peristaltic pump and Teflon[R] tubing will be inserted through the drive rods and used to retrieve the sample. Proprietary devices also exist that collect samples by inducing flow toward an evacuated chamber or through a screen point. Procedures for groundwater sampling are outlined in SOP A-9. A single volume of the sampling device will be purged prior to collection of the sample (i.e. one volume of Teflon tubing or one bailer volume). Sampling device specifications must be submitted by the DPT subcontractor for approval.

Situations may arise when the aquifer does not produce sufficient flow to immediately sample the groundwater. In these cases, a temporary polyvinyl chloride (PVC) well will be inserted and left in place while additional borings at the site are completed. The temporary well can then be sampled after sufficient recharge has occurred. Following sampling, the well will be completely removed from the ground and the borehole will be sealed in accordance with SOP A-15.

### *3.5.4 Monitoring Wells*

Monitoring wells will be completed with a HSA drilling rig equipped with a split-spoon sampler or continuous sampler. For monitor well installation, the well casing is installed through the augers and the well is completed concurrent with auger removal. SOP A-10 presents a detailed description of the HSA drilling technique. SOP A-11 outlines the methods for monitoring well installation. While SOP A-12 describes the methods for well development and SOP A-13 describes the procedures for collecting groundwater samples (Appendix A).

### *3.5.5 Preliminary Field Screening*

Preliminary screening at each site will consist of visual observations and organic vapor head-space analysis with a photoionization detector (PID) or a flame-ionization detector (FID). After a soil core is retrieved, the length of the core will be screened with a PID/FID, visible contamination will be noted, and a small portion of the soil will be screened by head-space analysis. This procedure is described in the soil sampling methodology detailed in SOP A-7, Appendix A.

Although target sampling depths have been identified for each site, preliminary screening is important to identify contamination in intervals between those depths that may otherwise be missed. Only the samples appearing most contaminated should be selected for further analysis. Every interval need not be sampled to determine nature and extent of contamination. Visual observations and head space screening will help reduce the number of samples that need to be further analyzed. The decision-making process that will be used to determine when a sample should be collected is presented in detail in Section 2.

### *3.5.6 Geologic Standards*

To achieve a consistent and accurate description of soils at each site, the unconsolidated material retrieved from each borehole will be classified and described following the Unified Soil Classification System. Color will be described using a Munsall color chart. At a minimum, a section of soil will be logged once from every 2-foot depth interval. The exact

length of the logged soil core will vary between 12 and 24 inches, depending on the recovery and specific type of sampling equipment used. Visible contamination, as evidenced by dark staining and/or oily texture, will be highlighted in the comments section of the logging forms.

To obtain more accurate characterization of soils, one geotechnical sample will be collected from all six soil borings situated within the area of contamination during the Phase I investigation activities. Each sample will be analyzed for grain size distribution (American Society for Testing and Materials [ASTM] D421 and ASTM D422), Atterberg Limits (ASTM D4318-93), and moisture content (ASTM D2216-80). The procedure for logging soil and collecting geotechnical samples, along with an example of the logging form, is presented in SOP A-8, Appendix A.

## 3.6 Sample Chain-of-Custody, Packing and Transportation

Sample chain-of-custody, packing, and transportation procedures are discussed in SOP A-1 in Appendix A.

## 3.7 Field Documentation

This section of the CDAP provides a comprehensive guide for field documentation activities. The goal of these documents is to provide a traceable record of the field events as they occur during sample collection and field analysis procedures. Field data will include the data record (field notebooks, Daily Quality Control Report [DQCR], etc.) and results of field analysis. The field task manager will maintain field records sufficient to re-create all sampling and measurement activities. The field task manager will complete the DQCR daily for submittal to the project manager.

### *3.7.1 Field Data Record*

A bound field notebook will be used to permanently record all field activities and general observations. Sample locations and sample types have been identified in this CDAP. All pages of the field notebook will be signed and dated by the supervising field task manager who

is entering the data. The names and affiliations of all visitors on site will be entered in the notebook. General notes on project progress, problems encountered, deviations from plans (with rationale), sketches of sample locations, and etc. will also be entered in the notebook.

Chain-of-custody documentation will be completed to document the chain of possession and track the samples through shipping, handling, and analysis.

A DQCR will be completed by the field task manager daily during field activities. Field screening results will be entered on the Field Data Screening Report (FDSR) as the data is collected in the field. A copy of this form is presented in Appendix B.

# 4.0 WASTE MANAGEMENT PROCEDURES

## 4.1 Introduction

Investigation-derived waste (IDW) generated during the field activities should be handled in accordance with State and Federal regulations. The procedures discussed in this FSP are a summary of the applicable components of the Waste Management Plan in effect at Holloman AFB (Radian, October 1993). The plan is provided in Appendix C. This section provides guidance for the site-specific waste management guidance for the field activities associated with the SI. Should the conditions encountered during the field activities indicate that hazardous waste has been generated, the procedures detailed in the existing Waste Management Plan (Appendix C) will be consulted and followed.

## 4.2 Waste Characterization

The IDW expected to be generated during the described field activities constitutes the waste from Criteria 1 and Criteria 2 sites. Criteria 1 sites represent sites that managed materials that are listed hazardous waste under 40CFR Part 261. Criteria 2 sites are those areas where either characteristically hazardous, or nonhazardous wastes have been managed. Table 4-1 provides an evaluation of the expected criteria classification of each of the four waste sites based on the PA information gathered thus far.

**TABLE 4-1: CRITERIA CLASSIFICATION FOR WASTE SITES**

| Site ID | Operation at Site | Chemical of Concern | Criteria |
|---|---|---|---|
| SS-06 | Fuel Line Spill onto ground surface | Jet Fuel (JP-4) | Criteria 2 |
| SD-15 | Refrigerator/Heat Shop Washrack used acid to descale cooling equipment | Acid and oil | Criteria 2 |
| AOC-BBMS | Fuel Line Spill onto ground surface | Jet Fuel (JP-4) | Criteria 2 |
| AOC-RR | A) Former tanks that stored "golden bear oil" used as a dust suppressant. | Unknown - Reportedly not POL | Possible Criteria 1, may be Criteria 2 |
| | B) Former locomotive repair shop repair pit | Oils and solvents | Criteria 1 |

Site AOC-RR may be a Criteria 1 site, based on the potential use of solvents during locomotive repair. Sites AOC-BBMS, SS-06, and SD-15 are considered Criteria 2 sites.

Any materials, including soil cuttings and purge water derived from a Criteria 1 site (AOC-RR) is considered hazardous waste, unless 1) the listed waste constituent concentrations are already below relevant health-based levels (HBLs); or 2) the media can be treated to remove the listed constituents to below HBLs. Therefore, any IDW derived from a Criteria 1 site shall have soil and water sampling results compared to the HBL list contained within the existing Waste Management Plan (Table 2-2, Appendix C).

Waste generated from the Criteria 2 sites (SS-06, SD-15, and AOC-BBMS) will be evaluated if it meets the hazardous waste characteristic for ignitability, corrosivity, reactivity, or toxicity. However, prior knowledge of the chemicals of concern for these three sites indicates that the

waste will not be reactive. At Site SD-15 the characteristics of corrosivity and toxicity need to be evaluated and at Sites SS-06 and AOC-BBMS the characteristics of ignitability and toxicity need to be assessed. Hazardous waste classification for corrosivity is a pH less than or equal to 2 or greater than or equal to 10. Maximum concentration of contaminants for the toxicity characteristic are listed in the existing Facility Waste Management Plan (Table 2-1, Appendix C).

## 4.3 Total Petroleum Hydrocarbons

The NMED has established a remediation standard for soil of 1,000 parts per million (ppm) total petroleum hydrocarbons (TPH) at Holloman AFB. Any IDW soil that exceeds 1,000 ppm TPH (as determined by EPA Method 8015) will be transferred off site for disposal at an appropriate facility.

## 4.4 Management and Characterization of IDW

The field activities will involve predominantly soil and groundwater sampling and possibly well installation. These activities, in addition to associated decontamination and personal protection procedures, will generate all of the IDW. The specific types of waste that will be generated are described below:

- **Soil Cuttings** - Excess soil removed by DPT rig and HSA drilling technique. This soil will be generated at each soil boring.

- **Purge Water** - Groundwater pumped from a borehole prior to sampling or during well installation and development.

- **Decontamination Fluids** - Fluids used in cleaning equipment between borings. Fluids included are: soapy water, rinse water, and solvents (e.g., isopropanol) used during decontamination of sampling equipment.

- **Personal Protective Equipment (PPE) and Sampling Equipment** - Disposable coveralls, gloves, respirator cartridges, plastic sheeting, foil, tape, and disposable laboratory equipment.

Waste minimization techniques will be employed where possible to reduce the quantity of IDW generated. Waste characterization will primarily be based on comparisons of analytical data. The primary source of the analytical data will be the analytical results of soil and groundwater samples collected for the site investigation. If necessary, IDW will be directly sampled for waste characterization.

### *4.4.1 Management of Soil Cuttings*

A single method will be used for management of soil cuttings. At the time of generation, the cuttings will be placed in containers. All cuttings from the Criteria 1 site will be handled as RCRA hazardous waste, thereby being segregated, containerized in Department of Transportation (DOT)-approved drums, labeled, and transported to the 90-day temporary storage facility pending the analytical results from the field sampling. Any cuttings that are determined to either be visibly contaminated or which contain VOCs in the headspace analysis will be placed in separate containers from visually uncontaminated soils. Results from the field samples will be compared to HBLs (Table 2-2, Appendix C). If the field sample results indicate that additional analyses are necessary, than a composite sample from the drums will be collected for analysis for full suite TCLP.

Cuttings from the Criteria 2 sites will be initially containerized. These soils will also be segregated based on field screening data. Any cuttings that are determined to either be visibly contaminated or contain VOCs in the head space analysis will be placed in separate containers.

Analytical results for soil samples collected at Criteria 1 sites (AOC-RR) will undergo three levels of screening:

1) Levels will be compared to the HBLs (Table 2-2, Appendix C). If the HBLs are exceeded, then the soil will be handled and disposed of at an approved RCRA hazardous waste facility.

2) If comparison with the HBLs reveals that the soils do not meet the listed waste criteria, then the data will then be compared to evaluate if the material is characteristically hazardous (Table 2-1, Appendix C). If the waste is characteristically hazardous, once again the material would be handled and disposed of as a RCRA hazardous waste.

3) If the material does not constitute a characteristic waste, then the laboratory results will be compared to the NMED guidelines for Holloman AFB for TPH and benzene (less than 1,000 mg/kg and 25 mg/kg, respectively). If the TPH and benzene results are greater than 1,000 mg/kg and 25 mg/kg, respectively, then the soil will be disposed of off-site at a non-hazardous waste facility as a special waste. Finally, if the TPH results are less than 1,000 ppm, then the soil will be spread around the borehole if the area is undeveloped. If spreading of the soils is not feasible due to site restrictions, the soil will be disposed off-site as a non-hazardous solid waste.

Field sample results from the Criteria 2 sites will go through a two-step screening. The sample analytical results will be compared to items 2) and 3) discussed in the previous paragraph.

All soil that is containerized will be labeled to identify the waste generator (Holloman AFB), the site name, boring identification, accumulation date, and type of material. The label will also include analytical results. Each day, IDW drums will be transferred to a secured central staging area for storage on pallets. This area will have separate sections for Criteria 1 and Criteria 2 sites.

### *4.4.2 Management of Purged Water*

small amounts of purge water will be generated during groundwater sampling during the Phase I SI activities. If Phase II studies are implemented at any of the sites, larger volumes of purge water will be generated during well installation and development activities. All water generated will be containerized in DOT-approved 55-gallon drums by site and by well, in order to facilitate the use of groundwater sample analytical results for waste characterization.

Waste characterization will be performed using groundwater sample analytical results, unless water from different wells has been mixed or bulked. If the latter has occurred, then a composite sample will be collected for waste characterization. Water from the Criteria 1 sites will be segregated from water generated from Criteria 2 sites. This water will be handled as RCRA hazardous waste unless the results reveal that the HBLs are not exceeded, then this water will be evaluated similarly to the Criteria 2 sites, as discussed above in Section 4.4.1 for soil cuttings.

Since Criteria 2 site IDW contains no listed hazardous wastes, the groundwater sample results will be compared with Toxicity Characteristic Leaching Procedure (TCLP) regulatory levels. If the results indicate that the water is characteristically hazardous, the containers will be handled and disposed in accordance with RCRA hazardous waste requirements.

### *4.4.3 Decontamination Water*

All equipment will be decontaminated at the central staging area using a self-contained decontamination unit. Since the volume of water generated during the described field activities is anticipated to be small, all water will be collected and stored in 55-gallon drums. Water used for washing equipment will be contained in sealed tubs and transferred daily to 55-gallon drums. Water from Criteria 1 sites will be segregated from the Criteria 2 sites and dealt with as RCRA listed waste unless the laboratory data indicates otherwise.

The decontamination water in the drums will be sampled as a composite sample and analyzed for each of the constituents in Table 2-2 in Appendix C for Criteria 1 sites and Table 2-1 in

Appendix C for Criteria 2 sites of the existing Holloman AFB Waste Management Plan (Radian, October 1993) (Appendix C) when the drum is full or decontamination activities for the investigation are complete. Analytical results will be compared with applicable regulatory limits. If constituents exceed applicable regulatory levels, the entire drum will be labeled and managed as hazardous waste.

Under no circumstances will excess cleaning solutions (e.g., acetone, isopropanol) which are not contaminated or spent be added to decontamination water containers. All unused decontamination solutions will be removed from the Base at the time of demobilization.

### *4.4.4 Personal Protective Equipment and Sampling Equipment*

Holloman AFB has determined that PPE and other disposable items from all sites will be contained in sealed plastic trash bags. Prior to disposal, the PPE and disposable items will be cleaned and decontaminated. The bags will be disposed in a designated dumpster for disposal as nonhazardous solid waste.

## 4.5 Disposal Alternatives

### *4.5.1 Hazardous Waste*

Any drums of hazardous IDW will either be (1) removed from temporary accumulation at the end of 90 days for disposal at a permitted facility, or (2) transferred to the permitted storage facility at Holloman AFB until disposal can be arranged. Off-site disposal facilities for hazardous waste will be selected on the basis of the waste characterization and in accordance with the land disposal restrictions (40 CFR Part 268). Potential disposal facilities for hazardous IDW are listed in Appendix C. Selection of disposal facilities will conform with all applicable contractor, Base, and USACE compliance requirements.

### *4.5.2 Nonhazardous Waste*

Any soil IDW that is determined to be non-hazardous will be disposed as a special waste in an industrial non-hazardous landfill if the TPH content is greater than 1,000 ppm. If the TPH concentration is less than 1,000 ppm, the soil IDW will be spread around the borehole following filing of a Notice of Intent to Discharge with the NMED, and subsequent NMED approval. The existing Waste Management Plan for Holloman AFB (Appendix C) identifies potential off-site disposal facilities for non-hazardous IDW.

Holloman AFB has determined that any non-hazardous IDW water can be discharged to the Base sanitary sewer system. Holloman AFB will submit a Notice of Intent to NMED if IDW water is to be discharged to the ground surface. No groundwater will be discharged to the ground surface prior to NMED approval.

# 5.0 DATA MANAGEMENT

This section of the FSP provides a comprehensive guide for the management of all data generated during the PA/SI. This includes analytical data, field notebooks, project files, and progress reports. This section describes how collected data will be properly handled and documented for future use. The contractor will use a field notebook, soil boring logs, monitoring well development logs, groundwater sampling logs, sample custody forms, sample labels, sample inventories, and laboratory log books to track and document project data. The contractor will establish a data management plan to meet all data deliverables, which will include the requirements of the Installation Restoration Program Information Management System (IRPIMS).

There are five goals for the data management task:

- Archive project data and procedures to substantiate conclusions and recommendations drawn from the PA/SI;
- Provide timely access to an organized body of data to facilitate analysis and decision making throughout the investigation;
- Provide a useful centralized index of project information;
- Present project information in tabular and graphic form;
- Provide convenient and efficient access to project data for potential future investigation or remediation activities, if warranted.

The data management process is discussed below and addresses data and reporting requirements of the PA/SI. There are multiple data streams and multiple possible end users of the data associated with the PA/SI. The data management system implemented by the contractor will be capable of tracking all pertinent information associated with the PA/SI accurately and quickly. In particular, once the contractor receives the laboratory results and

performs necessary data loading and data validation procedures, the Base will be notified within five working days of the nature and extent of any releases. The Base will then evaluate the need for possible interim measures in conjunction with the NMED and EPA Region VI.

## 5.1 Field Data Record

A bound field notebook will be used to permanently record all field activities and general observations. Sections 2 and 3 of this CDAP identify the sample locations, sample types, sample depths, and unique identification numbers. A unique sample field identification number will be assigned to each sample. A corresponding laboratory ID number will be assigned and will be used to track each sample through the analytical process.

For soil borings and monitor wells, descriptions of lithologies encountered and the soil classification will be recorded on borehole logging forms. For monitoring wells, data collected during well development and groundwater sampling will be recorded on individual forms. These forms, in addition to any site maps that are generated on graph paper, will be kept in a 3-ring binder.

All pages of the field notebook will be signed and dated by the supervising field scientist who is entering the data. Also, the names and affiliations of all visitors on site will be entered in the notebook, as well as general notes on project progress, problems encountered, and deviations from plans (with rationale).

Chain-of-custody documentation will be completed to document the chain of possession and track the samples throughout shipping, handling, and analysis.

## 5.2 Field Data

Field data will include the data record (log books, etc.), results of field analysis, and survey results. Field analysis data (including results, duplicates, blanks, standards, etc.) should be recorded in a lab log book (similar to the field notebook) and the site-specific data sheets provided in Appendices A and B. The data collected will be input to an electronic data

management system (EDMS). The EDMS system that will be used for the project is GIS/KEY. This system is capable of integrating environmental data (chemical, geological, and hydrological), and graphical data which is built into the AutoCad system.

The contractor will maintain field records sufficient to re-create all sampling and measurement activities. At a minimum, the contractor also will keep information for the field program as specified in the IRPIMS data loading handbook.

## 5.3 Laboratory Data

The laboratory will maintain reports in hardcopy and electronic form. This data will be used to permanently record all laboratory data, including sample IDs, analytical results, detection limits, analytical methods, and other related data. Both electronic and hardcopy logs will be required as part of routine data transfer. At a minimum, the contractor will record the information that is required to be included in the IRPIMS data files, as specified in the IRPIMS data loading handbook. In addition, the contractor will provide USACE with copies of the laboratory data packages for QA/QC evaluation.

## 5.4 Project File

The contractor will maintain a project file at a single location in which copies of all project data and written communications are stored. Contents of the project file will include progress reports, field data, laboratory data, copies of maps, and all other facility description data. Copies of these data shall also be provided to the Base Environmental Coordinator (BEC) as required. The EDMS will be considered a component of the project file but will not preclude the need to keep all original hardcopy data in the project file.

The BEC will maintain a project file at Holloman AFB that contains all information and data reports regarding the PA/SI. The contractor will provide the Base with copies of all files and documents discussed below. A subject file index will be maintained such that documents in the file may be found easily. The project file will be maintained for a minimum of five years after the completion of the PA/SI.

## 5.5 Progress Reports

Monthly progress reports and a draft, draft final, and final report on PA/SI activities and results will be prepared. The monthly progress report will be submitted by the 15th of the following month and will contain:

- Estimates of the percentage of the investigation completed;
- Summary of work accomplished during the reporting period;
- Summary of the sampling and analytical activities;
- Summary of problems encountered during the reporting period and actions being taken to rectify problems;
- Projected work for the next reporting period;
- Summary of the data management status listing all IRPIMS files submitted during the reporting period;
- Any preliminary or final results obtained during PA/SI activities;
- Any changes in key project personnel; and
- Summaries of actual or proposed changes to the PA/SI work plan or its implementation.

## 5.6 PA/SI Report

Data gathered during the PA/SI will be organized in tabular and graphical representations by the EDMS to illustrate investigation results. Information gathered during PA/SI activities as

to the nature and extent of any potential releases from the sites under investigation will be included in the final report. Possible future use of the data will be considered when formatting.

Analysis of data collected during PA/SI activities will follow three basic approaches:

- Tabular summarization;
- Graphical analysis; and
- Statistical analysis.

Tabular summaries will be used to present the results of all data collection efforts. Graphical and statistical analyses will be used to further determine the presence or absence of potential contaminants at each site. Graphical methods are particularly useful for comparing detectable concentrations and detection limits with federal or state regulatory limits. Statistical methods are useful for determining whether detectable concentrations of naturally occurring constituents are significantly greater than "natural" or "background" concentrations.

The contractor will compile and report the data generated during the project in a timely fashion so that data can be used for decision making throughout the project. Detections of target compounds will be flagged and reported so that the data can be reviewed immediately to determine whether a release has occurred and if interim measures are required.

The PA/SI report will summarize field activities, investigation results, and recommendations for future activities. The PA portion of the report will include individual site data summary forms and a narrative section in the main report. No PA scoring will be conducted. The SI portion of the report will include a narrative section per site.

The PA/SI report will be prepared in general accordance with guidelines of Section 4.1 and 4.2 of the *EPA Guidance for Performing Preliminary Assessments under CERCLA* (EPA, 1991) and Section 6.1 of the *EPA Guidance for Performing Site Inspections under CERCLA* (EPA,

1992). A draft, draft final, and final version of the PA/SI report will be submitted to the USACE and Holloman AFB for review.

# 6.0 PA/SI SCHEDULE

## 6.1 PA/SI Schedule

The schedule of activities for the PA/SI is presented in Figure 6-1. The schedule allows 11 months to perform all PA/SI activities and submit a draft final report of findings to the NMED and EPA Region VI. This is a tentative schedule and subject to change, dependent on regulatory review periods, actual field work performed, and subcontractor availability.

# 7.0 REFERENCES

EPA Region III, Risk-Based Concentration Table, Forth Quarter 1994.

NMED USTB, Correspondence, dated November 2, 1992.

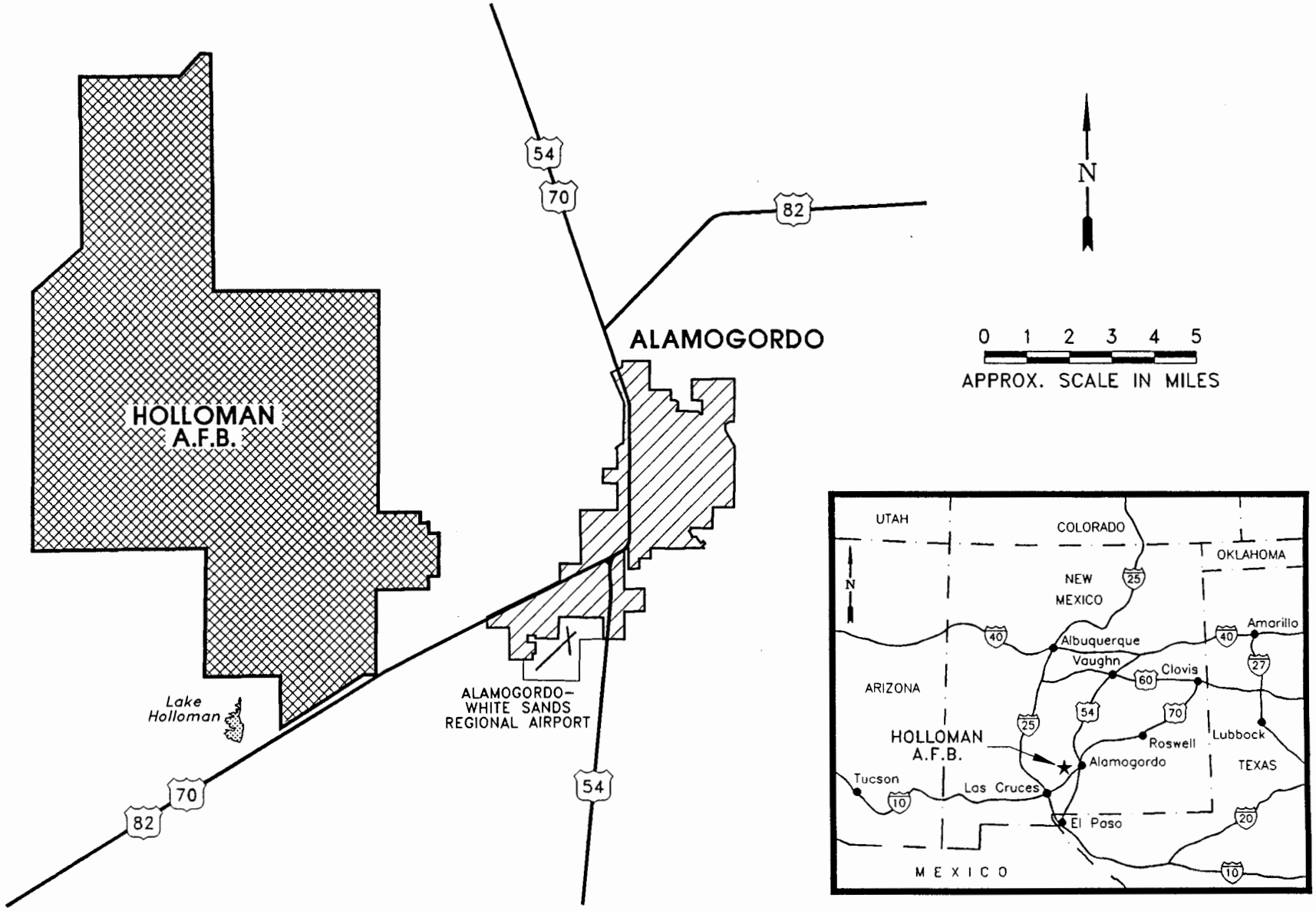
NMED USTB, Correspondence, dated January 25, 1993.

NM WQCC Regulations, August 18, 1991, Standards for Groundwater of 10,000 mg/L TDS concentrations or less.

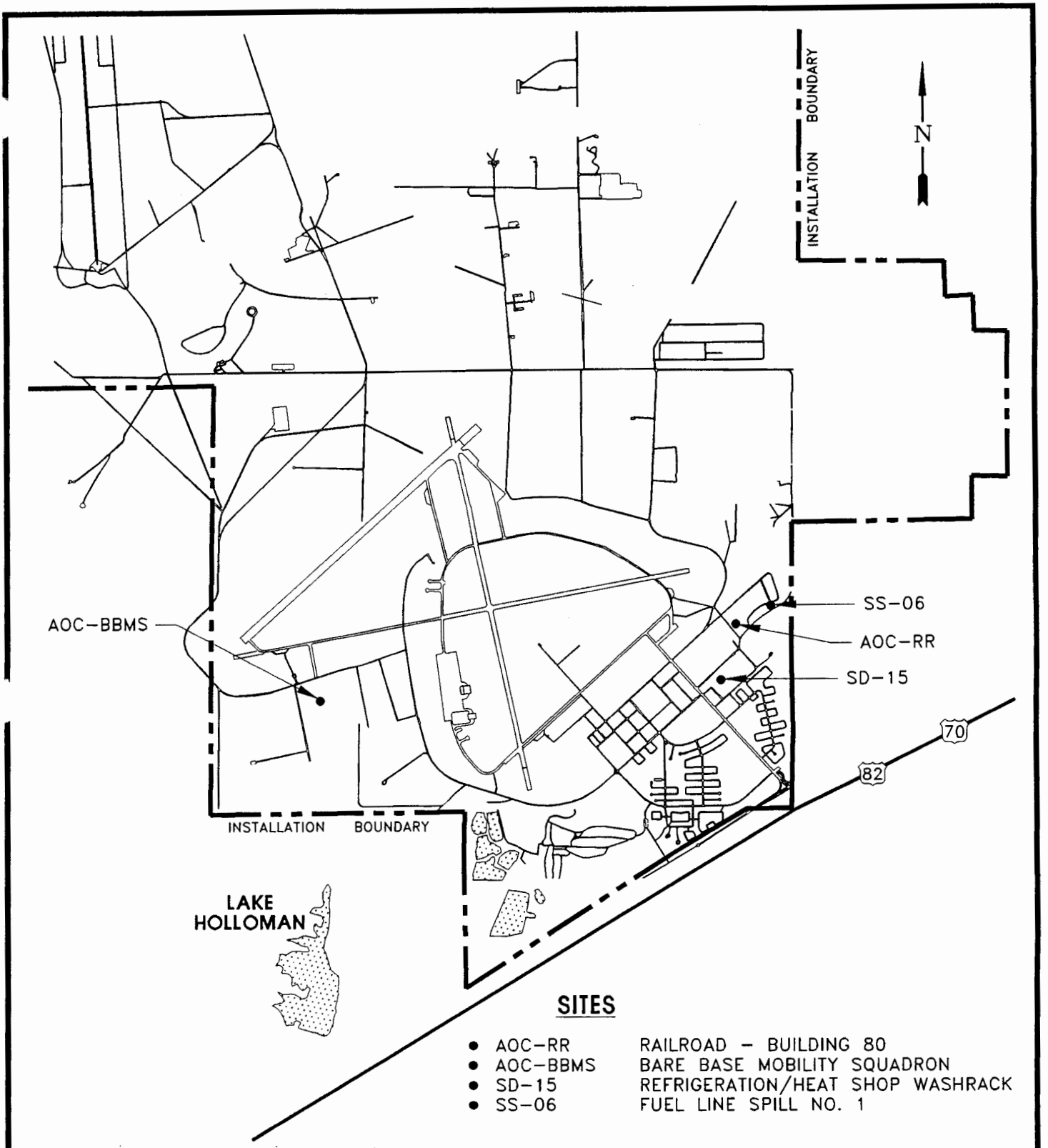
Radian, December 1993, *Phase I - Groundwater Assessment Monitoring Report for Holloman Air Force Base, New Mexico*, Appendix B.2 "Statistical Analysis of Metals Data for Phase I Assessment Monitoring".

Radian, October 1992, *Remedial Investigation (RI) Report, Investigation, Study, and Recommendation for 29 Waste Sites.*

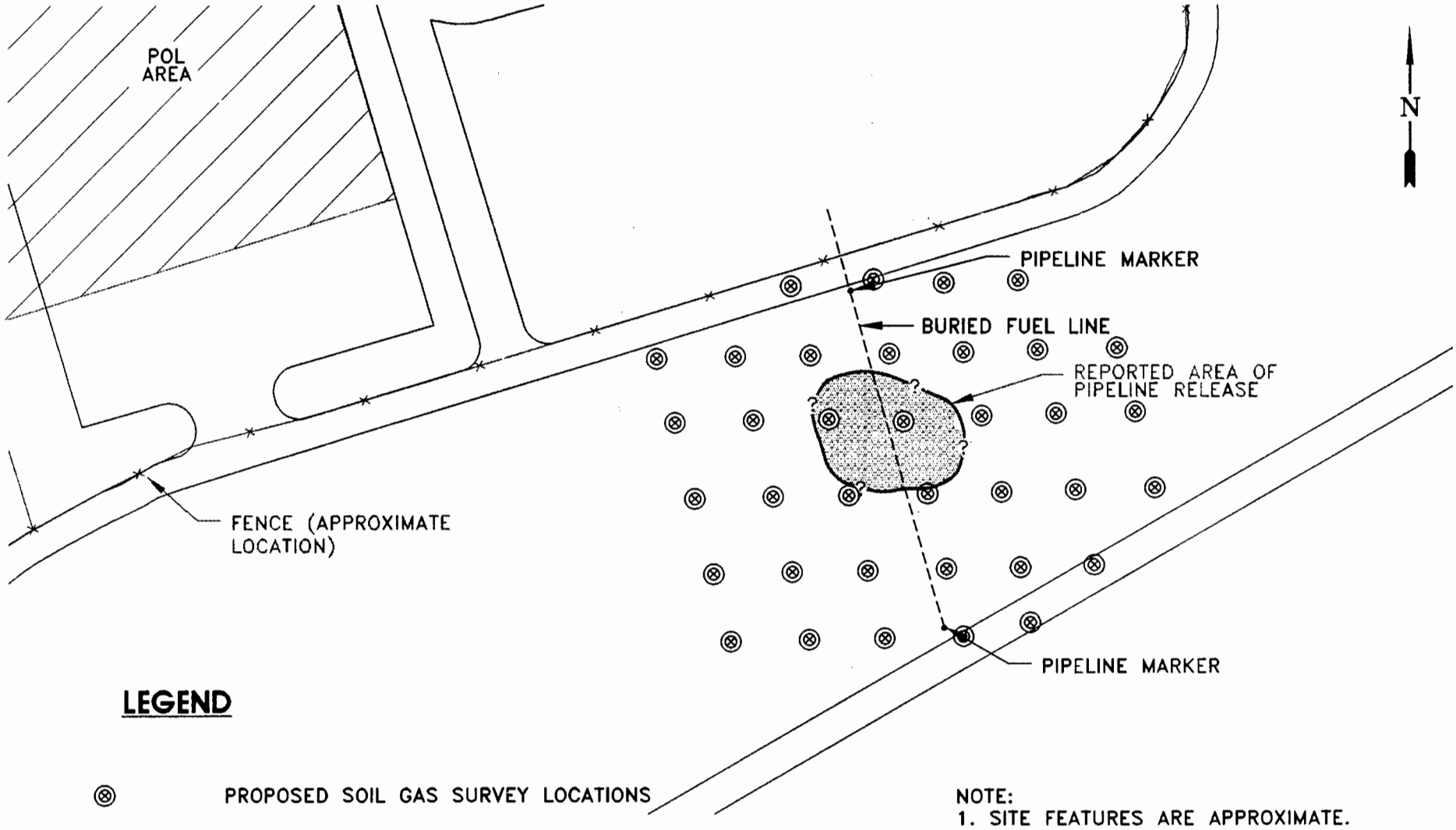
Radian, October 1993, *Waste Management Plan, for RCRA Facility Investigation, Holloman Air Force Base, NM,. Table 2 Phase I RFI.*



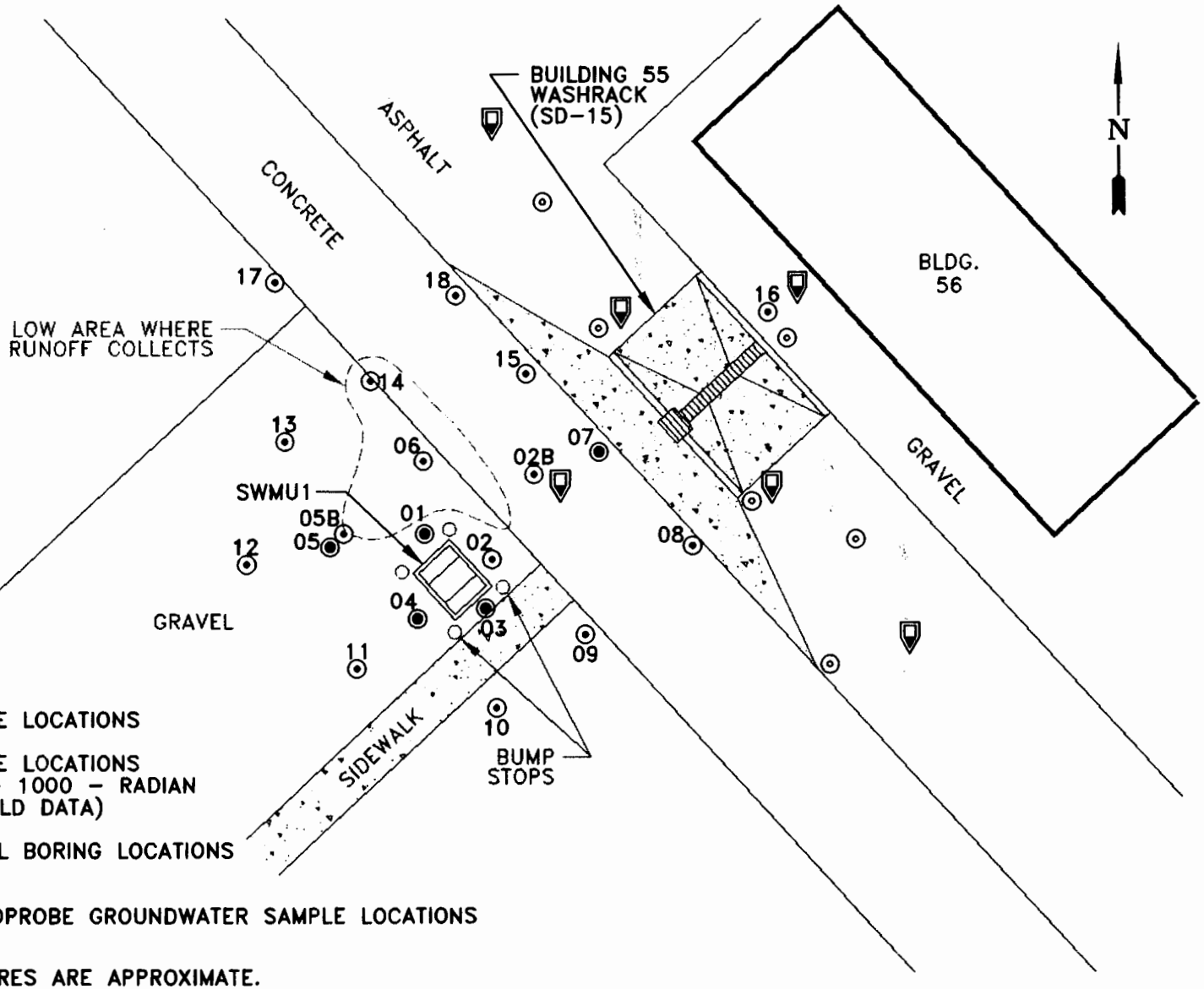

| | | | |
|---|---|---|---|
| PROJECT: SITE INVESTIGATION WAD NO. 3, 5 AND 9 | | CLIENT: HOLLOMAN AIR FORCE BASE | SITE LOCATION |
| FILE: 2201-SL3 (1:1) | PROJECT NO.: 83001-2201 | LOCATION: ALAMOGORDO, NEW MEXICO | PM: SLB / PE/RG: / FIGURE: 1-1 |
| REV.: | | DES.: KG / DET.: AJK / DATE: 12/15/94 | |




| | | | | | |
|---|---|---|---|---|---|
| PROJECT: SITE INVESTIGATION WAD NO. 3, 5 AND 9 | 0 FEET 5,000 SCALE | FACILITY MAP | | | |
| ENT: HOLLOMAN AIR FORCE BASE | FILE: 2201-SM3 (1:5000) | | PROJECT NO.: 83001-2201 | PM | PE/RG |
| | REV. | | | | |
| LOCATION: ALAMOGORDO, NEW MEXICO | DES. KG | DET. AJK | DATE: 12/15/94 | FIGURE: 1-2 | |




| | | | |
|---|---|---|---|
| PROJECT: SITE INVESTIGATION WAD NO. 3, 5, 9 | 0 FEET 100 SCALE | CLIENT: HOLLOMAN AIR FORCE BASE ALAMOGORDO, NEW MEXICO | **PROPOSED SAMPLE LOCATIONS** |
| FILE: SS-06SM (1:100) | PROJECT NO.: 83001-2201 | LOCATION: SITE SS-06 JP-4 FUEL LINE SPILL NO. 2 | PM: / PE/RG: / FIGURE: 2-1 |
| REV.: | | DES.: KG / DET.: AJK / DATE: 12/23/94 | |

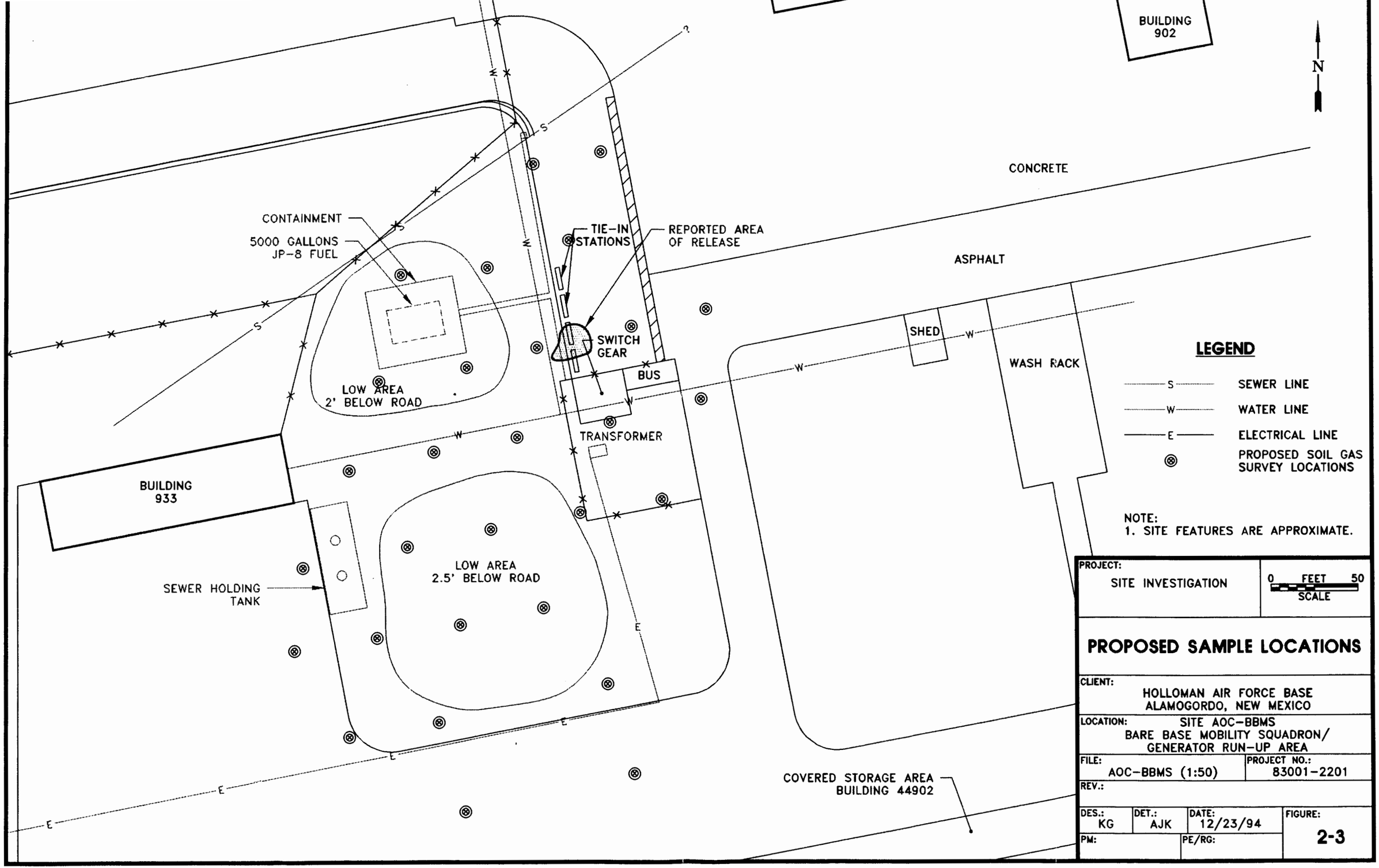


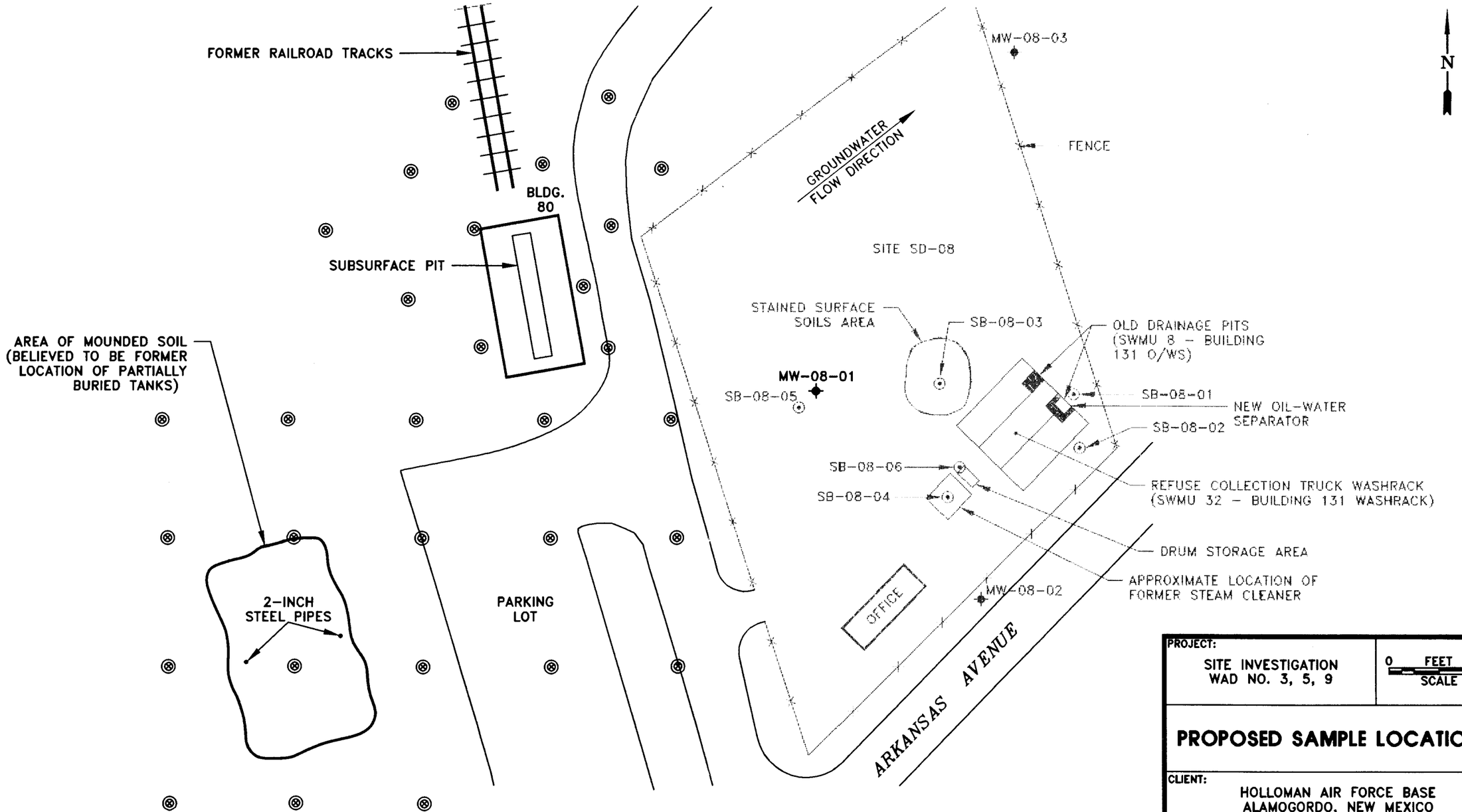

**LEGEND**

- RADIAN SAMPLE LOCATIONS
- RADIAN SAMPLE LOCATIONS (RED = TPH > 1000 – RADIAN FALL 1994 FIELD DATA)
- PROPOSED SOIL BORING LOCATIONS
- PROPOSED GEOPROBE GROUNDWATER SAMPLE LOCATIONS

NOTE:
1. SITE FEATURES ARE APPROXIMATE.

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: SITE INVESTIGATION | 0 FEET 30 SCALE | CLIENT: HOLLOMAN AIR FORCE BASE ALAMOGORDO, NEW MEXICO | | | **PROPOSED SAMPLE LOCATIONS** |
| FILE: SD-15SM (1:30) | PROJECT NO.: 83001-2201 | LOCATION: SITE SD-15 REFRIGERATOR/HEAT SHOP WASHRACK | | PM: | PE/RG: | FIGURE: 2-2 |
| REV.: | | DES.: KG | DET.: AJK | DATE: 12/15/94 | | |


BUILDING 902
N
CONCRETE
ASPHALT
CONTAINMENT
5000 GALLONS JP-8 FUEL
TIE-IN STATIONS
REPORTED AREA OF RELEASE
SWITCH GEAR
BUS
TRANSFORMER
LOW AREA 2' BELOW ROAD
SHED
WASH RACK
BUILDING 933
SEWER HOLDING TANK
LOW AREA 2.5' BELOW ROAD
COVERED STORAGE AREA BUILDING 44902
S
W
E
LEGEND
SEWER LINE
WATER LINE
ELECTRICAL LINE
PROPOSED SOIL GAS SURVEY LOCATIONS
NOTE:
1. SITE FEATURES ARE APPROXIMATE.
PROJECT:
SITE INVESTIGATION
0 FEET 50
SCALE
PROPOSED SAMPLE LOCATIONS
CLIENT:
HOLLOMAN AIR FORCE BASE
ALAMOGORDO, NEW MEXICO
LOCATION:
SITE AOC-BBMS
BARE BASE MOBILITY SQUADRON/
GENERATOR RUN-UP AREA
FILE:
AOC-BBMS (1:50)
PROJECT NO.:
83001-2201
REV.:
DES.:
KG
DET.:
AJK
DATE:
12/23/94
FIGURE:
2-3
PM:
PE/RG:




**LEGEND**

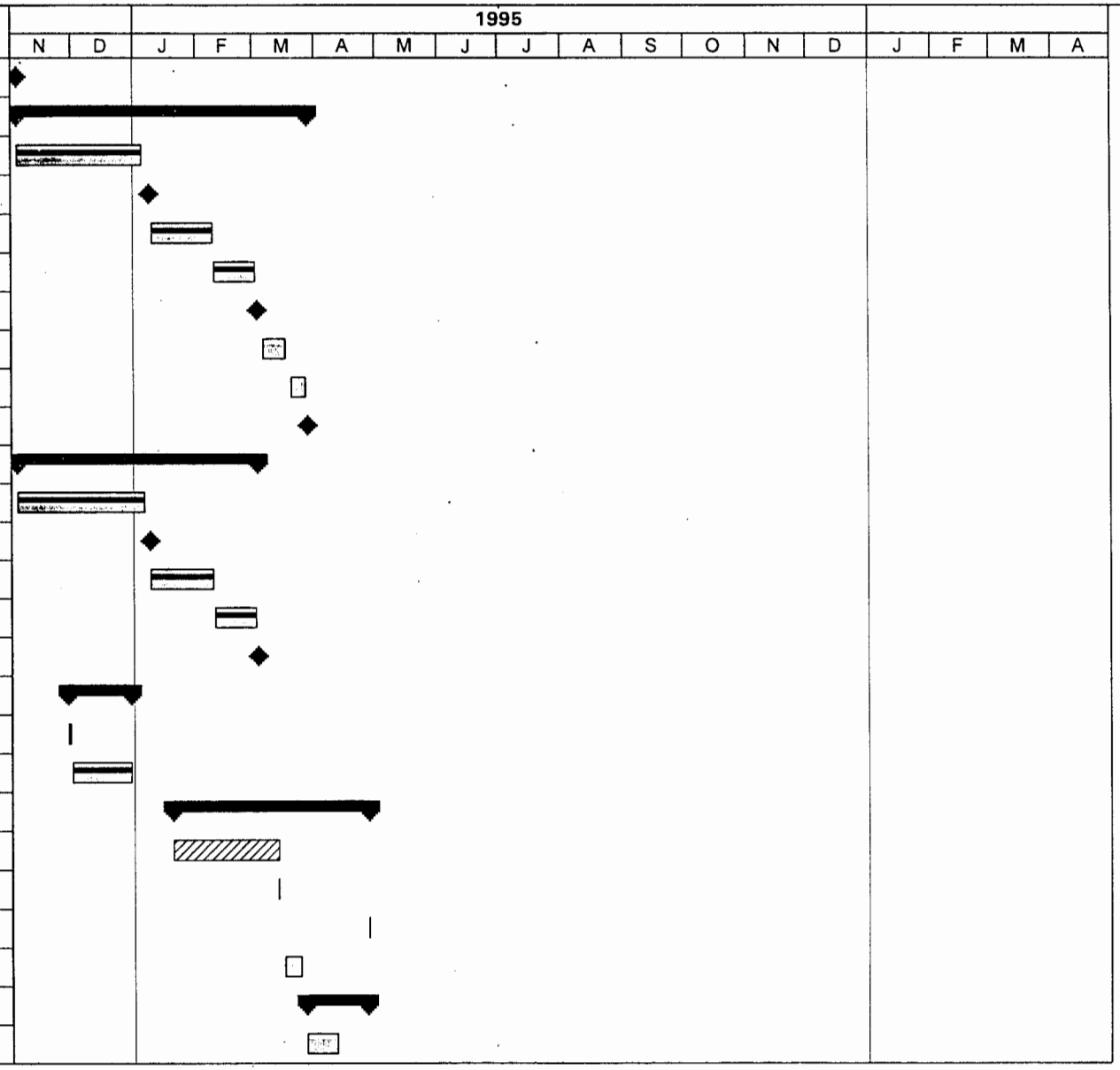
- MONITORING WELL LOCATIONS
- MONITORING WELL LOCATION (RED = DETECTABLE CONCENTRATIONS OF BENZENE AND ETHYLBENZENE)
- SOIL BORING LOCATIONS
- PROPOSED SOIL GAS SURVEY LOCATIONS

NOTE:
1. SITE FEATURES ARE APPROXIMATE.

| | |
|---|---|
| PROJECT: SITE INVESTIGATION WAD NO. 3, 5, 9 | 0 FEET 40 SCALE |
| **PROPOSED SAMPLE LOCATIONS** | |
| CLIENT: HOLLOMAN AIR FORCE BASE ALAMOGORDO, NEW MEXICO | |
| LOCATION: SITE AOC-RR RAILROAD, BUILDING 80 | |
| FILE: AOC-RRSM (1:40) | PROJECT NO.: 83001-2201 |
| REV.: | |
| DES.: KG / DET.: AJK / DATE: 12/15/94 | FIGURE: 2-4 |
| PM: / PE/RG: | |

**FIGURE 6-1: PROJECT SCHEDULE**
**Delivery Order #1, WADs 3, 5, 9: PRELIMINARY ASSESSMENTS/SITE INVESTIGATIONS**
**HOLLOMAN AFB, NEW MEXICO**

| Name | Start | Finish |
|---|---|---|
| Notice to Proceed | 11/4/94 | 11/4/94 |
| TASK 1: CDAP | 11/4/94 | 3/28/95 |
| Draft CDAP Preparation | 11/4/94 | 1/5/95 |
| Draft Submittal | 1/9/95 | 1/9/95 |
| USACE/Base Review | 1/10/95 | 2/9/95 |
| Draft Final Preparation | 2/10/95 | 3/2/95 |
| Draft Final Submittal | 3/3/95 | 3/3/95 |
| Agency Review | 3/6/95 | 3/17/95 |
| Final Preparation | 3/20/95 | 3/27/95 |
| Final Submittal | 3/28/95 | 3/28/95 |
| TASK 2: SSHP Preparation | 11/4/94 | 3/3/95 |
| Draft SSHP Preparation | 11/4/94 | 1/6/95 |
| Draft SSHP Submittal | 1/9/95 | 1/9/95 |
| USACE/Base Review | 1/9/95 | 2/9/95 |
| Draft Final Preparation | 2/10/95 | 3/2/95 |
| Draft Final Submittal | 3/3/95 | 3/3/95 |
| TASK 3: Prelim. Assess at AOC | 11/29/94 | 12/30/94 |
| Site Visit | 11/29/94 | 11/30/94 |
| Compile Information | 12/1/94 | 12/30/94 |
| TASK 4: Mob/Demob | 1/20/95 | 4/27/95 |
| Planning | 1/20/95 | 3/13/95 |
| Mobilization | 3/13/95 | 3/13/95 |
| Demobilization | 4/27/95 | 4/27/95 |
| TASK 5: Phase I Soil Gas Survey | 3/16/95 | 3/24/95 |
| TASK 6: Soil/Water Sampling | 3/27/95 | 4/26/95 |
| Phase I Soil/Water Sampling | 3/27/95 | 4/11/95 |

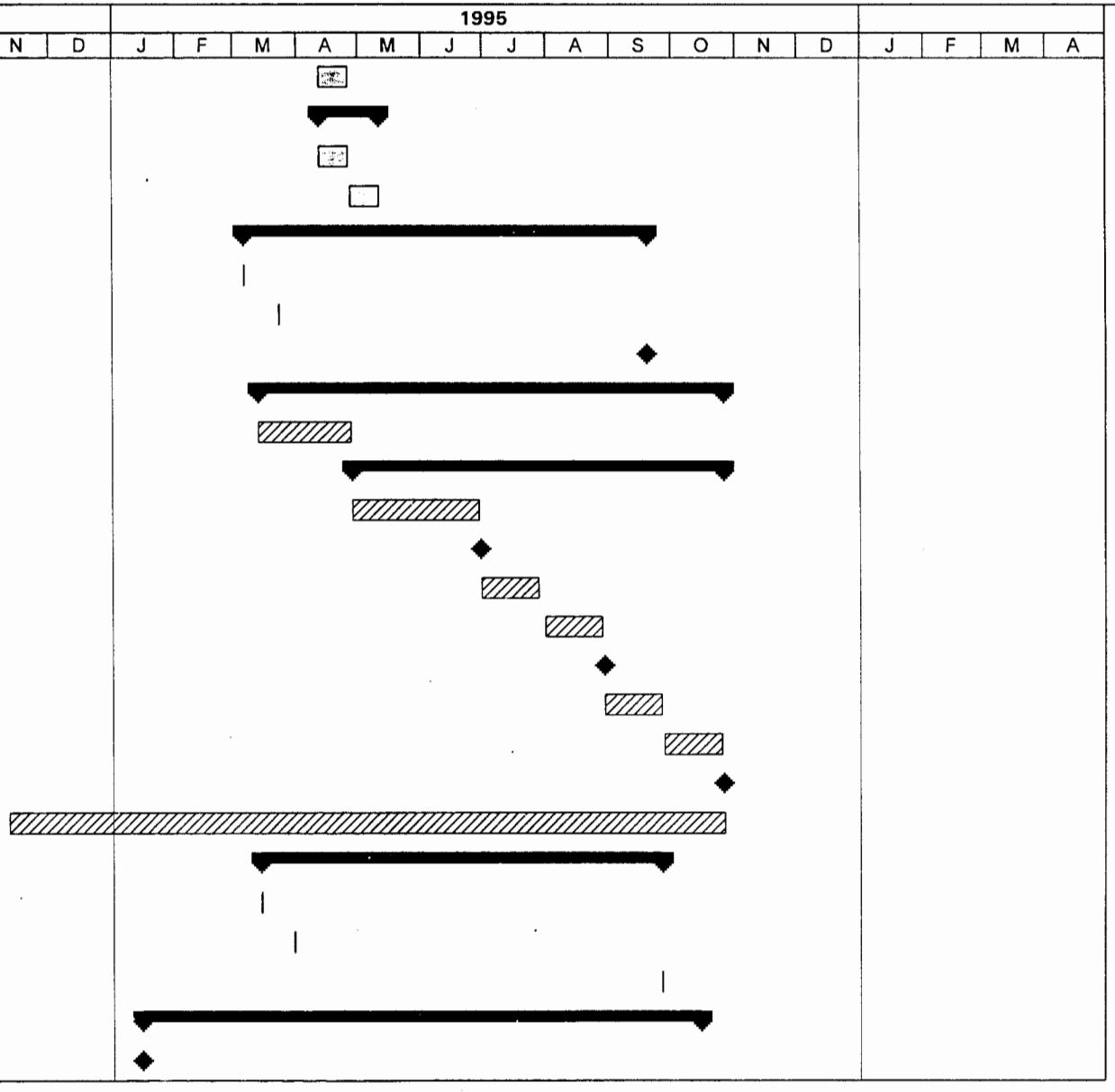



Contract No.: DACW45-94-D-003
3/2/95

Critical — Noncritical — Progress — Milestone — Summary — Rolled Up

**FIGURE 6-1: PROJECT SCHEDULE**
**Delivery Order #1, WADs 3, 5, 9: PRELIMINARY ASSESSMENTS/SITE INVESTIGATIONS**
**HOLLOMAN AFB, NEW MEXICO**

| Name | Start | Finish |
|---|---|---|
| Phase II Soil/Water Sampling | 4/12/95 | 4/26/95 |
| TASK 7: Sample Analysis | 4/12/95 | 5/11/95 |
| Phase I Soil and GW Sampling | 4/12/95 | 4/26/95 |
| Phase II Soil and GW Sampling | 4/27/95 | 5/11/95 |
| TASK 9: Meetings | 3/6/95 | 9/19/95 |
| Pre-Mobilization Fieldwork | 3/6/95 | 3/6/95 |
| Fieldwork Progress Meeting | 3/23/95 | 3/23/95 |
| Draft Final PA/SI Meeting | 9/19/95 | 9/19/95 |
| TASK 10: Reports/Deliverables | 3/13/95 | 10/26/95 |
| DQCRs during field work | 3/13/95 | 4/27/95 |
| PASI/SQCS Reports | 4/28/95 | 10/26/95 |
| Draft Report Prep | 4/28/95 | 6/29/95 |
| Draft Submittal | 6/30/95 | 6/30/95 |
| USACE/Base Review | 6/30/95 | 7/28/95 |
| Draft Final Prep | 7/31/95 | 8/28/95 |
| Draft Final Submittal | 8/29/95 | 8/29/95 |
| Agency Review | 8/29/95 | 9/26/95 |
| Final Prep | 9/27/95 | 10/25/95 |
| Final Submittal | 10/26/95 | 10/26/95 |
| Confirmation Notices (wkly submittal) | 11/11/94 | 10/26/95 |
| Conference Notes | 3/14/95 | 9/26/95 |
| Pre-Mobilization | 3/14/95 | 3/14/95 |
| Fieldwork Progress | 3/30/95 | 3/30/95 |
| Draft Final PA/SI | 9/26/95 | 9/26/95 |
| Monthly Progress Reports | 1/15/95 | 10/15/95 |
| December 94 Report | 1/15/95 | 1/15/95 |

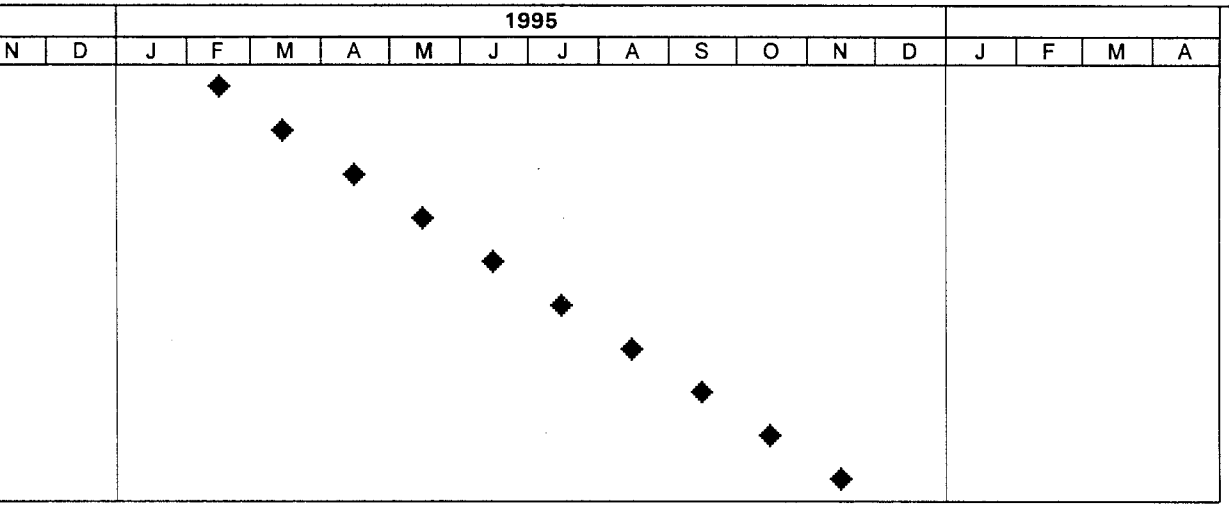



Contract No.: DACW45-94-D-003
3/2/95

Critical — Noncritical — Progress — Milestone — Summary — Rolled Up

**FIGURE 6-1: PROJECT SCHEDULE**
**Delivery Order #1, WADs 3, 5, 9: PRELIMINARY ASSESSMENTS/SITE INVESTIGATIONS**
**HOLLOMAN AFB, NEW MEXICO**

| Name | Start | Finish |
|---|---|---|
| January 95 Report | 2/15/95 | 2/15/95 |
| February 95 Report | 3/15/95 | 3/15/95 |
| March 95 Report | 4/15/95 | 4/15/95 |
| April 95 Report | 5/15/95 | 5/15/95 |
| May 95 Report | 6/15/95 | 6/15/95 |
| June 95 Report | 7/15/95 | 7/15/95 |
| July 95 Report | 8/15/95 | 8/15/95 |
| August 95 Report | 9/15/95 | 9/15/95 |
| September 95 Report | 10/15/95 | 10/15/95 |
| October 95 Report | 11/15/95 | 11/15/95 |




Contract No.: DACW45-94-D-003
3/2/95

Critical — Noncritical — Progress — Milestone — Summary — Rolled Up

## APPENDIX A -- Standard Operating Procedures (SOPs)

A-1 Documentation, Sample Handling, Chain-of-Custody, and Shipping
A-2 Sampling Equipment Decontamination
A-3 Staking, Utility Clearance, and Permitting
A-4 Soil Gas Survey
A-5 Direct Push Sampling for Soil and Groundwater
A-6 Soil Sampling For Chemical Analysis
A-7 Procedure For Field Screening of Volatile Organics
A-8 Lithologic Description And Geotechnical Sampling
A-9 Groundwater Sampling For Chemical Analysis
A-10 Hollow-Stem Auger (HSA) Drilling
A-11 Monitor Well Installation
A-12 Well Development
A-13 Groundwater Sampling From Monitoring Wells
A-14 Field Management of Investigation-Derived Waste (IDW)
A-15 Borehole Abandonment and Site Restoration
A-16 Location Surveying

# SOP A-1
# DOCUMENTATION, SAMPLE HANDLING, CHAIN-OF-CUSTODY, AND SHIPPING

## 1.0 OBJECTIVE

This SOP contains specific details concerning sample control, documentation, and transportation procedures.

## 2.0 EQUIPMENT AND MATERIAL

The following equipment will be necessary to complete sample documentation, handling, and shipment:

Forms and Records

- Log books;
- Chain-of-custody forms;
- Custody seals;
- Sample identification labels; and
- Daily Quality Control Report (DQCR) (Appendix C).

Shipping Supplies

- Clear tape;
- Rigid plastic coolers;
- Strapping tape;
- "This Side Up" arrow labels;
- Address labels;
- Heavy-duty plastic trash bags and ties;

- Small and large Ziploc bags;
- Protective mesh for various sample bottle sizes;
- Absorbent material for packing samples; and
- Ice.

## 3.0 METHODOLOGY

Sample control and documentation are necessary to ensure the defensibility of data and to verify the quality and quantity of work performed in the field. Accountable documents include field log books, instrument calibration log books, sample logs, correspondence, sample labels, chain-of-custody forms, photographs, and analytical records. All information pertinent to a field activity must be entered into a log book, including uncompleted work.

### 3.1 Sample Control and Documentation

All log books should be numbered and are to be bound with consecutively numbered pages; log book pages and data should never be removed. Loose-leaf forms, sample logs, and figures used for sample location will be kept in a 3-ring binder. Indelible black ink will be used for recording all data. At minimum, the following data should be recorded during the course of the investigation:

- Date, field observations, and weather conditions, including any unusual circumstances;
- Calibration of field equipment before sample analysis;
- Names of field crew members;
- Name of the sample collector;
- Identification of sampling location and depth of sample;
- Rough sketch of sampling location related to significant physical objects;

- Depth to water at groundwater sampling locations;
- Purge method and purge volume;
- Sample collection method;
- Types and numbers of sample containers used;
- Preservatives used;
- Results of field analysis; and
- Sample observations (color, turbidity, odor, soil type, etc.).

To change an incorrect entry, draw a line through the entry, write the change above or adjacent to the entry, and date and initial the change. If anyone other than the person to whom a log book is assigned makes an entry, that person should date and sign the entry. All project log books are to be turned over to the document control officer at the end of each work period and to a central file at the end of the field activity.

The field team leader will complete DQCRs (Appendix B) at the end of each day. The completed reports will be sent weekly to the USACE-Project Manager and Base Environmental Coordinator.

### 3.2 Sample Labeling

In addition to the field log book, a complete sample label should be filled out for each sample.

All sample containers should be sealed immediately after sample collection. Samplers should place the completed sample label onto the sample container and secure it with clear tape. Sample labels must identify the sample ID, site, sample type, sampler's initials, sampling location, depth, time, date, analyses requested, laboratory, containers, and any special instructions. Labels should be completed with black waterproof ink.

## 3.3 Sample Control/Chain-of-Custody/Shipment

Once the samples have been collected and labeled, they should be kept cool with ice or in a refrigerator. The following procedures are for sample handling and shipment to a laboratory for analysis:

A. Fill out a chain-of-custody form for every sample shipping container (cooler). Information recorded on this form includes the following:

- Samples collected and corresponding laboratory analyses;
- Time and date of sample;
- Sample number;
- Type of sample;
- Sampler's initials;
- Preservatives used;
- Matrix Spike/Matrix Spike Duplicate (MS/MSD) analysis;
- Relinquisher's signature, date, and time; and
- Special instructions.

B. Double check the information on the chain-of-custody form against the sample labels and sample logs. Make sure each sample is accounted for and that samples are being sent to the correct laboratory.

C. Wipe the sample container exteriors clean with a paper towel dampened with clean water.

D. Ensure that each container has a properly completed label.

E. Place the sample containers in Ziploc bags. Containers from the same sample location and depth can be placed in the same bag, but separate samples from different sites will not be placed in the same bag to prevent cross-contamination.

F. Place the sample container(s) in a cooler lined with a large plastic garbage bag.

G. Pack the container(s) with ample amounts of packing material to prevent possible breakage and absorb liquid material released should breakage occur. This material should be place under the container(s) and between all containers for multiple container shipments to prevent the containers from touching each other or the bottom of the shipping container.

H. Place ice among the sample containers to maintain the samples at or below 4°C during transport.

I. Add any needed absorbent to fill all void spaces.

J. Seal the completed chain-of-custody form for the appropriate cooler in a Ziploc bag and tape it to the inside of the top lid of the cooler. The sample custodian should retain the pink copy of the form and maintain it in a file of field documentation.

K. Securely close the outer shipping container with strapping tape around both ends. If there is a drain on the cooler, tape it shut.

L. Affix signed and dated custody seals to all closures on the shipping container to prevent tampering.

M. Affix "This Side Up" arrows on two opposing sides of the cooler. No Department of Transportation (DOT) placards are required.

Compliance with all applicable DOT and International Air Transport Association (IATA) shipping regulations is required.

## 4.0 COMMENTS

- To expedite the sampling and shipping process, it is recommended that preprinted sample labels, chain-of-custody forms, address labels, and overnight delivery forms be used

- If using a refrigerator to store sample, monitor the temperature using a thermometer and be careful not to freeze water samples.

GTEL ENVIRONMENTAL LABORATORIES, INC

4211 MAY AVE.
WICHITA, KS 67209
(316) 945-2624
(800) 633-7936

# CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST

936

Company Name: Phone #:

FAX #:

Company Address: Site Location:

Project Manager: Client Project ID: (#)

(NAME)

I attest that the proper field sampling procedures were used during the collection of these samples. Sampler Name (Print):

| Field Sample ID | GTEL Lab # (Lab Use only) | # CONTAINERS | Matrix | | | | | | Method Preserved | | | | | | Sampling | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | WATER | SOIL | AIR | SLUDGE | PRODUCT | OTHER | HCl | $HNO_3$ | $H_2SO_4$ | ICE | UNPRE-SERVED | OTHER (Specify) | DATE | TIME |
| | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | |

| TAT | Special Handling | SPECIAL DETECTION LIMITS | REMARKS: |
|---|---|---|---|
| Priority (24 hr) ☐ | GTEL Contact _____ | | |
| Expedited (48 hr) ☐ | Quote/Contract # _____ | | |
| 7 Business Days ☐ | Confirmation # _____ | | |
| Other_____ Business Days ☐ | P.O. # _____ | SPECIAL REPORTING REQUIREMENTS | Lab Use Only Lot #: Storage Location |
| QA/QC Level | | FAX ☐ | Work Order #: |
| Blue ☐ CLP ☐ Other ☐ _____ | | | |

| CUSTODY RECORD | | | | |
|---|---|---|---|---|
| | Relinquished by Sampler: | Date | Time | Received by: |
| | Relinquished by: | Date | Time | Received by: |
| | Relinquished by: | Date | Time | Received by Laboratory: Waybill # |

| STANDARD REQUEST | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | OTHER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BTEX 602 ☐ 8020 ☐ with MTBE ☐ | BTEX/Gas Hydrocarbons PID/FID ☐ with MTBE ☐ | Hydrocarbons GC/FID Gas ☐ Diesel ☐ Screen ☐ | Hydrocarbon Profile (SIMDIS) ☐ | Oil and Grease 413.1 ☐ 413.2 ☐ SM-503 ☐ | TPH/IR 418.1 ☐ SM 503 ☐ | EDB by 504 ☐ DBCP by 504 ☐ | EPA 503.1 ☐ EPA 502.2 ☐ | EPA 601 ☐ EPA 8010 ☐ | EPA 602 ☐ EPA 8020 ☐ | EPA 608 ☐ 8080 ☐ PCB only ☐ | EPA 624/PPL ☐ 8240/TAL ☐ NBS (+15) ☐ | EPA 625/PPL ☐ 8270/TAL ☐ NBS (+25) ☐ | EPA 610 ☐ 8310 ☐ | EP TOX Metals ☐ Pesticides ☐ Herbicides ☐ | TCLP Metals ☐ VOA ☐ Semi-VOA ☐ Pest ☐ Herb ☐ | EPA Metals - Priority Pollutant ☐ TAL ☐ RCRA ☐ | CAM Metals TTLC ☐ STLC ☐ | Lead 239.2 ☐ 200.7 ☐ 7420 ☐ 7421 ☐ 6010 ☐ | Organic Lead ☐ | Corrosivity ☐ Flash Point ☐ Reactivity ☐ | | | | |

# SOP A-2
# SAMPLING EQUIPMENT DECONTAMINATION

## 1.0 OBJECTIVE

Decontamination of boring equipment and sampling tools is performed as a QA measure and safety precaution. It helps prevent cross-contamination among samples and helps maintain a clean working environment for the safety of field personnel. The methodology for decontamination was prepared in accordance with the following documents:

EPA. 1991. *Environmental Compliance Branch, Standard Operating Procedures and Quality Assurance Manual* (SOPQAM), U.S. Environmental Protection Agency, Region IV, Environmental Services Division, Athens, Georgia.

NIOSH, OSHA, USCG, and EPA. 1985. *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities.* Prepared by the National Institute for Occupational Safety and Health (NIOSH), Occupational Safety and Health Administration (OSHA), U.S. Coast Guard (USCG), and EPA. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, NIOSH report, October 1985. Washington, D.C.: U.S. Government Printing Office.

## 2.0 EQUIPMENT AND MATERIAL NEEDS

- Soap: Laboratory grade, non-phosphated - or equivalent;
- Tap water;
- Reagent-grade water;
- Pesticide-grade isopropanol (only to be used where LNAPL is encountered);
- Cleaning brushes;
- Cleaning containers: plastic bucket and galvanized steel pans;

- Waste containers as outlined in Appendix C and A-14; and
- Health and safety equipment as outlined in the SSHP.

## 3.0 METHODOLOGY

Small, reusable equipment, including sampling equipment, is mainly decontaminated by rinsing with liquids that include soap or detergent solutions, tap water, deionized water, or solvents. Following decontamination, if the equipment is not to be reused immediately, it will be stored, protected from recontamination by wrapping in aluminum foil, and appropriately rinsed before the next use.

### 3.1 Pre-Sampling Decontamination Activities

A. Don the appropriate PPE, as specified in the SSHP and as required for the specific work area.

B. Assemble containers and equipment for decontamination, designing the decontamination station in such a manner as to prevent liquid from spilling onto the ground.

C. Decontaminate all new equipment or equipment not previously decontaminated before use.

D. If the protective wrapping on a piece of precleaned equipment has been torn, or if there is any question about its cleanliness, the equipment should be considered contaminated and undergo the full decontamination procedures before it is used.

### 3.2 Decontaminating Sampling Procedure

A. Remove any solid particles form the equipment or material by brushing and rinsing with available potable water. This will remove gross contamination.

B. Wash equipment with a brush and a phosphate-free detergent solution.

C. Rinse equipment thoroughly with potable water.

D. Double rinse the equipment with reagent-grade water.

E. Allow equipment to air dry thoroughly. If there is not enough time to air dry complete, the equipment should be rinsed with copious amounts of reagent water. Equipment may then be reused immediately.

F. Unless the equipment is going to be used immediately, it must be wrapped in new aluminum foil, shiny side out, to keep it clean until needed. For large bulky equipment, new visqueen can be substituted for the aluminum foil.

### 3.3 Decontamination of Large Equipment

Drilling equipment (rigs, drill rods, augers, bits, etc.), DPT equipment, and other large pieces of field equipment, unable to be decontaminated using the method described above, must be high-pressure steam cleaned before and after each use.

Steam cleaning will be performed at an appropriate central decontamination area specified by the Base. The decontamination area must be capable of containing decontamination fluids and allow for managing of investigation-derived wastes (IDW) as specified in the waste management plan (Appendix C and SOP A-14).

## 4.0 COMMENTS

- Any field equipment not used during a field activity must be decontaminated before its return to the equipment stock for reuse at another site. This requirement applies even if the aluminum foil on precleaned equipment is not torn. This requirement can be waived only if after initial decontamination, the equipment was sealed in plastic.

- At each phase of the decontamination process, decontamination fluids and rinsates should be collected and managed as outlined in Appendix C and SOP A-14 (Field Management of Investigation-Derived Waste).

- Isopropanol rinse should be omitted for any equipment such as plastic well-sounding tapes.

- Solvents should not be used on any type of non-Teflon plastic equipment that will contact an environmental sample or be introduced into a monitoring well.

# SOP A-3
# STAKING, UTILITY CLEARANCE, AND PERMITTING

## 1.0 OBJECTIVE

To ensure the health and safety of field sampling personnel and prevent damage to underground utilities during soil sampling, precautions must be taken to properly locate hazards such as gas lines, high-voltage electrical lines, water mains, communication lines, sewer lines, and so forth.

Before any intrusive work (including hand-auger borings) can begin at Holloman AFB, sampling locations at each site must be cleared and a proper digging permit must be obtained.

## 2.0 EQUIPMENT AND MATERIAL NEEDS

- Wooden stakes, lathes, hubs, surveyors flags, and/or spray paint;
- Small sledge-type hammer;
- Permanent marker;
- Site maps from Section 2; and
- Base Civil Engineering Clearance Request (Air Force Form #103).

## 3.0 METHODOLOGY

Begin the site clearance procure by locating and marking all soil boring locations at each site, using the following guidelines:

- If possible, procedure ahead of time utility maps so that the preliminary positioning of sample locations will avoid underground obstructions.
- Visually scan each sample location to be sure that there are no obvious underground lines or obstructions.

- Pound the flag and the hub/stake firmly into the ground, making sure that it is clearly marked with the site number and the bore-hole number (e.g. SS06-01). If the location is on a paved surface, it should be marked with spray paint.

B) To obtain all utility clearances, site tours must be completed with appropriate representatives of the Base utilities (electric, plumbing, and Army cable) and New Mexico One Call.

New Mexico One Call coordinates the locating of non-Base utilities on Base, including US West phone lines, Simmons' cable lines, and Standard Transpipe fuel lines. They will provide you with a control number and submit locator requests for you.

Obtain clearance by contacting the locators listed below and arrange for site tours:

| | |
|---|---|
| Exterior Plumbing X5990 | Chuck Price |
| Exterior Electric X3781 | Guy Williams/Jack Quost |
| Army Cable | (for North- and West-Base sites) |
| New Mexico One Call | 1 (800) 321-2537 |

- During the site tours, have the locators mark utility locations with flags or spray paint.
- If possible, obtain a blanket site clearance to cover possible Phase II boring locations at the site. (For certain utilities, this may not be possible. In which case, inquire about the procedure necessary to gain additional clearances).
- If obstructions exist or if a borehole must be moved to avoid utilities, it should be relocated to a position that satisfies the intent of the original location.

C) To obtain the actual digging permit, a Base Civil Engineering Clearance Request Forms (AF103) must be completed and signed by appropriate parties (see

attachment A3-1). (Note that the locators should also sign the form in the appropriate space, as well as initial the site figures.) This process is usually expedited through coordination with a representative of the Civil Engineering's Environmental Flight. Once a digging permit has been issued, it is valid for one month.

## 4.0 COMMENTS

- Proper preparation in the initial location and staking is critical for expediting the sampling process. If sampling locations are not properly marked and cleared, significant costs could be incurred through delays while waiting for drilling permits. Drilling permits should be reviewed and signed if necessary by the field manager.

- New Mexico One Call requires a 10-day to 48-hour advance notice before drilling may proceed.

- Utility locators may require information about how long the job will last, the type of marker being used, and the location of the boreholes. Be prepared to provide the various utility locators and signatories on the drilling permit with multiple copies of site figures and location maps.

- When doing any intrusive work on the Base, the contractor must have a valid permit on hand.

- If the investigation is expected to last beyond the expiration date of the excavation permit, leave at minimum four days lead time to obtain clearances and a new digging permit.

# BASE CIVIL ENGINEERING WORK CLEARANCE REQUEST

DATE PREPARED

. Clearance is requested to proceed with work at _____

or k Order/Job No. _____, Contract No. _____, involving excavation or utility disturbance per ..ed sketch. The area involved ☐ Has ☐ Has not been staked or clearly marked.

TYPE OF FACILITY/WORK INVOLVED

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A. PAVEMENTS | | B. DRAINAGE SYSTEMS | | C. RAILROAD TRACKS | | D. FIRE DETECTION AND PROTECTION SYSTEMS | E. UTILITY ☐ OVERHEAD ☐ UNDERGROUND |
| F. COMM. ☐ OVERHEAD ☐ UNDERGROUND | | G. AIRCRAFT OR VEHICULAR TRAFFIC FLOW | | H. SECURITY | | I. OTHER *(Specify)* | |

INSTRUCTIONS: The BCE work clearance request is used for any work (contract or in house) that may disrupt aircraft or vehicular traffic flow, base utility services, protection provided by fire and intrusion alarm system, or routine activities of the installation. This form is used to coordinate the required work with key base activities and keep customer inconvenience to a minimum. It is also used to identify potentially hazardous work conditions in an attempt to prevent accidents. The work clearance request is processed just prior to the start of work. If delays are encountered and the conditions at the job site change (or may have changed) this work clearance request must be reprocessed.

| | | |
|---|---|---|
| 4. DATE CLEARANCE REQUIRED | 5. DATE CLEARANCE TERMINATED | |
| REQUESTING OFFICIAL *(Signature)* | 7. PHONE NO. | 8. ORGANIZATION |

CLEARANCE REVIEW

| | ORGANIZATION | REMARKS | REVIEWER'S NAME AND INITIALS |
|---|---|---|---|
| 9. BASE CIVIL ENGINEERING | A. ELECTRICAL DISTRIBUTION | | |
| | B. STEAM DISTRIBUTION | | |
| | .. WATER DISTRIBUTION | | |
| | D. POL DISTRIBUTION | | |
| | E. SEWER LINES | | |
| | F. DRAINAGE SYSTEMS | | |
| | G. PAVEMENTS, GROUNDS, RAILROADS | | |
| | H. FIRE DEPARTMENT | | |
| | I. ENGINEERING & ENVIRONMENTAL PLANNING | | |
| | J. CATHODIC PROTECTION | | |
| | K. OTHER | | |
| 10. SECURITY POLICE | | | |
| 11. SAFETY | | | |
| 12. COMMUNICATIONS | | | |
| 13. ∠ OPERATIONS | | | |
| 14. COMMERCIAL UTILITY COMPANY *(Telephone, Gas, Electrical, etc.)* | | | |
| 15. OTHER *(Specify)* | | | |

16. **REMARKS** *(This section must describe specific precautionary measures to be taken before and during work accomplishment. Specific comments concerning the approved method of excavation, hand or powered equipment should be included.)*

**REQUESTED CLEARANCE**

☐ APPROVED ☐ DISAPPROVED

| DATE | SIGNATURE OF APPROVING OFFICER *(Chief of Operations or Chief of Engineering and Environmental Planning)* |
|---|---|
| | |

# SOP A-4
# SOIL GAS SURVEY

## 1.0 OBJECTIVE

A soil gas survey will be used at several sites during PA/SI activities. The soil gas survey will be conducted before any other soil or groundwater sampling is conducted to assist in selecting the locations of subsequent soil and groundwater samples.

## 2.0 EQUIPMENT

- Mobile soil gas survey rig equipped with hydraulic ram;
- 3/4- to 1.5-inch diameter drill rods with detachable sampling point;
- vacuum pump and polyethylene tubing;
- 10-milliliter glass syringe;
- gas chromatograph (GC) with PID or FID;
- decontamination equipment;
- health and safety equipment as specified in subcontractor SSHP; and
- small shelby tube for back up should a heated headspace analyses need to be conducted.

## 3.0 METHODOLOGY

A) Confirm that all the locations are staked and that the clearances from all on-Base and off-Base utilities have been obtained. Do not begin sampling until all the utilities have been marked (SOP A-3).

B) Locate the sample location and position of the soil gas survey rig. If the sample point is on truck asphalt or concrete, soil gas survey crew will saw cut through the pavement.

C) Verify that the sampling tip has been properly decontaminated as specified in SOP A- 2 before beginning penetration.

D) Hydraulic advance the steel pipe and drive points to the desired soil gas sampling interval and pull piping string back approximately 0.5 to 1 feet.

E) Insert the polyethylene tubing to the desired sampling depth.

F) Initiate the vacuum pump and extract two to five proper volumes prior to conducted air sampling.

G) Extract the soil gas sample using a 10-milliliter glass syringe.

H) Immediately analyze the sample for aromatic volatile hydrocarbons (EPA Method 8020) and total petroleum hydrocarbons (modified EPA Method 8015) using a gas chromatograph with PID or FID.

I) Extract sampling rods and decontaminate using the procedures specified in SOP A-2.

J) Abandon sample point and repair pavement before moving to the new site per specifications in SOP A-15.

## 4.0 COMMENTS

- If a buried object impedes the insertion of the soil gas survey sampler reposition the rig in a location that will satisfy to intent of the original sample point and try again.

- If an insufficient amount of soil gas can be extracted due to a decrease in permeability, following precipitation events (rain or snowfall) or due to shallow groundwater table, a heated head-space analyses will be performed on soil samples collected using a small shelby tube, using the sample preparation procedures specified in SOP A-7. Soil gas samples will be collected with a glass syringe or other acceptable sampling device.

# SOP A-5
# DIRECT PUSH SAMPLING FOR SOIL AND GROUNDWATER

## 1.0 OBJECTIVE

Direct push technology (DPT) will be used to rapidly collect soil and water samples for SI. This technique provides for collection of undisturbed samples and does not generate soil cuttings. This SOP discusses the DPT method only; for actual soil and groundwater sampling procedures, refer to SOPs A-8 and A-9, respectively.

## 2.0 EQUIPMENT AND MATERIAL NEEDS

The Contractor will need a copy of the subcontractor work plan, waste containers (as specified in SOP A-14), and appropriate health and safety gear. All additional equipment and materials will be provided by the DPT subcontractor. The DPT subcontractor should be equipped with a rig capable of pushing 30 ft and collecting soil and groundwater samples from any interval within that depth. Equipment should include at minimum the following items:

- Hydraulic ram with hammer assembly;
- 1- to 1.5-inch diameter drill rods;
- Piston-type, split-spoon, or equivalent soil sampling device that allows for lithologic characterization and retrieval of at least 400 mL of sample volume;
- GeoProbe, Hydrocone, bailer, Teflon tubing and peristaltic pump, or equivalent water sampling device;
- Small diameter PVC riser and screen to make temporary wells if recovery is too slow;
- Decontamination equipment; and
- Health and safety equipment, as outlined in the subcontractor's SSHP.

## 3.0 METHODOLOGY

A) Verify that the subcontractor has the necessary drilling and sampling equipment, as well as proper decontamination supplies.

B) Confirm that sampling locations are staked and that the clearances from all on-Base and off-Base utilities have been obtained. Do not begin the sampling until proper digging permits have been obtained and all of the utilities have been marked.

C) Locate the sample location an position the DPT rig. If the sample point is on thick asphalt or concrete, the DPT subcontractor will use hammer-drill or equivalent to drill a hole through the pavement.

D) Verify that the sampling tip has been properly decontaminated, as specified in SOP A-2 before beginning penetration.

E) For soil sampling, hydraulically advance the sampler to above the target sample interval, unlock the piston point, and advance the sampling device through the sampling interval, unlock the piston point, and advance the sampling device through the sampling interval:

- Pull the rods using the hydraulic apparatus and remove the sample insert or splitspoon.
- Log the soil and collect the required samples as specified in Section 2 and SOPs A-6, A-7, and A-8.

F) Continue sampling at additional depth intervals or abandon the borehole, as appropriate for the location. To determine if sufficient depth has been covered, see the FSP, Sections 2, 3.1, and 3.5.2.

G) If groundwater sampling is necessary, advance the sampler into the water table and collect a sample with the sampling device as specified in SOP A-9.

H) Collect and manage all wastes as specified in SOP A-14.

I) Abandon all boreholes and repair pavement before moving to a new site as specified in SOP A-15.

## 4.0 COMMENTS

- If a buried object impedes the DPT sampler or if an insufficient sample volume is recovered, reposition the rig in a location to satisfy the intent of the original sample point and try again. Note this on the borehole logging form.

- If the total recovered sample volume is insufficient for both screening and laboratory analysis, a second hole will be pushed as close as possible to the original hole and an additional sample will be taken from the same depth interval. The two samples will be composited prior to sampling for chemical analysis.

- If a situation arises in which the groundwater recharge is too slow to allow sampling, a PVC well can be inserted temporarily for sampling at a later time. The PVC well shall consist of decontaminated one-inch or two-inch schedule 40 PVC screen (0.010") and a threaded bottom cap. In general, a 10 foot length of screen shall be sufficient for use as a temporary well.

# SOP A-6
# SOIL SAMPLING FOR CHEMICAL ANALYSIS

## 1.0 OBJECTIVE

Soil samples will be collected for field screening and chemical analysis to enable determination of the nature and extent of contamination in soil. Soil samples will be collected for both phases using primarily direct push sampling method, however, in locations where monitoring wells will be installed hallow-stem auger drilling will be used (SOPs A-5 or A-10).

The following procedures were designed to ensure consistent and high quality data collection and are in accordance with EPA procedures for sample collection as detailed in the following document:

EPA. 1991. *Environmental Compliance Branch, Standard Operating Procedures and Quality Assurance Manual* (SOPQAM), U.S. Environmental Protection Agency, Region IV, Environmental Services Division, Athens, Georgia.

## 2.0 EQUIPMENT AND MATERIAL NEEDS

- Appropriate number and types of sample containers (see Table A6-1);
- Precleaned stainless steel sample mixing bowl;
- Precleaned stainless steel sampling spoons and knife;
- Sample coolers and ice;
- Appropriate field documentation forms and an indelible ink pen;
- Sampling equipment decontamination supplies;
- Waste containers as specified in SOP A-14; and
- Health and safety equipment, as specified in the SSHP.

## 3.0 METHODOLOGY

Soil samples collected using DPT or an HSA with a split-spoon sampler, continuous sampler, or piston sampler will be handled as follows:

A) Retrieve the sampler from the borehole and placed it on a sample table covered with plastic or aluminum foil. Remove the drive shoe and head assembly of the split spoon or piston sampler, and open the sampler carefully so that the sample is not disturbed, If a liner is used, remove the liner assembly and split it longitudinally with a stainless steel knife.

- Once the sampler has been opened or the liner has been split, screen the entire length of the sample with a OVA, and record the reading on the drilling log.

B) Collect samples for VOC analysis first (as required by the sampling plan) to minimize the potential for volatilization. Use a precleaned stainless steel spoon to collect a sufficient amount of soil directly into VOC sample containers.

- The sample will be packed to completely fill the container and reduce the amount of headspace, which will minimize the loss of volatile compounds.

- Teflon-lined septum lids will be immediately secured on each sample container.

C) Collect approximately one tablespoon of soil and place it in a foil covered 120-mL jar for head space analysis.

- Place the remaining sample into the precleaned stainless steel mixing bowl with a precleaned stainless spoon, taking care to minimize disturbance of the sample.

D) For samples that will not be analyzed for VOCs, composite the remaining soil by carefully mixing with a decontaminated stainless steel spoon. Divide the composite sample into aliquots of equal size, corresponding to the number of required sample containers.

E) Use the stainless steel implement to place each aliquot into the appropriate containers and secure each container immediately with a Teflon-lined lid.

F) Complete the sample labels as specified in SOP A-14.

G) Wipe the container with a paper towel prior to affixing the sample label.

H) Pack the sample containers in coolers with ice to minimize volatilization and preserve the samples. Do not add chemical preservatives to the soil samples.

I) Decontaminate all sampling equipment in accordance with SOP A-2.

K) Collect and manage all excess sample and other wastes as specified in SOP A-14

## 4.0 COMMENTS

- The supervising geologist should be prepared and have all the supplies available on site to conduct both Phase I and Phase II sampling programs at each site.
- Container and preservation requirements for various analytical methods are detailed in Table A6-1.

**TABLE A6-1**
**CONTAINER AND PRESERVATION REQUIREMENTS FOR SOIL SAMPLING**

| REFERENCE METHOD | PARAMETER | CONTAINER[1] | SAMPLE PRESERVATION[2] | MAXIMUM HOLDING TIME[3] EXTRACTION | ANALYSIS |
|---|---|---|---|---|---|
| EPA 8015 | TPH-gas | 1 x 4 oz wide mouth jar, G | Ice to 4°C | -- | 14d |
| EPA 8015 | TPH-diesel | 1x8 oz wide mouth jar, G | Ice to 4°C | -- | 28 d |
| EPA 8240 | Volatile Organics | 2x40 mL G, Septa vial | Ice to 4°C | -- | 14 d |
| EPA 8270 | B/N/A | 1x8 oz wide mouth jar, G | Ice to 4°C | 7 d | 40 d |
| TAL 6000/7010 series | Metals | 1x8 oz wide mouth jar, G | Ice to 4°C | -- | 6 months |
| SW-846:9045 | pH | 1x2 oz wide moth jar, G | Not specified | -- | ASAP |
| EPA 8080 | PCBs/Pesticides | 1x8 oz wide mouth jar, G | Ice to 4°C | 7 d | 40 d |
| Full suite (8240, 8270, 6000/7010) | TCLP | 2x8 oz wide mouth jar, G | Ice to 4°C | -- | 14d |

[1] All containers must have Teflon-lined seals (Teflon-lined septa for all VOA vials). G = Glass, P = High density polyethylene.

[2] Container volume may vary slightly depending upon laboratory specific requirements.

[3] When only one holding time is given, it implies total holding time from sampling until analysis.

# SOP A-7
# PROCEDURE FOR FIELD SCREENING OF VOLATILE ORGANICS

## 1.0 OBJECTIVE

Soil samples can be screened in the field for relative concentrations of total volatile organic constituents (VOCs) rapidly and inexpensively. It is important to note, however, that the screening technique is relative and will not quantify the exact concentration of the particular constituents present in the sample matrix. The procedure is only used to determine the relative concentrations of VOCs between sets of soil samples. For example, if 10 soil samples are collected vertically from one soil boring, the screening technique can be used to determine which samples may have relatively higher concentrations of VOCs with respect to the other samples. Section 2.0 covers equipment required to perform the screening. Section 3.0 presents the steps required to perform the sampling.

## 2.0 EQUIPMENT AND MATERIAL

The following equipment is required for field VOC screening:

- A photoionization detector (PID) or a flame ionization detector (FID);
- Sample containers such as glass jars and aluminum foil or zip-lock-style plastic bags;
- Calibration gas for the FID or PID (Isobutylene for PIDs, methane for FIDs); and
- Field Sampling Data Report (FSDR) (Appendix B).

## 3.0 METHODOLOGY

The following steps are employed when screening soil samples for total concentrations of VOCs. The procedure assumes that a fraction of the soil sample has already been collected using the soil sample procedure SOPs.

A) Place a fraction of the soil sample collected in a glass jar and cover the jar mouth with aluminum foil or place the sample in a ziploc-type plastic bag. Place the samples in a warm place or area of stable temperature such as a building or temperature controlled environment.

B) Allow all the samples to equilibrate to the temperature controlled environment.

C) Turn the PID and FID on and calibrate the instrument using the appropriate calibration gas (i.e. methane for a FID and isobutylene for a PID) using the procedures specified by the manufacturer.

D) Insert the probe from the PID or FID into the headspace of the jar (i.e. through the aluminum foil lined lid or through the plastic bag and collect a sample of the air in the headspace of the jar.

E) Observe and record the headspace measurement as parts per million (ppm) in the field notebook or soil boring log. Note which type of instrument and the calibration gas was used.

F) Repeat steps D and F until all the samples have been screened.

## 4.0 COMMENTS

- Obtaining a good sample for chemical analysis for VOCs is the first priority.
- Field screening the sample for VOCs using a PID or FID is second priority.
- Transcribing the lithologic descriptions and collecting the geotechnical sampling is the last priority.

# SOP A-8
# LITHOLOGIC DESCRIPTION AND GEOTECHNICAL SAMPLING

## 1.0 OBJECTIVE

Lithologic logging will be performed to define the subsurface geology. All soils will be described using the Unified Soils Classification System (USCS) (ASTM Designation D 2488-84: Standard Practice for Description and Identification of Soils [Visual-Manual Procedure]).

## 2.0 EQUIPMENT AND MATERIAL NEEDS

- Tape measure;
- Munsall soil color chart;
- Hand lens;
- Knife or spatula;
- Dropper with 10% HCl for calcium carbonate test;
- LaMotte soil texture kit or small vial;
- Water;
- Borehole log forms (Attached); and
- Health and safety equipment, as specified in the SSHP.

## 3.0 METHODOLOGY

A) Note penetration rates and comments in "remarks" section of logging form (e.g. "easy penetration", "hammering required", "2 ft in 3 minutes", etc.). If using a drop hammer, record blow counts.

B) Measure entire sample length and record recovery (as total footage recovered over the total length that sampler was pushed) to nearest tenth of a foot. Mark lithologic changes on logging form.

C) Separate a small, representative portion of each distinct soil to be identified.

D) Identify the color using the Munsall chart.

E) Identify the soil type using the field tests outlined in the ASTM guidance. All required tests considered appropriate for soil type should be performed (i.e. tests for fine-grained soils, such as plasticity, need not be performed on coarse grained soil).

F) Record descriptions of the soil on the borehole log form. To facilitate the comparison of logs, all descriptions should use the following order and style:

- Soil type (*Silty SAND w/Clay*);
- USCS Code (*SM*);
- Soil Color (*Moderate yellow brown (10YR5/4)*;
- Moisture content;
- Angularity and shape of particles (if a sand or gravel);
- Consistency;
- Cementation;
- Structure;
- Dry strength;
- Dilatancy;
- Toughness;
- Plasticity;
- Miscellaneous descriptors (roots, nodules, odors, texture percentages from the LaMotte kit, etc.).

G) Note all visible contamination, PID/FID measurements, odor, or any observed evidence of contamination in the sample.

H) As necessary, identify the percentages of sand, silt, and clay in each sample using a LaMotte soil texture kit, or by settling using a small vial or bottle.

I) The sample should be placed in a soil jar or steel tube and sealed with as little air as possible (Table A8-1).

J) Label the contained for shipment to a lab for geotechnical grain size distribution (without the hydrocarbons portion of the test) (ASTM D421 and D422). Atterberg Limits (ASTM D4318), and moisture content (ASTM D2216).

## 4.0 COMMENTS

- Obtaining a good sample for chemical analysis is the first priority; collect chemical samples for volatile organic compounds (VOCs) before logging the soil core or taking geotechnical samples.
- Because visible contamination and field screening by FID/PID is used to define extent of contamination, it is essential that all observations concerning odor and staining and PID or FID readings are recorded on the logging form.
- Consistent logging is important for accurate characterization of site geology. Although the geologist may need to use his/her professional judgement to infer contacts and lithology, using the tests listed in the ASTM method will ensure consistent results.
- Drilling log scale should be adjusted based on the total depth and level of detail required for site-specific investigation being conducted.

**TABLE A8-1**
**CONTAINER AND PRESERVATION**
**REQUIREMENTS FOR GEOTECHNICAL**

| Reference Method | Parameter | Minimum Volume | Container |
|---|---|---|---|
| ASTM D4318 | Atterberg Limits | 100 grams | 4 oz glass jar[1] |
| ASTM D2216 | Moisture content | 50-100 grams | 4 oz glass jar[1] |
| ASTM D421 & 422 | Grain size | 30-40 grams | 2- to 4- oz glass jar[1] |

[1] OK to combine these analyses into a larger container

# DRILLING LOG

| | | |
|---|---|---|
| | | HOLE NO. |
| 1. COMPANY NAME | 2. DRILLING SUBCONTRACTOR | SHEET 1 OF SHEETS |
| 3. PROJECT | 4. LOCATION | |
| 5. NAME OF DRILLER | 6. MANUFACTURER'S DESIGNATION OF DRILL | |
| 7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT | 8. HOLE LOCATION | |
| | 9. SURFACE ELEVATION | |
| | 10. DATE STARTED | 11. DATE COMPLETED |
| 12. OVERBURDEN THICKNESS | 15. DEPTH GROUNDWATER ENCOUNTERED | |
| 13. DEPTH DRILLED INTO ROCK | 16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED | |
| 14. TOTAL DEPTH OF HOLE | 17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) | |

| | | | |
|---|---|---|---|
| 18. GEOTECHNICAL SAMPLES | DISTURBED | UNDISTURBED | 19. TOTAL NUMBER OF CORE BOXES |

| | | | | | | |
|---|---|---|---|---|---|---|
| 20. SAMPLES FOR CHEMICAL ANALYSIS | VOC | METALS | OTHER (SPECIFY) | OTHER (SPECIFY) | OTHER (SPECIFY) | 21. TOTAL CORE RECOVERY % |

| | | | | |
|---|---|---|---|---|
| 22. DEPOSITION OF HOLE | BACKFILLED | MONITORING WELL | OTHER (SPECIFY) | 23. SIGNATURE OF INSPECTOR |

| ELEV. a | DEPTH b | DESCRIPTION OF MATERIALS c | FIELD SCREENING RESULTS d | GEOTECH SAMPLE OR CORE BOX NO. e | ANALYTICAL SAMPLE NO. f | BLOW COUNTS g | REMARKS/RECOVERY h |
|---|---|---|---|---|---|---|---|
| | 1 | | | | | | |
| | 2 | | | | | | |
| | 3 | | | | | | |
| | 4 | | | | | | |
| | 5 | | | | | | |
| | 6 | | | | | | |
| | 7 | | | | | | |
| | 8 | | | | | | |
| | 9 | | | | | | |

| | |
|---|---|
| PROJECT | HOLE NO. |

# DRILLING LOG

HOLE NO.

PROJECT

INSPECTOR

SHEET 2 OF SHEETS

| ELEV. a | DEPTH b | DESCRIPTION OF MATERIALS c | FIELD SCREENING RESULTS d | GEOTECH SAMPLE OR CORE BOX NO. e | ANALYTICAL SAMPLE NO. f | BLOW COUNTS g | REMARKS/RECOVERY h |
|---|---|---|---|---|---|---|---|
| | 11 | | | | | | |
| | 12 | | | | | | |
| | 13 | | | | | | |
| | 14 | | | | | | |
| | 15 | | | | | | |
| | 16 | | | | | | |
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| | 26 | | | | | | |
| | 27 | | | | | | |

PROJECT

HOLE NO.

# SOP A-9
# GROUNDWATER SAMPLING FOR CHEMICAL ANALYSIS

## 1.0 OBJECTIVE

Groundwater will be sampled during Phase I and Phase II activities using the direct push method. This SOP outlines procedures that will be followed to ensure that samples taken using direct push methods are representative of the groundwater in the formation.

## 2.0 EQUIPMENT AND MATERIAL NEEDS

- Groundwater sampling log (Attachment A9-1);
- Electric water level meter (E-line);
- pH/temperature/electrical conductivity meters (and calibration standards);
- Decontamination supplies, as specified in SOP A-2;
- Sample containers, preservatives, pH paper, coolers, sample labels, and ice (see Table 1);
- Field documentation (field log book, field data sheets, chain-of-custody forms);
- 1-11 pH indicator paper;
- Preservatives (concentrated $HNO_3$, $H_2SO_4$, HCl, etc.);
- Disposable pipettes; and
- Health and safety equipment, as specified in the SSHP.

## 3.0 METHODOLOGY

A) Ensure that all equipment is operational and has been calibrated by following the manuals provided by the manufacturer. Meters should be calibrated, at minimum, twice daily. Record results of the calibration in he meter's calibration log book.

B) Condition the groundwater sampling tool by removing at least one volume of the tool's total capacity (i.e., one bailer, one tube volume, etc.). Measure pH, temperature, and conductivity of the discharge water at the end of purging. Record the water quality readings and the volume purged on the groundwater sampling log.

C) Collect samples in the appropriate sample container (Table A9-1), taking care to avoid agitation and splashing of the sample.

- Volatile organic analysis (VOA) samples should be collected first, with no headspace remaining in capped vials.
- Samples for semivolatile organic analysis should be collected second, followed by samples for all other parameters.

D) Chemical preservatives for VOA samples need to be added to the vial prior to sampling. Laboratory-prepared pre-preserved bottles are preferable over field preservation. One VOA vial should be filled with the sample, and drops of preservative added until the desired pH is reached (measure with pH paper). The same number of drops should be added to the empty VOA vials prior to collection of the samples. Samples for other analyses should have the preservatives added to the full sample bottle, and a small amount will be poured into a small vessel, where the pH can be tested. Preservative will be added until the desired pH is reached. Samples will also be preserved by storing them on ice immediately after sampling.

E) Complete the sample label accurately and legibly and affix to the sample bottles with clear packing tape. Individual sample bottles (and groups of three VOA vials) will be placed in Ziploc bags and stored on ice prior to shipping (see SOP A-14).

F) Dispose of purge water in an appropriate fashion (see SOP A-14).

G) After samples have been collected, take a depth-to-water measurement through the rods using an electronic e-line. (be sure to take into account stick-up of the rods).

H) Decontaminate all sampling equipment that has touched contaminated soil or water (see SOP A-2).

## 4.0 COMMENTS

If the DPT sample point yields insufficient water for sample collection, or does not recharge after removing one sampler volume, the supervising geologist has the option of installing a temporary PVC casing and well screen, and moving to the next sampling location. The temporary well may then be sampled when sufficient recovery has occurred.

**TABLE A9-1**
**CONTAINER AND PRESERVATION REQUIREMENTS FOR WATER SAMPLING**

| REFERENCE METHOD | PARAMETER | CONTAINER[1] | SAMPLE PRESERVATION[2] | MAXIMUM HOLDING TIME[3] EXTRACTION | ANALYSIS |
|---|---|---|---|---|---|
| EPA 8015 | TPH-gas | 4x40 mL G, Septa | Ice to 4°C | -- | 14d |
| EPA 8015 | TPH-diesel | 3x1 L amber, G | Ice to 4°C | -- | 28 d |
| EPA 8240 or 8010/8020 | Volatile Organics | 4x40 mL G, Septa vial | Ice to 4°C<br>4 drops conc HCl to pH<2 | -- | 14 d |
| EPA 8270 | B/N/A | 3x1 L amber, G | Ice to 4°C | 7 d | 40 d |
| TAL 6000/7010 series | Metals | 1x1 L, P | $HNO_3$ to pH<2<br>Ice to 4°C | -- | 6 months |
| SW-846/EPA 9045 | pH | 1 250 mL, plastic | not specified | -- | ASAP |
| EPA 8080 | PCBs/Pesticides | 3x1 L amber, G | Ice to 4°C | 7 d | 40 d |
| Full Suite | TCLP | 3x1 L amber, G | Ice to 4°C | -- | 14 d |

1 All container must have Teflon-lined seals (Teflon-lined septa for all VOA vials). G = Glass, P = High density polyethylene.

2 Sample preservation will be done in the field immediately upon sample collection. If samples are filtered in the field, differential pressure methods and 45 micron filters will be used. Preservation is added after filtration. VOA samples must never be filtered.

3 When only one holding time is given, it implies total holding time from sampling until analysis.

# SOP A-10
# HOLLOW-STEM AUGER (HSA) DRILLING

## 1.0 OBJECTIVE

Hollow-stem auger (HSA) drilling provides a means of advancing a borehole for soil sampling, where use of a DPT rig may be inappropriate. Sampling tools can be easily installed through the center of the augers, while the augers maintain the integrity of the borehole and seal the surrounding formation from the sampler and the interval being sampled. This method will only be used at Sites SD-15, AOC-BBMS, and AOC-RR should the Phase I activities determine that a Phase II investigation is warranted. This field method will be used to collect soil samples for lithologic descriptions (SOP A-8), geotechnical and chemical analyses, (SOPS A-6, A-7, and A-8) and to install monitoring wells (SOP A-11).

HSA drilling activities will be conducted in accordance with:

U.S. Environmental Protection Agency (EPA). 1991. *Environmental Compliance Branch, Standard Operating Procedures and Quality Assurance Manual* (SOPQAM), U.S. Environmental Protection Agency, Region IV, Environmental Services Division, Athens, Georgia.

Korte, Nic, and Peter Kearl. 1985. *Procedures for the Collection and preservation of Groundwater and Surface Water Samples and for the Installation of Monitoring Wells: Second Edition*. U.S. Department of Energy Report GJ/TMC-08. Technical Measurements Center, Grand Junction Project Office, Grand Junction, Colorado.

ASTM Standard Method D 1586-84, "Penetration Test and Split-Barrel Sampling of Soils."

## 2.0 EQUIPMENT AND MATERIAL NEEDS

- HSA drilling rig, equipped with split spoons, continuous samplers, and, at a minimum, 60 ft of approximately 8 in.-O.D. hollow-stem auger (provided by subcontractor).
- Support vehicles (supplied by subcontractor).

- Equipment for lithologic logging as listed in SOP A-8.
- Sampling equipment as outlined in SOP A-6.
- Health and safety equipment, as specified in the SSHP.

## 3.0 METHODOLOGY

A) Obtain clearances from all on-Base and off-Base utilities (SOP A-2). Do not start drilling until all utilities are marked.

B) Begin drilling to depth specified in the FSP for sample collection.

C) Collect samples using a split spoon (with drop hammer), or continuous samples (pushed ahead of drill bit). The procedures for using each of these samplers is as follows:

- Split spoons will be used with a wire line hammer or suitable alternative 140 lb drop hammer. When the desired sampling depth is reached, remove the drill stem, attach a decontaminated split spoon to the wire line hammer, and lower the apparatus to the bottom of the borehole. If an above-hole hammer is used, attach the split spoon to the drill stem and lower it back down to the borehole. After the sample has been collected by driving the sampler with the hammer, retrieve the sampler from the borehole. (Refer to SOPs A-6, A-7, and A-8 for soil sampling procedures).

- If extensive sampling is required in one borehole, a continuous sampler can be used (providing the lithology permits it). This requires the use of a special drill bit and stem that allow a decontaminated split spoon to be lowered through the drill stem and locked into place just below the bottom of the drill bit. The sampler is then pressed ahead of the drill bit as the borehole is advanced. When the sample run is complete, the sampler can be retrieved on the wire line.

- If drilling and sampling with split spoons, a center bit plug should be used to avoid build up of a soil plug at the base of the lead auger.

D) When saturated soil is encountered in the sampling device, discontinue soil sampling for chemical analysis. However, sampling shall be continued for lithologic logging.

E) When the borehole has been completed to the desired depth, complete the borehole with a monitoring well as specified in SOP A-11.

F) Collect and manage all wastes as indicated in SOP A-14.

# SOP A-11
# MONITOR WELL INSTALLATION

## 1.0 OBJECTIVE

Monitor wells will be installed in order to collect representative samples of groundwater and to measure the static water level. Monitoring wells will be installed to a total depths of approximately 15 feet. The screened interval will consist of 10 feet. Actual well depth should be adjusted to actual water levels encountered at the site during drilling. The screened interval should extend 7 feet into groundwater. Depending on location, the wells will be completed above-grade in protective steel surface casing or flush-mounted traffic-rated roadboxes surrounded by a concrete pad.

All monitor wells will be constructed in a manner that complies with all applicable federal, state, or local regulations. For further information on well installation procedures, please refer to the *Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells* (National Water Well Association, 1989).

## 2.0 EQUIPMENT AND MATERIALS

- HSA drilling rig (supplied by subcontractor);
- Grout mixing and pumping equipment with a tremie system equipped with a side emptying discharge attachment;
- Well materials (supplied by subcontractor);
  - 10 ft lengths of 4-inch diameter, flush-treated, Schedule 40 PVC well screen with 0.01-inch slots and flush treads,
  - 5 ft length of 4-inch diameter flush-threaded, Schedule 40 PVC,
  - Centralizers,
  - Washed silica, #10-20 grade filter sand,
  - 1/4-inch sodium bentonite pellets,
  - Neat cement grout (3-5% bentonite powder, 95% Portland cement, and 7 gal. water)
  - Locking steel protective casing and guard posts or flush boxes,
  - Concrete, and
  - Protective steel posts (3" diameter).
- vented surge block and bailer (nominal 3-inch diameter for 4-inch diameter well, 1.5-inch diameter for 2-inch diameter well);

- Indelible pen;
- Borehole Log Forms (SOP A-8);
- Weighted measuring tape;
- Electric water level meter (E-line);
- Waste containers as specified in WMP; and
- Safety equipment as specified in the SSHP.

## 3.0 METHODOLOGY

A) Immediately prior to the completion of the borehole, remove the well screen and riser from the packaging and check it for imperfections as well as oil or ink. If the well materials are not clean, decontaminate them using the procedures outlined in SOP A-2.

B) Place the well screen and riser on a clean surface (such as sawhorse) and attach the casing centralizers such that they will be immediately above the screen and at 25-ft intervals on the riser.

C) Once the borehole is at the desired depth, clean the borehole thoroughly, and check the depth-to-water (using E-line) and to the bottom of the borehole (using the weighted tape).

D) If the borehole is clear to the desired depth, begin installing the well within the auger. Place the well screen inside the augers and hold it in place using a slip lock or other instrument designed to suspend well screen. Do not use a pipe or chain wrench.

E) Attach the riser to the screen suspended in the augers and attach a top cap to the top of the riser. Remove the slip lock and use a winch attached to the top cap to slowly lower the well screen and riser to a point low enough that another section of pipe can be attached to the top of the riser.

F) Continue attaching riser using the techniques outlines in steps D and E until the well rests on the bottom of the borehole. Use Schedule 40 PVC riser for all installations below and above the water table. When complete, the top of the well should be 3 inches below the ground surface for a flush completion and at 2.5 ft above the ground surface for a stick-up completion well.

G) When all riser is set in place, lower a tremie pipe between the well and augers. The bottom of the tremie should be lowered to a depth of no more than 5 ft above the bottom of the borehole.

H) When the tremie is in place, begin adding sand slowly, washing it into place using clean, potable water. Check the depth to sand continuously using a weighted tape.

I) As the sand level rises, raise the tremie pipe slowly so that the bottom of the tremie pipe is between 3 and 5 ft from the top of the filter sand.

J) Pull the augers as the filter sand is added, and continue until the sand has reached a height of 1-2 ft above the top of the well screen.

K) When the filter sand is at the desired height, retract the augers so that they are just above the top of the filter sand.

L) Lower the decontaminated (see SOP A-2) bailer into the well and remove several bailers of water in order to remove sand and fines from the well. Bail until less than 1 inch of sand is recovered in the bailer. Remove the bailer and lower the decontaminated (SOP A-2) surge block into the well and surge it vigorously across the screen length to settle the filter pack. Caution shall be used not to damage the screen. Remove the surge block and resume bailing until only trace amounts of sand are removed. Place all developed water and sand into the contained of saturated soil cuttings.

M) Check the depth to the top to the filter pack and verify that it is between 1-2 ft above the top of the well screen. Use the tremie to add additional sand as required.

N) Remove the tremie pipe and begin pouring bentonite pellets between the well casing and the boring. Pour bentonite slowly to prevent bridging. Check the

height of the bentonite continuously and when the bentonite is at least 3 ft above the top of the filter pack, retract the augers to above the bentonite. If the bentonite pellets are installed above the water table, add clean potable water to the top of the pellets and allow the bentonite to hydrate for at least a half hour.

O) When the bentonite has hydrated, replace the tremie pipe (with a side-emptying discharge attachment) between the drive casing and well and attach it to the grout mixing and pumping equipment. Make sure that the bottom of the tremie pipe is between 3-5 ft from the top of the bentonite.

P) Mix the neat cement grout and begin pouring/pumping it into the borehole, retracting the augers as the grout is added. Add the grout until it is visible at the top of the borehole.

Q) Remove the tremie system and retract the augers completely. If the grout has fallen below the top of the borehole, add additional grout.

R) After the grout has hardened for at least 24 hours, place the protective casing or flush box in the borehole and support it at the appropriate height (2.7 ft above the ground surface for a stick-up completion and 3 inches above the surface for a flush completion).

S) Build a 3 x 3 ft-square form at least 4 inches deep around the well completion, with edges of form no less than 1 ft from edge of protective casing. Pour concrete into the form and smooth the concrete so that it slopes gently away from the well completion.

T) Install three 3-inch diameter protective steel posts at even intervals around the above-ground completed wells.

U) Lock the well cap. Well is now ready for development (SOP A-12).

V) Collect and manage all waste as specified in WMP (Appendix C and SOP A-14).

## 4.0 COMMENTS

- Be sure to measure the actual lengths of all well materials carefully. Well screen and riser sections are rarely exact lengths, and in a well that is over 100 ft deep, small variations on each section can add up to significant differences in total length.

- Careful, precise depth measurements and slow rates for sand and bentonite installation are the keys to a superior well construction. A half hour saved on installation may result in the need to reinstall the well.

- The well completion will be a permanent feature that will be visible and obvious. Make sure that completions are neat and attractive. Any time the well riser needs to be cut to achieve the proper height for the stick up, it should be cut with a hack saw before installation, or with a pipe cutter after installation so that the cut is even and level.

- In the event that a pure pocket of dense nonaqueous phase liquid is encountered during drilling, stainless steel screen and riser will need to be used instead of PVC below the water table.

- The subcontractor will produce a well completion report and submit it to the state within 30 days of the completion of the well.

# SOP A-12

# WELL DEVELOPMENT

## 1.0 OBJECTIVE

Each monitoring well installed during the investigation will be developed to:

A) Assure that groundwater enters the well screen freely thereby yielding a representative groundwater sampling and accurate well water level measurement.

B) Remove all water that may have been introduced during drilling and well installation.

C) Remove fine-grained sediment in filter pack and formation so that groundwater samples are not highly turbid and so that silting of the well does not occur.

Development will be conducted by the contractor. During well development, water quality parameters will be measured and recovery rates will be documented, the latter of which can be used to select sample purge rates and pumping test rates during future field activities. Water level measurements should be collected during development to assess the specific capacity of the well.

## 2.0 EQUIPMENT AND MATERIALS

- Water level probe;
- pH/temperature/electrical conductivity/redox potential meter and calibration standards;
- Turbidity meter;
- Clear glass jars;
- Water bailer and appropriate pumping equipment;
- Well development log (attached);

- Camera and film;
- Decontamination equipment as specified in SOP A-2;
- Waste management equipment as specified in SOP A-14; and
- Health and safety equipment as specified in the SSHP.

## 3.0 METHODOLOGY

A) Begin developing no sooner than 48 hours after a well has been constructed;

B) Prior to the start of development activities, clean all well development equipment following proper decontamination procedures as specified in SOP A-2;

C) Measure vapor readings at the well head using field screening equipment outlined in the SSHP;

D) Before developing a well, measure the total well depth and the depth to the top of the water table, and record the measurements in the well development log;

E) Use a bailer to collect water for initial water quality parameter measurements, (pH, temperature, electrical conductance, and turbidity readings), and record these readings in the well development log;

F) Take photograph to document water quality prior to development;

G) Alternately surge and bail the well until minimal fines are produced and the purged water begins to clear;

H) Take water quality measurements frequently, at least every half hour, or more frequently as visual observations or water quality measurements indicate that the quality of the water is changing;

I) Contain purge water in properly labeled drums, and handle according to the WMP (Appendix C);

J) Have the subcontractor install a development pump (typically 2- to 5-gpm capacity, submersible or centrifugal pump);

K) Purge water from the well using the pump, at a rate approximately equal to or greater than the anticipated purging/sampling rate;

L) Continue water quality measurements until the following criteria for continuing development have been met:

- Develop for a minimum period of 2-hours per well,
- Develop for a maximum period of 8-hours per well,
- Develop until the pH, temperature, specific conductivity, and redox potential have stabilized to within 10% of the previous two readings, and until sediment in the water has cleared to a point such that the turbidity meter reads less than 30 nephelometric turbidity units (NTUs),
- Develop at least as much water as was introduced during drilling, if any, has been removed from the well, and
- Develop until one well casing volume and one filter pack volume have been purged;

M) Record all measurements in the well development log;

N) Continue to contain the purge water according to methods outlined in the WMP (Appendix C); and

O) When development is complete, measure and record a final total well depth and top of the water table depth, and take a final photograph to document water quality.

## 4.0 COMMENTS

- No water or other fluids, other than natural formation water, shall be added during development of that well.
- Wells at the site are expected to produce sufficient volumes of water to allow for standard development. However, slow producing wells may need

to be developed using an alternative procedure. If, during the initial phases of development should be performed by bailing the well, allowing it to recover to at least 90% of the initial water level, and repeating the bailing until dry/recovery method at least three times. Water quality measurements (pH, electrical conductance, temperature, and turbidity) should be collected at least three times during bailing.

# MONITORING WELL DEVELOPMENT RECORD



| INSTALLATION | WELL ID | | DATE | TIME |
|---|---|---|---|---|
| PERFORMED BY | WATER LEVEL | | TOTAL DEPTH | |
| | INITIAL | FINAL | INITIAL | FINAL |
| DEVELOPMENT METHOD | | SURGE TECHNIQUE | | |
| FIELD MEASUREMENTS | | | | |

| Time | Cum. Volume (gal) | Water Quality | | | | Comments |
|---|---|---|---|---|---|---|
| | | Temp | pH | Cond | Turbidity | |
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| | | | | | | Final Measurements |

| Total Volume Removed | Comments |
|---|---|
| Development Time | |

# SOP A-13

# GROUNDWATER SAMPLING FROM MONITORING WELLS

## 1.0 OBJECTIVE

This SOP outlines the methods used for conducting groundwater sampling. These procedures will be followed to ensure that samples collected from monitor wells are representative of the groundwater in the formation within which the well is screened. Groundwater sampling of any new monitor wells shall not commence until a minimum of two days has elapsed since completion of well development, allowing time for stabilization of groundwater conditions in the well.

## 2.0 EQUIPMENT AND MATERIALS

Wells that will be installed during the PA/SI will be purged from either dedicated teflon bailers, stainless steel bailers, or disposable bailers, where applicable.

Equipment and materials required for groundwater sampling include:

- Bladder pump with teflon bladder and stainless steel case;
- Control box;
- Compressed gas source;
- Air lines;
- Clear teflon, stainless steel, or disposable bailer;
- Dedicated disposable Teflon bailers;
- Electric water level meter (E-line);
- pH/temperature/specific conductance/dissolved oxygen/redox potential meter, flow-through cell and calibration standards;
- pH paper;
- Decontamination supplies as specified in SOP A-2;

- Sample containers, preservatives, coolers, sample labels, and ice (Table A9-1);
- Field documentation (field log book, etc.);
- Groundwater sampling log (Attached);
- Water containers as specified in the WMP; and
- Health and safety equipment as specified in the SSHP.

## 3.0 METHODOLOGY

The following procedures are written with separate steps for: 1) wells with dedicated bailers which require a portable purge pump; 2) wells equipped with dedicated bladder pump systems; and 3) wells in which dedicated bladder pumps may be installed.

A) Ensure that all equipment is properly calibrated and operated by following the manuals provided by the equipment manufacturer. Record results of the equipment check in the log book.

B) Locate well and record well number, site, date, time, weather conditions, and condition of well completion on the groundwater sampling log (Attachment A9-1) and in the field log book.

C) Open well, noting condition of inner well seal/cap on the groundwater sampling log, and measure depth to water and total well depth with a decontaminated E-line.

D) Check for presence of a floating free-phase product layer in the well with a oil-water interface probe.

E) Calculate total submerged casing volume, using the following formula:

$$V = 3.14\ r^2L \times 7.48\ \text{gals./ft}^3$$

where:

V = submerged casing volume;
r = inside radius of casing; and
L = height of water column in well (ft).

F) Lower purging bailer slowly to desired depth (total depth or mid-point of screened interval).

G) Bail water until desired volume and/or water quality measurements have stabilized.

H) Wells should be purged at a low flow rate (approx. 0.25 gal./minute), if using pump.

I) Measure pH, specific conductance, temperature, dissolved oxygen and redox potential of the discharge water throughout purging. Measurements should be recorded at an interval sufficient to determine changes in water quality parameters: a maximum of one reading every gallon for wells containing a small volume of water, and a minimum of about 5 readings per purge. Purging will be complete when these parameters have stabilized to within $\pm$ 0.10 pH units, 10% change in mohms specific conductance, and $\pm$ 1°C over a successive well volume. A minimum of three wetted borehole volumes will be purged. Record the water quality readings and the volume purged on the groundwater sampling log.

J) Collect one final depth to water measurement with the decontaminated electronic water level indicator to ensure that sufficient water remains in the well to fill all required sample containers.

K) Reduce the pumping rate for sampling. VOA samples should be collected first, with no headspace remaining in capped vials. Care should be taken to avoid agitation and splashing of the sample.

L) Preservatives for VOA samples need to be added to the vial prior to sampling. It is important to add an adequate amount of preservative to the VOA vials, as these samples cannot be reopened to check pH following collection. Samples for other analyses should have the preservatives added to the full sample bottle until the desired pH is reached.

M) Complete the sample labels accurately and legible and affix to the sample bottles with clear packaging tape. Individual sample bottles (and groups of three VOA vials) will be placed in Ziploc bags and stored on ice prior to shipping (SOP A-1).

N) Collect and manage all wastes as outlined in this WMP.

O) Decontaminate all sampling equipment that has touched contaminated water, soil, or wastes (see SOP A-2).

## 4.0 COMMENTS

- Dedicated sampling devices are installed in many wells to minimize the potential for cross-contamination and reduce the need for decontamination. Only the portable submersible purge pump, the E-line and Teflon bailer (if used) will need decontamination between wells. Decontamination procedures are presented in SOP A-2.

- If the well should be pumped dry during purging, the sampler will wait until sufficient water (50% of saturated casing volume) has recharged to the well, and then proceed to sample as outlined in this SOP.

WELL GAUGING, PURGIN D SAMPLING MONITORING FORM



Project Name/Location _____ Date: _____

Project Number _____ Technician _____

| | | A | B | C | D | E | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Well Number | Well Diameter (Inches) | Gallons Per Foot | Well Depth (Feet) | Depth To Water FromTop Of Casing (Feet) | Feet Of Water In Well (B – C) | Gallons Of Water In Well (A x D) | Gallons Of Water To Purge (E x 3) | Purge Method (Bail/Pump) | Time Purging Began (HH:MM) | Actual Amount Purged (Gallons) | Depth To Water After Purging (Feet) | Depth To Water Prior To Sampling (Feet) | Time Sample Collected (HH:MM) | Sample With Disposable Or Decontaminated Bailer | Metals Samples Filtered (Y/N) |
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| Well Diameter | Gallons Per Foot |
|---|---|
| 1" | 0.04 |
| 2" | 0.16 |
| 3" | 0.37 |
| 4" | 0.65 |
| 6" | 1.47 |
| 8" | 2.61 |
| 10" | 4.08 |

Comments:

# WELL GAUGING, PURGING, AND SAMPLING MONITORING FORM

## 4.0 Samples Collected

| | Well Location | Comments |
|---|---|---|
| 4.1 VOC's _____ EPA Analysis | _____ | _____ |
| 4.2 Total Suspended Solids | _____ | _____ |
| 4.3 Plate Count | _____ | _____ |
| 4.4 Fe _____ Method | _____ | _____ |
| 4.5 Mn _____ Method | _____ | _____ |
| 4.6 Ca _____ Method | _____ | _____ |
| 4.7 Other Analyses | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |

| Analysis | <---------- Well Locations | | | | ----------> | Comments |
|---|---|---|---|---|---|---|
| _____ | _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ | _____ |

**Sign Off:**

Technician _____

Field Service Manager _____

Project Engineer _____

Project Manager _____

# SOP A-14

## FIELD MANAGEMENT OF INVESTIGATION-DERIVED WASTE (IDW)

## 1.0 OBJECTIVE

To collect and manage IDW in accordance with state and federal regulations, this SOP provides easy-to-follow procedures for characterizing, handling, storing, and disposing of IDW generated during the PA/SI field program. Details of the waste management procedures are presented in Section 5. IDW management techniques emphasize waste minimization.

## 2.0 EQUIPMENT AND MATERIAL NEEDS

- DOT-approved drums and containers;
- IDW "Analysis Pending" labels (Attached);
- "Hazardous Waste" labels and Non Hazardous labels (Attached);
- Indelible markers (i.e., Sharpie);
- Clear adhesive tape;
- Ratchet, socket, and crescent wrench for opening/closing drums;
- PPE;
- Plastic buckets for carrying purge water to drums;
- Absorbent pads or booms for cleaning up spills;
- Wooden pallets;
- Waste inventory form (Attached); and
- PID or FID.

# 3.0 METHODOLOGY

## 3.1 Soil and Water IDW

A) Conduct sampling in accordance with SOPs 6 and/or 9.

B) If soil is stained, place excess soil in appropriately sized DOT-approved drums or cans. IDW soil and water shall not be placed in the same container.

C) Place an adhesive label on the side of the container. Using an indelible marker, write the following information on the label

- The phrase "Analysis Pending"
- Accumulation start date
- Name of waste (e.g., soil from soil or well boring ID numbers)
- Name and phone number of Holloman AFB contact (BEC)

D) When label is complete, cover it with a piece of clear adhesive tape.

E) If soil is not stained, conduct VOC screening with a PID or FID.

F) If no VOCs are detected in headspace analysis, spread excess soil around borehole.

G) If VOCs are detected in the soil, place excess soil in DOT-approved drums, and label the drum (or container) in accordance with step #B above.

H) If the site is developed and will not accommodate the spreading of soils, then soils containing TPH concentration less than 1,000 ppm will be transferred to the Base's landfill.

I) If soils are containerized, move to IDW drum storage area.

J) If original analytical levels do not exceed 20 times the TCLP levels, then a maximum of one sample per site should be collected from the container for analysis of TCLPs by Methods 8240, 8270, and Total TAL Metals.

K) The appropriate tables in the WMP (Appendix C) should be referenced for disposal options once the laboratory data is obtained.

### 3.2 PPE and Disposable Sampling Equipment Waste

A) Removed excess solid and liquid waste from PPE and disposable sampling equipment.

B) Place all PPE and sampling equipment to be disposed of in sealed plastic trash bags.

C) Dispose of trash bags in a dumpster at the IDW staging area.

D) If a Base dumpster is not located near the IDW staging area, arrange for one that can be used during the course of the investigation.

### 3.3 Field Laboratory Waste

A) Excess soil and water that contains no Freon should be disposed of in the same manner as IDW generated at the time of sampling.

B) Sample bottles, lids, filters, and other disposable lab equipment should be placed in a sealed plastic trash bag, and placed in a Base dumpster.

## 4.0 COMMENTS

Be sure each container is labeled in accordance with step C) of the Methodology section in this SOP (section 3.1 above). Be sure that the contractor's name never appears on the label; only the contact person of Holloman AFB should appear on the label.

If IDW that may be hazardous is spread on the ground at the boring location, Holloman AFB is potentially liable for unauthorized land disposal of hazardous waste. All IDW pending analysis must be moved to the drum staging area. No waste may be discharged to the ground surface until a Notice of Intent to Discharge is approved by the NMED. Only IDW from Criteria 1 and 2 sites which contains constituents below the HBLs designated in Table 2-2, Appendix C, which is not characteristically hazardous, and which does not contain TPH in excess of 1,000 ppm, may be spread on site.

# NON-CLASSIFIED WASTE MATERIAL

## LABORATORY ANALYSIS IN PROGRESS

**CAUTION:** THE CONTENTS OF THIS CONTAINER HAVE NOT BEEN CLASSIFIED AND MUST BE MANAGED WITH CAUTION UNTIL CLASSIFIED AND THEN MANAGED ACCORDINGLY. DO NOT OPEN OR MOVE WITHOUT PRIOR APPROVAL FROM GENERATOR/CONTRACTOR. CONTENTS MAY BE HARMFUL TO HUMAN HEALTH OR THE ENVIRONMENT.

MATERIAL: _____

SITE ADDRESS: _____

_____

_____

ACCUMULATION DATE: _____

GENERATOR: _____

GENERATOR CONTACT & PHONE: _____

CONTRACTOR CONTACT & PHONE: _____

_____

_____

**NOTE:** THIS CONTAINER CANNOT BE SHIPPED UNTIL CLASSIFICATION IS COMPLETE AND CONTAINER IS APPROPRIATELY MARKED AND LABELED IN ACCORDANCE WITH EPA AND D.O.T. REGULATIONS.

NCWM-P

Printed by: Mesa Label Express, 8525 Arjons, Ste. T, San Diego, CA 92126 (619) 693-4988

# HAZARDOUS WASTE

FEDERAL LAW PROHIBITS IMPROPER DISPOSAL

IF FOUND, CONTACT THE NEAREST POLICE, OR
PUBLIC SAFETY AUTHORITY, OR THE
U.S. ENVIRONMENTAL PROTECTION AGENCY

PROPER D.O.T.
SHIPPING NAME_____ UN OR NA#_____

GENERATOR INFORMATION:

NAME_____

ADDRESS_____

CITY_____ STATE_____ ZIP_____

EPA
ID NO._____

EPA
WASTE NO._____

ACCUMULATION
START DATE_____

MANIFEST
DOCUMENT NO._____

## HANDLE WITH CARE!

CONTAINS HAZARDOUS OR TOXIC WASTES

STYLE WM 6

Printed by LABELMASTER, Div. of AMERICAN LABELMARK CO. CHICAGO, IL 60646

# SOP A-15
# BOREHOLE ABANDONMENT AND SITE RESTORATION

## 1.0 OBJECTIVE

All boreholes must be sealed to prevent the spread of contaminants with depth and to eliminate direct pathways from the surface to the subsurface and groundwater. Surface materials such as asphalt and cement that have been drilled or pushed through must also be repaired to a satisfactory condition.

## 2.0 EQUIPMENT AND MATERIAL NEEDS

- Bentonite chips and funnel;
- Cold-patch asphalt material and quick-set concrete;
- Grout (97% Portland cement/3% bentonite mixture);
- Ample amounts of water; and
- Health and safety equipment, as specified in the SSHP.

## 3.0 METHODOLOGY

In general, borehole abandonment will be completed by the DPT or HSA subcontractor under supervision of the rig geologist. The subcontractor will supply all necessary materials listed above. The contractor, however, may need small amounts of bentonite to seal hand-auger boreholes.

A) After a boring has been completed by **DPT technique**, leave the drive rods in place pending abandonment.

B) Add bentonite chips slowly into the top of the drive rods using a funnel. As the rods are being slowly pulled from the borehole, add bentonite to complete the seal to the surface.

C) If the rods have been driven into groundwater, it will not be possible to seal the borehole through the rods. (The bentonite chips will stick to the inside of the rods, clogging the end). In this case, carefully extract the rods and slowly add bentonite chips, being careful not to allow bridging.

D) Hydrate the seal using ample amounts of potable water.

E) If **HSA drilling methods** are used, seal the borehole by using a Portland cement/bentonite grout. Emplace the grout through the augers from the bottom of the borehole to he surface using a tremie pipe or hose.

F) If the borehole is through asphalt or concrete, leave the seal below the bottom of the pavement to allow for sufficient fill and patching material.

G) Patch pavement with appropriate material.

H) Mark the boring location with a clearly labeled stake, flag, or spray-painted number, that indicates the site and borehole number.

## 4.0 COMMENTS

- For proper surveying at a later time, it is crucial to clearly mark each boring location with a labeled stake, flag, or spray-painted number.

# SOP A-16
# LOCATION SURVEYING

## 1.0 OBJECTIVE

The location of every sampling point, including soil gas survey points, soil sampling points, groundwater sampling points, and monitor wells will be surveyed by a State of New Mexico registered land surveyor. This will provide a permanent record of sampling locations and information that can be used in future reports and potential corrective measures designed for the site.

## 2.0 EQUIPMENT AND MATERIALS

The surveying subcontractor will supply all equipment and materials that will be used during the surveying activity.

## 3.0 METHODOLOGY

The surveying subcontractor may use either traditional survey techniques or a global positioning system (GPS) to satisfy the following survey requirements:

- Horizontal coordinates of each sampling location must be measured to an accuracy of 0.10 ft in reference to the State Plane Coordinate System.
- Monitor well top of casing elevations must be measured to an accuracy of 0.01 ft relative to mean sea level of the Natural Geodetic Vertical Datum of 1993.
- Ground elevations of each boring location will be measured to the nearest 0.10 ft relative to mean sea level of the National Geodetic Vertical Datum of 1983. (If the 1983 datum is not available, references may be made to the 1929 Datum).
- To aid in accurate reconstruction of site figures and future plans of the site, one permanent reference point will also be the nearest building corner to the SWMU or a suitable alternative reference point.

## 4.0 COMMENTS

- Do not mobilize the surveying subcontractor until it is certain that there will not be additional borings at a site.
- To assist the surveying effort and minimize the chance of missed survey points, provide the surveyors with completed site maps and the number of locations per site.

# APPENDIX B -- Forms

Daily Quality Control Report (DQCR)
Field Sampling Data Report (FSDR)

_____
(FIRM NAME)

DAILY QUALITY CONTROL REPORT

Daily Report No.:_____ Date:_____
Contract No.:_____
Project Title & Location:_____
Weather:_____ Precipitation:_____ In.:___ Temp.:_____ Min.:_____ Max.:_

1. Contract/Subcontractors and Area of Responsibility:

| NUMBER | TRADE | HOURS | EMPLOYER | LOCATION/DESCRIPTION WORK |
|---|---|---|---|---|
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2. Operating Plant or Equipment. (Not hand tools)

| Plant/Equipment | Date of Arrival/ Departure | Date of Safety Check | Hours Used | Hours Idle | Hours Repair |
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3. Work Performed Today: (Indicate location and description of work performed by prime and/or subcontractors. When network analysis is used, identify work by NAS activity number).

4. Control Activities Performed:
Preparatory Inspections: (Identify feature of work and attached minutes).
Initial Inspections: (Identify feature of work and attach minutes).
Follow-Up Inspections: (List inspections performed, results of inspection compared to specification requirements, and corrective actions taken when deficiencies are noted).

5. Tests Performed and Test Results: (Identify test requirement byu paragraph number in specifications and/or sheet number in plans).

6. Material Received: (Note inspection results and storage provided).

7. Submittals Reviewed:

| (a) Submittal No. | (b) Spec/Plan Reference | (c) By Whom | (d) Action |
|---|---|---|---|
| | | | |
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8. Off-site Surveillance Activities, Including Action Taken:

9. Job Safety: (List items checked, results, instructions and corrective actions taken).

10.Remarks: (Instructions received or given. Conflicts(s) in Plans and/or specifications. Delays encountered.).

Contractor's Verification: On behalf of the Contractor, I certify this report is complete and correct, and all materials and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications, to the best of my knowledge, except as may be noted above.

CQC System Manager Date

## FIELD SAMPLING DATA REPORT

**Sampling Descriptions and Results** **Page _____ of _____**

Sampler(s): _____ Date(s) _____

| Sample ID[a] | Sample Interval (in. or ft.) | Visible Contamination (Yes or No) | [VOC Headspace] (ppm) | [TPH][b] (mg/Kg) | Hot Spot[c] (Yes or No) | Laboratory Analysis[d] | Comments |
|---|---|---|---|---|---|---|---|
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[a] Format: [SWMU No.-Sample Location-Method/Matrix-Relative Depth]
[b] Field IR Analysis
[c] TPH concentration>action level (100 mg/kg)="Yes"
[d] Format: [Analytical Lab-Sample Type]

| | |
|---|---|
| FLD=Field lab | C=Confirmation |
| CON=Contractor lab | D=Duplicate |
| MRD=Missouri River Division lab | EB=Equipment blank |
| | QA=QA duplicate |
| | M=Matrix/matrix spike duplicate |

Additional Comments/Explanations:

# APPENDIX C -- Waste Management Plan

*Headquarters, Air Combat Command*
*Langley Air Force Base,*
*Virginia*

# *Waste Management Plan for RCRA Facility Investigation Holloman Air Force Base New Mexico*

*Table 2 Phase I RFI*

*October 1993*

*49 CES/CEV*
*Holloman Air Force Base,*
*New Mexico*

## PURPOSE OF DOCUMENT

a. The WMP provides the waste management procedures for waste generated during the RFI. The WMP contains descriptions of the investigation-derived waste (IDW) and procedures for characterizing, managing, storing, and disposing of IDW.

DCN 93-612-001-04-04
RCN 612-001-04-40

# DRAFT FINAL
# WASTE MANAGEMENT PLAN
# FOR
# RCRA FACILITY INVESTIGATION
# HOLLOMAN AIR FORCE BASE, NM

## TABLE 2 PHASE I RFI WORK PLAN

Prepared for:

49 CES/CEV
Holloman Air Force Base, NM

September 1993

**WASTE MANAGEMENT PLAN**

**FOR**

**RCRA FACILITY INVESTIGATION**

**HOLLOMAN AIR FORCE BASE, NM**

**TABLE 2 PHASE I RFI WORK PLAN**

**APPROVAL**

This Waste Management Plan (WMP) provides the guidelines for handling investigation-derived waste (IDW) during the Table 2 Phase I RFI at Holloman Air Force Base (AFB). The signatures below indicate concurrence with the procedures specified in the plan.

New Mexico Environment Department, Enforcement:

Signature: _____ Date: _____

Printed Name: _____

Title: _____

U.S. Environmental Protection Agency, Region VI, RCRA:

Signature: _____ Date: _____

Printed Name: _____

Title: _____

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## 1.0 INTRODUCTION

The Table 2 Phase I RCRA Facility Investigation (RFI) for Holloman Air Force Base (AFB) comprises 43 solid waste management units (SWMUs) and two areas of concern (AOCs) that are grouped into 28 sites for investigation purposes. The Table 2 Phase I RFI Work Plan details the field and laboratory procedures, site-specific sampling plans, and data management and evaluation procedures for the investigation of these SWMUs.

### 1.1 Objective

The objective of this waste management plan (WMP) is to document the procedures that will be used to characterize, handle, store, and dispose of wastes generated as part of the RFI field program.

### 1.2 Regulatory Background

The investigation-derived waste (IDW) generated as part of the RFI field program will be regulated under the Resource Conservation and Recovery Act (RCRA) as implemented by rules adopted in Title 40 of the Code of Federal Regulations (40 CFR), Parts 260-270, Department of Transportation (DOT) regulations (49 CFR Parts 171-179), and the New Mexico Solid Waste Management Regulations.

### 1.3 Description of the RFI

Table 1-1 provides a list of the SWMUs that are included in the RFI. The table also provides a description of the materials that were managed at each SWMU and the activities that will occur during the field program. The SWMUs have been divided into two categories: Criteria 1 and Criteria 2 sites. Criteria 1 sites are those that are known to

## Table 1-1

## Solid Waste Management Units (SWMUs) for Table 2 RFI

| SWMU No. | Unit Name | Contents | RFI Activities |
|---|---|---|---|
| **Criteria 1 Sites: Known to Have Managed Listed RCRA Hazardous Wastes** | | | |
| 71 | Building 1178A Waste Accumulation Area | Paint, lacquer thinner, paint thinners (D001) (F005), PD-680 solvent, toluene (F005) mixed with acetone (F003) | Soil Borings |
| 155 | Sludge Drying Beds | Hydrocarbons, solvents, industrial cleaner, paint strippers, methanol, acetone, formaldehyde, F001, F003, F005, P012, P106, U002, U012, U036, U044, U167, U188, U220, U159 | Hand Auger/Surface Samples |
| 156 | Imhoff Tanks | Hydrocarbons, solvents, industrial cleaner, paint strippers, methanol, acetone, formaldehyde, F001, F003, F005, P012, P106, U002, U012, U036, U044, U167, U188, U220, U159 | Soil Borings<br>Hand Auger/Surface Samples |
| 183 | Air Base Sewer System | Hydrocarbons, solvents, industrial cleaner, paint strippers, methanol, acetone, formaldehyde, F001, F003, F005, P012, P106, U002, U012, U036, U044, U167, U188, U220, U159 | Smoke Testing (no IDW will be generated) |
| 129<br>178[a] | Building 1191 and 1192 Spill Tanks<br>Building 1191 Fuel Runoff Pits | Unsymmetrical dimethylhydrazine, JP-4, inhibiting red fuming nitric acid, inhibiting white fuming nitric acid, and aniline | Soil Borings<br>Hand Auger/Surface Samples<br>Monitoring Well Installation<br>Groundwater Samples |
| 165[a], 177, 181, 179[a] | Building 1176 Pond, Sumps, Drainage Trough, and Discharge Box | Unsymmetrical dimethyl hydrazine, JP-4, inhibiting red fuming nitric acid, inhibiting white fuming nitric acid, aniline, liquid oxygen, dyes, and rocket propellants | Soil Borings<br>Hand Auger/Surface Samples<br>HydroPunch/Geoprobe<br>Surface Water Samples |

## Table 1-1

## (Continued)

| SWMU No. | Unit Name | Contents | RFI Activities |
|---|---|---|---|
| **Criteria 2 Sites: Managed Characteristic Wastes or Nonhazardous Waste Only** | | | |
| 63 | Building 867 Waste Accumulation Area | Paint and paint thinners (D001) | Soil Borings |
| 101 | Bldg. 121 Landfill | Waste oils and solvents | None |
| AOC-U[b] | Lost River Basin | Stormwater runoff | Hand Auger/Surface Samples |
| 119<br>2[c] | Bldg. 121 Waste Oil Tank<br>Bldg. 121 Oil/Water Separator | Waste oil | Soil Borings |
| 120<br>15[c] | Bldg. 309 Waste Oil Tank<br>Bldg. 309 Oil/Water Separator | Waste oil | Soil Borings |
| 121<br>17[c] | Bldg. 316 Waste Oil Tank<br>Bldg. 316 Oil/Water Separator | Waste oil | Soil Borings |
| 123<br>22[c] | Bldg. 704 Waste Oil Tank<br>Bldg. 704 Oil/Water Separator | Waste oil | Soil Borings |
| 126<br>36[c] | Bldg. 1001 Waste Oil Tank[d]<br>Bldg. 1001 Oil/Water Separator[d] | Waste oil | Soil Borings<br>Waste Sampling from Tank and O/WS |
| 125<br>32[c] | Bldg. 868 Fire Water Tank<br>Bldg. 868 Oil/Water Separator | Washwater containing fire suppressant | Soil Borings<br>Waste Sampling from Tank and O/WS |
| 127<br>39[c]<br>135 | Bldg. 1092 Waste Oil Tank<br>Bldg. 1092 Oil/Water Separator<br>Bldg. 1092 Oil/Water Separator Drainage Pit | Drainage of fuel and fire water | Soil Borings<br>Hand Auger/Surface Samples |
| 138<br>128<br>40[c] | Bldg. 1166 Oil/Water Separator<br>Drainage Pit<br>Bldg. 1166 Waste Oil Tank<br>Bldg. 1166 Oil/Water Separator | Water, oils, detergents, and fuels | Soil Borings<br>Hand Auger/Surface Samples |

## Table 1-1

## (Continued)

| SWMU No. | Unit Name | Contents | RFI Activities |
|---|---|---|---|
| 118<br>132[a]<br>AOC-A[a,b] | Bldg. 21 Pesticides Holding Tank<br>Bldg. 21 Leach Field<br>Bldg. 21 Pesticide Rinsewater Spill Area | Pesticides, soap, water rinsate | Soil Borings<br>Groundwater Samples<br>HydroPunch/Geoprobe |
| 54<br>55 | Bldg. 702 Waste Accumulation Area<br>Bldg. 702A Waste Accumulation Area | Waste oil, flammable liquids | Soil Borings |
| 56 | Bldg. 807 Waste Accumulation Area | Waste oil and waste fuels | Soil Borings |
| 78 | Trim Pad 3 Waste Accumulation Area | Waste oil | Soil Borings |
| 91 | Bldg. 816 Washrack | Washwater containing oil and fuel | Soil Borings |
| 136 | Bldg. 1119 Washrack Drainage Pit | Rinsate containing waste fuels and oils | Soil Borings |
| 164 | Bldg. 1080 Pond | Stormwater runoff | Soil Borings<br>Hand Auger/Surface Samples |
| 124 | Bldg. 752 Waste Oil Tank | Waste oil | Hand Auger/Surface Samples<br>Waste Sampling from Tank |

O/WS = Oil/Water Separator

[a] HSWA Permit, Table 1.

[b] AOC = Area of concern.

[c] These SWMUs were moved from Table 3 to Table 2 in a permit modification dated 23 July 1993.

[d] This SWMU was renamed as "Bldg. 1001" in a permit modification dated 23 July 1993.

have managed listed RCRA hazardous waste. Criteria 2 sites are those that managed either characteristically hazardous or nonhazardous wastes.

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## 2.0 WASTE DEFINITIONS

In order to determine the proper handling, storage, and disposal requirements for IDW, a RCRA hazardous waste determination must be made. RCRA regulations define hazardous waste as either characteristic or listed. Wastes are determined to be characteristically hazardous on the basis of their chemical constituents or physical properties. Listed wastes are specifically identified in 40 CFR Sections 261.31, 261.32, and 261.33.

### 2.1 Characteristically Hazardous Wastes

A solid waste is characteristically hazardous if it exhibits one or more of the following characteristics: ignitability, corrosivity, reactivity, or toxicity. The IDW generated during the RFI will be composed largely of soil and/or water, and is not ignitable, corrosive, or reactive. However, it may contain constituents that exhibit constituent concentrations that exceed toxicity characteristic (TC) levels (40 CFR Section 261.24). To determine whether IDW is toxic, a comparison of analytical results with the TC levels presented in Table 2-1 will be performed.

Solid wastes exhibit the characteristic of toxicity if, when tested by the toxicity characteristic leaching procedure (TCLP), the wastes yield an extract containing any of 40 specified constituents in excess of specified concentrations. According to Section 1.2 of Method 1311 TCLP (40 CFR Part 261, Appendix II), a TCLP need not be run if a total analysis of a waste indicates that individual analytes are not present at concentrations that are potentially greater than TC regulatory levels. Therefore, TCLP analyses may not need to be performed on all of the IDW. The U.S. Environmental Protection Agency (EPA) authorizes using sample analytical results based on totals analyses to be subject to abbreviated version of a TCLP analysis (53 *Federal Register* 51444, December 21, 1988; Section 1.2 of Appendix II to 40 CFR Part 261; both are provided in Appendix A). If the total waste concentration is 20 times or less than the TC regulatory levels, then the waste is not a characteristic hazardous waste. The number 20 is the mass volume ratio prevailing

## Table 2-1

## Maximum Concentration of Contaminants for the Toxicity Characteristic (40 CFR Section 261.24)

| EPA HW No.[1] | Contaminant | CAS No.[2] | Regulatory Level (mg/L) |
|---|---|---|---|
| D004 | Arsenic | 7440-38-2 | 5.0 |
| D005 | Barium | 7440-39-3 | 100.0 |
| D018 | Benzene | 71-43-2 | 0.5 |
| D006 | Cadmium | 7440-43-9 | 1.0 |
| D019 | Carbon tetrachloride | 56-23-5 | 0.5 |
| D020 | Chlordane | 57-74-9 | 0.03 |
| D021 | Chlorobenzene | 108-90-7 | 100.0 |
| D022 | Chloroform | 67-66-3 | 6.0 |
| D007 | Chromium | 7440-47-3 | 5.0 |
| D023 | o-Cresol | 95-48-7 | 200.0 |
| D024 | m-Cresol | 108-39-4 | 200.0 |
| D025 | p-Cresol | 106-44-5 | 200.0 |
| D026 | Cresol | -- | 200.0 |
| D016 | 2,4-D | 94-75-7 | 10.0 |
| D027 | 1,4-Dichlorobenzene | 106-46-7 | 7.5 |
| D028 | 1,2-Dichloroethane | 107-06-2 | 0.5 |
| D029 | 1,1-Dichloroethylene | 75-35-4 | 0.7 |
| D030 | 2,4-Dinitrotoluene | 121-14-2 | 0.13[3] |
| D012 | Endrin | 72-20-8 | 0.02 |
| D031 | Heptachlor (and its epoxide) | 76-44-8 | 0.008 |
| D032 | Hexachlorobenzene | 118-74-1 | 0.13[3] |
| D033 | Hexachlorobutadiene | 87-68-3 | 0.5 |
| D034 | Hexachloroethane | 67-72-1 | 3.0 |
| D008 | Lead | 7439-92-1 | 5.0 |
| D013 | Lindane | 58-89-9 | 0.4 |
| D009 | Mercury | 7439-97-6 | 0.2 |
| D014 | Methoxychlor | 72-43-5 | 10.0 |
| D035 | Methyl ethyl ketone | 78-93-3 | 200.0 |
| D036 | Nitrobenzene | 98-95-3 | 2.0 |
| D037 | Pentrachlorophenol | 87-86-5 | 100.0 |
| D038 | Pyridine | 110-86-1 | 5.0[3] |

# Table 2-1

## (Continued)

| EPA HW No.[1] | Contaminant | CAS No.[2] | Regulatory Level (mg/L) |
|---|---|---|---|
| D010 | Selenium | 7782-49-2 | 1.0 |
| D011 | Silver | 7440-22-4 | 5.0 |
| D039 | Tetrachloroethylene | 127-18-4 | 0.7 |
| D015 | Toxaphene | 8001-35-2 | 0.5 |
| D040 | Trichloroethylene | 79-01-6 | 0.5 |
| D041 | 2,4,5-Trichlorophenol | 95-95-4 | 400.0 |
| D042 | 2,4,6-Trichlorophenol | 88-06-2 | 2.0 |
| D017 | 2,4,5-TP (Silvex) | 93-72-1 | 1.0 |
| D043 | Vinyl chloride | 75-01-4 | 0.2 |

[1] Hazardous waste number.

[2] Chemical abstracts service number.

[3] Quantitation limit is greater than the calculated regulatory level. The quantitation limit, therefore, becomes the regulatory level.

during a TCLP extraction. The calculated result is the maximum possible concentration of each analyte that could exist in a TCLP leachate sample.

Although the Method 1311 TCLP will be performed on most of the IDW generated during the RFI, this abbreviated TC analysis may be performed for the IDW, as appropriate. Analytical results corresponding to IDW soils (not by Method 1311) will be adjusted using the TCLP mass volume ratio of 20, which assumes 100% leaching. The adjustment will be made by dividing each analytical result by 20 to convert the results to maximum possible concentrations in milligrams per liter. These concentrations will be compared with TC regulatory levels.

Since groundwater results will already be in milligrams per liter (i.e., groundwater does not require a TCLP extraction), these values will be compared directly with TCLP levels.

## 2.2 Listed Hazardous Wastes

The EPA has specifically identified certain hazardous wastes and has listed these wastes in the regulations. There are four types of listed wastes (40 CFR Sections 261.32 and 261.33), which are categorized as follows:

- F Wastes: wastes from nonspecific sources. Examples include spent halogenated solvents (tetrachloroethylene, methylene chloride), non-halogenated solvents (xylene, acetone, ethyl ether), still bottoms from the recovery of spent solvents, and some wastewater treatment sludges.

- K Wastes: wastes from specific sources. Examples include wastewater treatment sludges from production of zinc yellow and chrome green pigments, and still bottoms from the distillation of benzyl chloride.

- P Wastes: discarded commercial chemical products, manufacturing intermediates, off-specification chemicals (which, if they met specifications, would be listed), and container and spill residues that are acutely hazardous. Examples include aldrin and phosgene.

- U Wastes: discarded commercial chemical products, manufacturing chemical intermediates, or off-specification commercial chemical products that are "toxic." Examples include chlorobenzene and mercury.

According to EPA, the determination of whether IDW is listed or not should be assessed using best professional judgment along with readily available information about the site (manifests, storage records, preliminary assessments, results of earlier investigations, and chemical analytical data). The EPA has specifically indicated that IDW may be assumed not to contain listed wastes under RCRA unless available information about the site suggests otherwise (53 *Federal Register* 51444, December 21, 1988).

## 2.3 "Contained In" Policy

Generally, once a listed hazardous waste is generated, that waste (as well as any materials that become contaminated with it or that are derived from treating it) must always be managed as a listed waste. Strict application of this rule has meant that any environmental media (such as soil cuttings and purge water) that are contaminated with a listed waste are themselves considered to contain a listed waste regardless of constituent concentrations.

The EPA has issued a policy directive that provides the opportunity for contaminated media, including IDW, to be excluded from the listed waste definition. This is known as the "contained in" policy and is outlined in a letter provided in Appendix A. This policy provides that contaminated media will not be considered to contain listed hazardous wastes if: 1) listed waste constituent concentrations are already below relevant health-based levels, or 2) the media can be treated to remove the listed constituents to below health-based levels.

Given this guidance, the concentrations of any listed waste constituents that are detected in IDW derived from Criteria 1 sites will be compared with the health-based

levels (HBLs) in Table 2-2. The HBLs were determined from the proposed RCRA corrective action Subpart S action levels (55 *Federal Register* 30798-30884, July 27, 1990). HBLs for constituents which are not found in the proposed RCRA corrective action Subpart S action levels were determined as noted in Table 2-2. Appendix B provides a detailed description of the derivation of the HBLs.

If the constituent concentrations are below the HBLs presented in Table 2-2, the IDW will *not* be considered or managed as a listed waste.

## 2.4 Total Petroleum Hydrocarbons

The New Mexico Environment Department (NMED) established a standard of 1000 parts per million (ppm) total recoverable petroleum hydrocarbons (TRPH) for the cleanup of soils at Holloman AFB (Appendix C). Any soils which exceed 1000 ppm TRPH (as determined by EPA Method 418.1) will be transferred off site for disposal at an appropriate facility.

## Table 2-2

## Health-Based Levels for Listed Waste Constituents at Criteria 1 SWMUs

| Waste Constituents | Action Levels | |
|---|---|---|
| | Water (mg/L) | Soil (mg/kg) |
| F001 - Tetrachloroethene | 0.000067 | 14 |
| Trichloroethene | 0.03 | 63.6 |
| Methylene chloride | 0.005 | 93 |
| 1,1,1-Trichloroethane | 3.15 | 7,200 |
| Carbon tetrachloride | 0.00027 | 5.4 |
| Chlorinated fluorocarbon[a] | 7 | 16,000 |
| F003 - Xylene | 70 | 1,600 |
| Acetone | 3.5 | 8,000 |
| Ethyl actetate | 31.5 | 72,000 |
| Ethyl benzene | 3.5 | 8,000 |
| Methyl isobutyl ketone | 1.8 | 4,000 |
| n-Isobutyl alcohol | 10.5 | 24,000 |
| Cyclohexane[b] | 2450 | 1,600 |
| Methanol | 17.5 | 40,000 |
| F005 - Toluene | 7 | 16,000 |
| Methyl ethyl ketone | 3.5 | 8,000 |
| Carbon disulfide | 3.5 | 8,000 |
| Isobutanol | 10.5 | 24,000 |
| Pyridine | 0.035 | 80 |
| Benzene | 0.001 | 24 |
| 2-Ethoxyethanol[c] | 10.5 | 24,000 |
| 2-Nitropropane[d] | 0.00004 | 0.74 |
| P012 - Arsenic trioxide[e] | 0.00002 | 0.4 |
| P106 - Sodium cyanide | 1.4 | 3,200 |
| U002 - Acetone | 3.5 | 8,000 |
| U012 - Aniline | 0.006 | 123 |
| U036 - Chlordane, alpha & gamma isomers | 0.000027 | 0.54 |
| U044 - Chloroform | 0.0057 | 115 |
| U099 - Unsymmetrical dimethylhydrazine | 0.000013 | 0.27 |
| U159 - 2-Butanone | 21 | 48,000 |
| U167 - 1-Naphthalenamine[f] | 1.4 | 3200 |

# Table 2-2

## (Continued)

| Waste Constituents | Action Levels | |
|---|---|---|
| | Water (mg/L) | Soil (mg/kg) |
| U188 - Phenol | 21 | 48,000 |
| U217 - Nitric acid | --[g] | --[g] |
| U220 - Toluene | 7 | 16,000 |

NOTE--Values calculated using the reference dose (RfD) or slope factor (SF) with EPA's method for calculating action levels (Appendix 4 of "Draft Preliminary Standards for RCRA Risk Assessment," EPA Region VI, 20 February 1991; and 27 July 1990 *Fed. Reg.*, "Corrective Action for SWMUs at Hazardous Waste Management Facilities," Appendix E). Unless otherwise noted, RfDs or SFs used to calculate HBL are from the *Electronic Handbook of Risk Assessment Values*, which lists values from both the Integrated Risk Information System (IRIS) and Health Effects Assessment Summary Tables (HEAST).

[a] RfD for dichlorodifluoromethane used as proxy toxicity value for all CFCs.

[b] No value is available for cyclohexane; xylene is used as a surrogate.

[c] RfD calculated based on HBL listed in "Docket Report on Health-Based Levels and Solubilities used in the Evaluation of Delisting Petitions Submitted Under 40 CFR Sec. 260.22." EPA, July 1991.

[d] Inhalation slope factor listed in HEAST used as proxy value for oral slope factor.

[e] Arsenic used as proxy for arsenic trioxide.

[f] RfD for naphthalene used as proxy toxicity value.

[g] pH >2.

## 3.0 MANAGEMENT OF IDW

### 3.1 Description of IDW

As indicated in Table 1-1, the RFI activities will include predominantly soil and groundwater sampling activities. These activities and associated decontamination and personal protection procedures will generate all of the IDW during the RFI. The specific types of waste that will be generated are described below:

- **Soil Cuttings**--Excess soil removed by the hollow-stem auger drilling technique. This soil will be generated at each soil boring and monitor well installation.

- **Development and Purge Water**--Groundwater pumped from a monitor well after installation, and water pumped from a well prior to sampling. Small amounts of purge water will also be generated during Hydropunch investigations.

- **Decontamination Water**--Water used in cleaning drilling equipment (i.e., augers, rod, and drill rig) between borings. Also included are: soapy water, rinse water, and solvents (e.g., isopropanol and hexane) used during decontamination of sampling equipment.

- **Personal Protective Equipment (PPE) and Sampling Equipment**--Disposable coveralls, gloves, respirator cartridges, plastic sheeting, foil, and tape used during soil borings, well installations, and associated sampling.

Waste minimization techniques will be employed, where possible, to reduce the quantity of IDW produced. For example, the use of the Hydropunch method will reduce the amounts of purge water.

### 3.2 On-site Management of IDW

The following sections present how each type of waste, according to the source of generation, will be managed following its generation, but prior to final characterization

and disposal. Final characterization and disposition of IDW are discussed in Sections 4 and 5, respectively.

### 3.2.1 Soil Cuttings

Holloman AFB has determined that soil cuttings will be handled according to *Management of Investigation Derived Wastes During Site Inspections* (Office of Emergency and Remedial Response Directive 9345.3-02, May 1991). In accordance with this guidance, soil cuttings will be: 1) placed back in the borehole, 2) placed in a land-based unit at the site, or 3) spread around the borehole. Soil cuttings from both Criteria 1 and Criteria 2 sites will be evaluated according to field observations and available data regarding contaminants generated at the site. On the basis of this available data, soil cuttings will be handled in one of the three ways previously discussed. Unless the field crew determines that the situation warrants placing the cuttings in a container.

Although all soil cuttings are anticipated to remain on site, and, therefore, no IDW characterization is necessary, the procedures outlined in the following sections will be employed in the event that waste characterization and disposal are required.

### 3.2.2 Criteria 1 Sites

Because Criteria 1 sites potentially contain listed hazardous wastes, IDW generated at these sites must be handled as hazardous waste at the point of generation. At the time of generation, any soil cuttings generated at Criteria 1 sites that are not left on site as previously discussed in Section 3.2.1 will be containerized separately and sealed in 55-gal. drums. Each drum will be labeled to identify the waste generator (Holloman AFB), site name, boring identification, accumulation date, and type of material. The label will also include a notation that the waste determination is pending analytical results. Each day, IDW drums will be moved to a central staging area to await final characterization on the basis of the analytical results.

Development and purge water generated after the installation of monitoring wells at SWMUs 129/178 may also contain listed hazardous waste. For this reason, during monitor well development and sampling activities, all water removed from the wells (but not used for sampling) will be immediately contained and sealed in 55-gal. drums. Each drum will be labeled to identify Holloman AFB as the waste generator, the site name, monitoring well identification, the accumulation start date, and the type of material. The label will also include a notation that the hazardous waste determination is pending analytical results. These drums will be moved to the central staging area daily. Excess water generated during Hydropunch sampling activities at SWMUs 165/177/181/179 will also be contained and handled in the same manner as other water.

### 3.2.3 Criteria 2 Sites

Criteria 2 sites do *not* contain listed wastes; the sites are known to have handled only characteristically hazardous or nonhazardous wastes. With the exception of SWMUs 118/132/AOC-A, Criteria 2 sites handled similar types of potentially characteristic wastes (waste oil). Similar to Criteria 1 sites, any soil cuttings that are not left on site as previously discussed in Section 3.2.1 will be containerized separately and sealed in 55-gal. drums. Each drum will be labeled to identify the waste generator (Holloman AFB), the site name, boring identification, accumulation date, and type of material. The label will also include a notation that the waste determination is pending analytical results. Each day IDW drums will be transferred to a central staging area.

No monitor wells will be installed or sampled at Criteria 2 sites during the RFI. Small amounts of purge water will be generated, however, during Hydropunch and groundwater sampling at SWMU 118/132/AOC-A. Since the site has been identified as having the potential for characteristically hazardous waste (pesticides), excess water will be drummed and handled as described for Criteria 1 sites in Section 3.2.2.

### 3.2.4 Decontamination Water

All drilling equipment will be decontaminated at the central staging area using a self-contained decontamination unit. Regardless of whether the equipment is associated with a Criteria 1 or 2 site, all water will be collected and pumped into a 4000-gal. tank for temporary storage. Water used for washing split-spoons and other sampling equipment will be contained in sealed tubs and transferred daily to the 4000-gal. covered tank.

### 3.2.5 Personal Protective Equipment and Sampling Equipment

Holloman AFB has determined that PPE and other disposable items from both Criteria 1 and 2 sites will be contained in sealed plastic trash bags. The bags will be disposed of in the Base's landfill. Prior to disposal, the PPE and disposable items will be cleaned and decontaminated.

## 4.0 WASTE CHARACTERIZATION

Waste characterization will primarily be based on comparisons of analytical data with HBLs in Table 2-2 (listed hazardous wastes) and TC regulatory limits in Table 2-1 (characteristically hazardous wastes). The primary source of the analytical data will come from results of samples analyzed for the site investigation, however, direct sampling of the IDW will be employed in some cases. The comparison process is described below and also presented in decision process diagrams (Figures 4-1 and 4-2). Disposal of hazardous and nonhazardous IDW is discussed in Section 5.

### 4.1 Criteria 1 Site Waste

After the IDW is generated (excluding soil cuttings left on site), additional characterization is necessary to accurately determine if the IDW can be managed as a nonlisted hazardous waste under the "contained in" policy. The analytical results from both soil and water samples will be compared with the HBLs listed in Table 2-2. If any of the HBLs are exceeded for a sample, the IDW associated with that sample will be considered a listed hazardous waste and the appropriate EPA waste code will be placed on the associated hazardous waste label (see Figure 4-3). To determine if any of the soil cuttings are TC hazardous, the cuttings will either be sampled and submitted for TCLP analysis or the abbreviated TC analysis discussed in Section 2.1 will be performed. TCLP results for soils and total analysis results for water will then be compared with the regulatory levels in Table 2-1. If any of the TC levels are exceeded, the IDW will be considered TC hazardous and the appropriate EPA waste code will be placed on the hazardous waste label (or if the IDW is already classified as listed hazardous waste, the EPA waste code for the TC constituent will be added to the label). In addition, all soil will be analyzed for TRPH to determine whether it exceeds the NMED established standard of 1000 mg/kg.

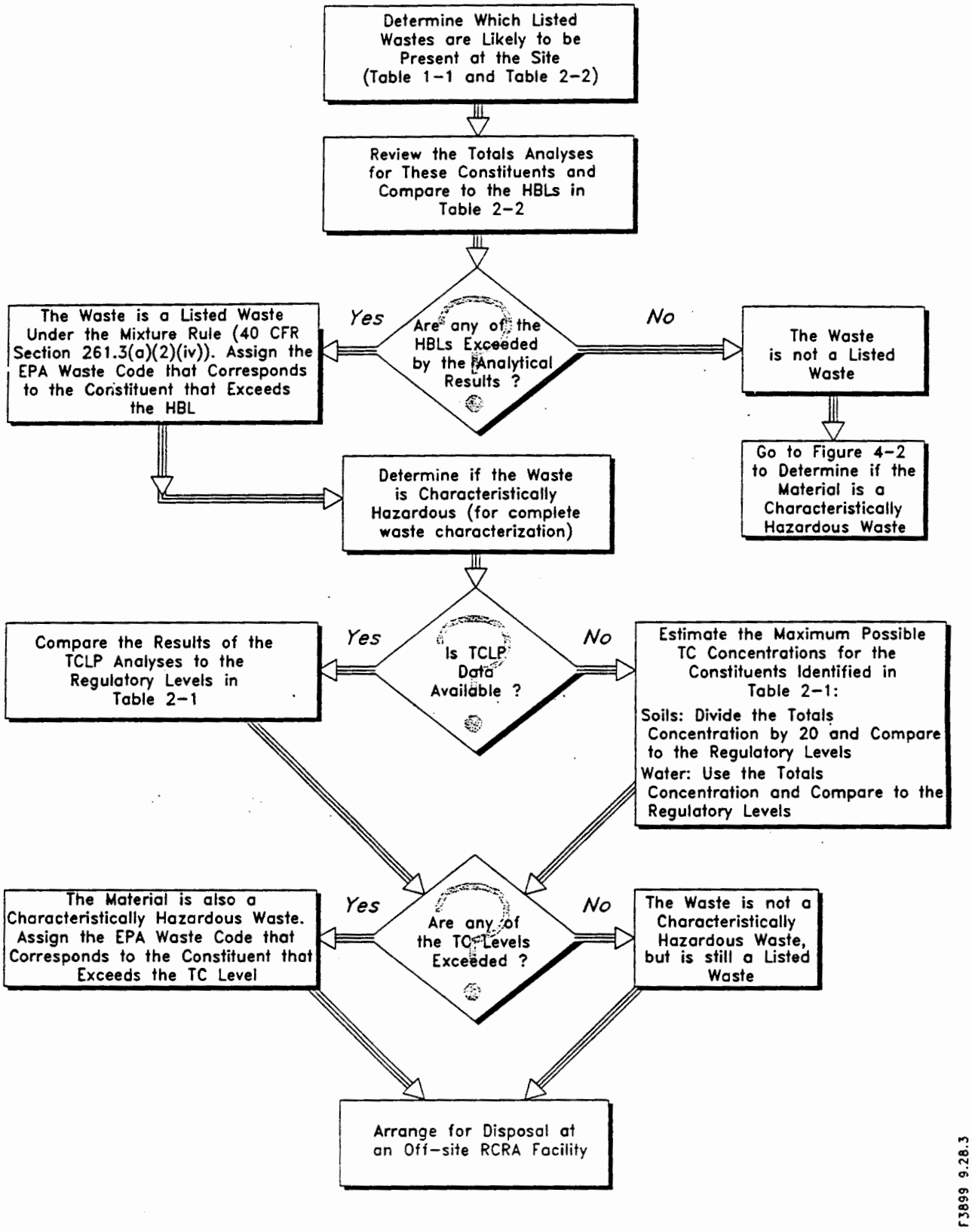


**Figure 4-1. Decision Process Diagram for Criteria 1 Sites**

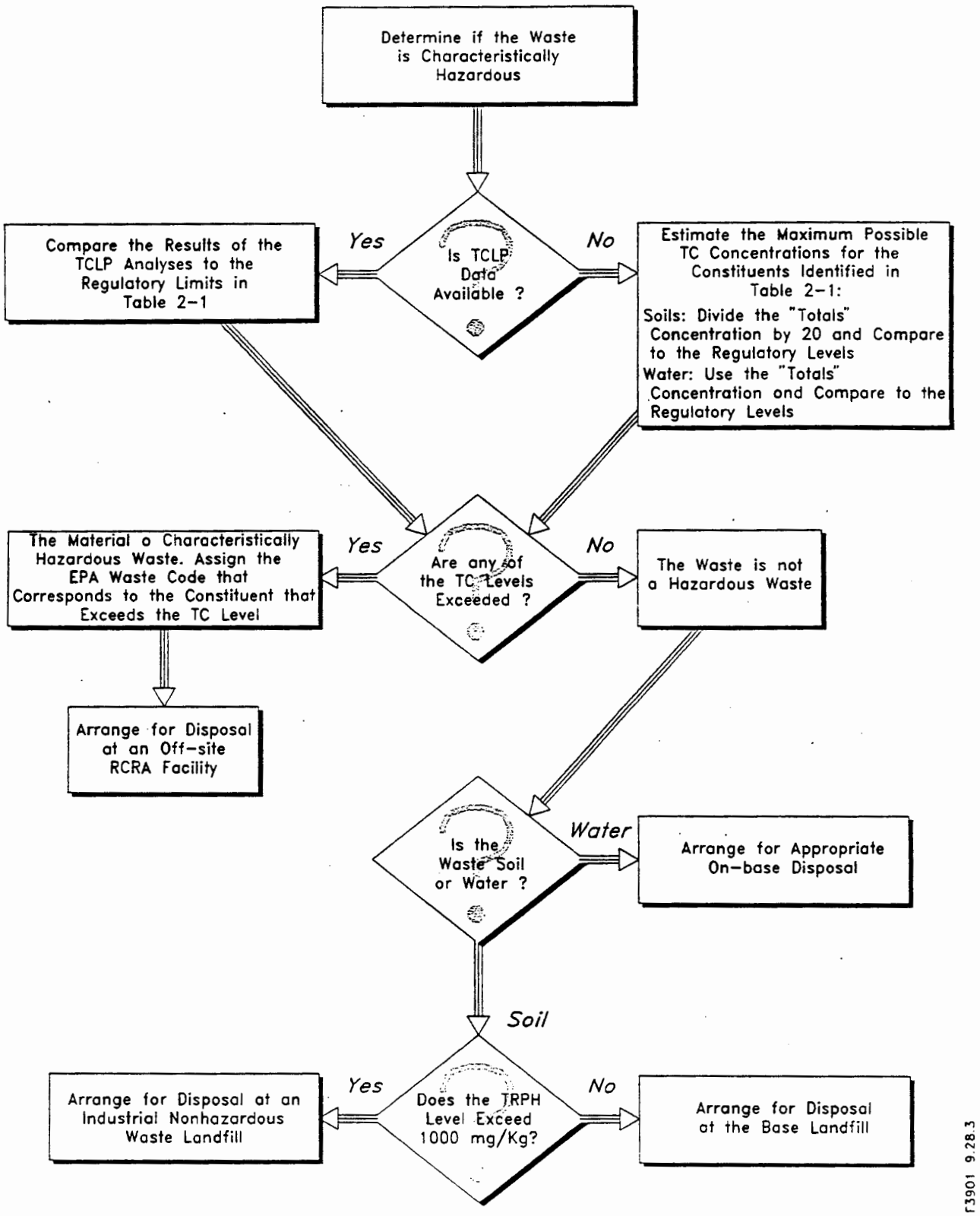


**Figure 4-2. Decision Process Diagram for Criteria 2 Sites**

# HAZARDOUS WASTE

FEDERAL LAW PROHIBITS IMPROPER DISPOSAL

IF FOUND, CONTACT THE NEAREST POLICE, OR
PUBLIC SAFETY AUTHORITY, OR THE
U.S. ENVIRONMENTAL PROTECTION AGENCY

PROPER D.O.T.
SHIPPING NAME _____ UN or NA# _____

GENERATOR INFORMATION:

NAME _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

EPA
ID NO. _____

EPA
WASTE NO. _____

ACCUMULATION
START DATE _____

MANIFEST
DOCUMENT NO. _____

## HANDLE WITH CARE!

CONTAINS HAZARDOUS OR TOXIC WASTES

STYLE WM-6-P

Printed by LABELMASTER, Div. of AMERICAN LABELMARK CO., INC., CHICAGO, IL 60646

Figure 4-3. Hazardous Waste Container Label

## 4.2 Criteria 2 Site Waste

Since Criteria 2 site IDW contains no listed hazardous wastes, the IDW will be compared with TC regulatory levels in Table 2-1. Any drums of soil cuttings will either be sampled and analyzed for the appropriate TC constituents or the abbreviated TC analysis discussed in Section 2.1 will be performed. If the results indicate that the soil cuttings are TC hazardous, they will be labeled as described in Section 4.1. For the purge water generated at this site, analytical results of totals' concentrations will be compared directly with TC levels in Table 2-1. In addition, any soil samples will be analyzed for TRPH to determine whether the soil exceeds the NMED standard of 1000 mg/kg.

## 4.3 Decontamination Water, PPE, and Sampling Equipment

The decontamination water in the 4000-gal. covered tank will be sampled and analyzed for each of the constituents in Table 2-1 and the full suite of TC constituents when the tank is full or decontamination activities for the RFI are complete. Analytical results will be compared with HBLs and TC regulatory limits as discussed previously and presented in Figure 4-1. If any constituent exceeds these levels, the entire tank will be labeled and managed as hazardous waste.

Holloman AFB has determined that PPE and other disposable items from all sites will be contained in sealed plastic bags and disposed of in the Base's landfill. PPE and equipment will be cleaned and decontaminated as outlined in the Table 2 Work Plan prior to disposal.

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## 5.0 DISPOSAL ALTERNATIVES

### 5.1 Hazardous Waste

Any drums of IDW that is determined to be hazardous waste (listed or characteristic) will either be removed from temporary accumulation at the end of 90 days for disposal at a permitted facility or will be transferred to the permitted storage facility at Holloman AFB until disposal can be arranged. Off-site disposal facilities for hazardous waste will be selected on the basis of the waste characterization and in accordance with the land disposal restrictions (40 CFR Part 268). Appendix D identifies potential disposal facilities for hazardous IDW.

### 5.2 Nonhazardous Waste

Any soil IDW that is determined to be nonhazardous will be disposed of in an industrial nonhazardous landfill if the TRPH is greater than 1000 mg/kg. If the TRPH is less than 1000 mg/kg, the soil IDW will be disposed of in the Base landfill. Appendix D identifies potential disposal facilities for nonhazardous IDW.

Holloman AFB has determined that any water IDW that is determined to be nonhazardous will be disposed of on site by discharging to the surface or disposal through the Base sewer system. Holloman AFB will submit a Notice of Intent to NMED if water IDW is discharged to the surface.

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# APPENDIX A

## Regulatory Guidance

A.1 Use of Total Waste Analysis in lieu of TCLP

A.2 Abbreviated TCLP Analysis

A.3 "Contained In" Policy Letter

# A.1

# Use of Total Waste Analysis in lieu of TCLP

(10) The name and model numbers of the instrument(s) used in performing the tests:

(11) QA/QC documentation: and

(12) The following statement signed by the generator or his authorized representative:

I certify under penalty of law that all process equipment required to be cleaned or replaced under 40 CFR 261.35 was cleaned or replaced as represented in the equipment cleaning and replacement plan and accompanying documentation. I am aware that there are significant penalties for providing false information, including the possibility of fine or imprisonment.

[55 FR 50482, Dec. 6, 1990, as amended at 56 FR 30195, July 1, 1991]

EFFECTIVE DATE NOTE: At 55 FR 50482, Dec. 6, 1990, § 261.35 was added. Paragraph (c) contains information collection and recordkeeping requirements and will not become effective until approval has been given by the Office of Management and Budget. A notice will be published in the FEDERAL REGISTER once approval has been obtained.

## APPENDICES TO PART 261

## APPENDIX I TO PART 261—REPRESENTATIVE SAMPLING METHODS

The methods and equipment used for sampling waste materials will vary with the form and consistency of the waste materials to be sampled. Samples collected using the sampling protocols listed below, for sampling waste with properties similar to the indicated materials, will be considered by the Agency to be representative of the waste.

Extremely viscous liquid—ASTM Standard D140-70 Crushed or powdered material—ASTM Standard D346-75 Soil or rock-like material—ASTM Standard D420-69 Soil-like material—ASTM Standard D1452-65

Fly Ash-like material—ASTM Standard D2234-76 [ASTM Standards are available from ASTM, 1916 Race St., Philadelphia, PA 19103]

Containerized liquid wastes—"COLIWASA" described in "Test Methods for the Evaluation of Solid Waste, Physical/Chemical Methods." * U.S. Environmental Protection Agency, Office of Solid Waste, Washington, D.C. 20460. [Copies may be obtained from Solid Waste Information, U.S. Environmental Protection Agency, 26 W. St. Clair St., Cincinnati, Ohio 45268]

Liquid waste in pits, ponds, lagoons, and similar reservoirs.—"Pond Sampler" described in "Test Methods for the Evaluation of Solid Waste, Physical/Chemical Methods." *

This manual also contains additional information on application of these protocols.

## APPENDIX II TO PART 261—METHOD 1311 TOXICITY CHARACTERISTIC LEACHING PROCEDURE (TCLP)

### 1.0 Scope and Application

1.1 The TCLP is designed to determine the mobility of both organic and inorganic analytes present in liquid, solid, and multiphasic wastes.

1.2 If a total analysis of the waste demonstrates that individual analytes are not present in the waste, or that they are present but at such low concentrations that the appropriate regulatory levels could not possibly be exceeded, the TCLP need not be run.

1.3 If an analysis of any one of the liquid fractions of the TCLP extract indicates that a regulated compound is present at such high concentrations that, even after accounting for dilution from the other fractions of the extract, the concentration would be equal to or above the regulatory level for that compound, then the waste is hazardous and it is not necessary to analyze the remaining fractions of the extract.

1.4 If an analysis of extract obtained using a bottle extractor shows that the concentration of any regulated volatile analyte equals or exceeds the regulatory level for that compound, then the waste is hazardous and extraction using the ZHE is not necessary. However, extract from a bottle extractor cannot be used to demonstrate that the concentration of volatile compounds is below the regulatory level.

### 2.0 Summary of Method

2.1 For liquid wastes (i.e., those containing less than 0.5% dry solid material), the waste, after filtration through a 0.6 to 0.8 μm glass fiber filter, is defined as the TCLP extract.

2.2 For wastes containing greater than or equal to 0.5% solids, the liquid, if any, is separated from the solid phase and stored for later analysis; the particle size of the solid phase is reduced, if necessary. The solid phase is extracted with an amount of extraction fluid equal to 20 times the weight

* These methods are also described in "Samplers and Sampling Procedures for Hazardous Waste Streams," EPA 600/2-80-018, January 1980.

# A.2

# Abbreviated TCLP Analysis

would need to comply with the applicable closure requirements for those units in completing the remedial action. Second, if the lead agency determines that RCRA listed or characteristic hazardous waste is present at the site (even if the waste was disposed before the effective date of the requirement) and the proposed CERCLA action involves treatment, storage, or disposal as defined under RCRA, then RCRA requirements related to those actions would be applicable.

These two scenarios are contingent upon determinations that RCRA Subtitle C hazardous waste is present and on the identification of the period of waste management. To determine whether a waste is a listed waste under RCRA, it is often necessary to know the source. However, at many CERCLA sites no information exists on the source of the wastes nor are references available citing the date of disposal. The lead agency should use available site information, manifests, storage records, and vouchers in an effort to ascertain the source of these contaminants. When this documentation is not available, the lead agency may assume that the wastes are not listed RCRA hazardous wastes, unless further analysis or information becomes available which allows the lead agency to determine that the wastes are listed RCRA hazardous wastes. If the lead agency assumes the wastes are not listed RCRA hazardous wastes and it is determined that the wastes are not characteristic wastes under RCRA (see discussion below, 17.i.) RCRA requirements would not be applicable to CERCLA actions, but may be relevant and appropriate if the CERCLA action involves treatment, storage or disposal and/or if the wastes are similar or identical to RCRA hazardous waste.

Under certain circumstances, although no historical information exists about the waste and when it was treated, stored, or disposed, it may be possible to identify the wastes as RCRA characteristic wastes. With respect to hazardous characteristics, (ignitability, corrosivity, reactivity, or EP toxicity), it is the responsibility of the generator (in this case, the lead agency or PRP conducting the action) to determine if the wastes exhibit any of these characteristics (defined in 40 CFR 261.21 through 24). The lead agency must use best professional judgment to determine, on a site-specific basis, if testing for hazardous characteristics is necessary. Testing is required unless it can be determined, by "applying knowledge of the hazard characteristic in light of the materials or process used," that the waste does not have hazardous characteristics (40 CFR 262.11(c)).

In determining whether to test for the toxicity characteristic using the Extraction Procedure (EP) Toxicity Test, it may be possible to assume that certain low concentrations of waste are not toxic. For example, if the total waste concentration is 20 times or less the EP Toxicity concentration, the waste cannot be characteristic hazardous waste. In such a case RCRA requirements would not be applicable and would not likely be relevant or appropriate unless the waste also contained other RCRA hazardous wastes and the CERCLA action involved treatment, storage, or disposal.

If the wastes exhibit hazardous characteristics, RCRA requirements are potentially applicable if the wastes also were either treated, stored, or disposed after the effective date of the applicable RCRA requirement or if the CERCLA actions will involve treatment, storage, or disposal.

ii. *Actions constituting treatment, storage, or disposal.* Many CERCLA actions occur in areas of contamination that contain waste treated, disposed of, or stored prior to November 19, 1980. If left untouched, wastes in such areas are not currently regulated under Subtitle C of RCRA. (Solid waste management units at RCRA facilities are regulated by the 3004(u) corrective action requirements.) However, certain physical movement, alteration, or disturbance of RCRA hazardous waste associated with a remedial action may meet the RCRA definition of treatment, storage, or disposal. For instance, treatment has occurred when the CERCLA remedial action uses "any method, technique, or process, including neutralization, designed to change the physical, chemical, or biological character or composition of any hazardous waste so as to neutralize such waste, or so as to recover energy or material resources from the waste, or so as to render such waste non-hazardous, or less hazardous; safer to transport, store, dispose of; or amenable for recovery, amenable for storage, or reduced in volume." 40 CFR 260.10.

Similarly, storage occurs when a CERCLA remedial action involves the "holding of hazardous waste for a temporary period, at the end of which the hazardous waste is treated, disposed of, or stored elsewhere." 40 CFR 260.10.

Land disposal occurs when RCRA hazardous waste is placed into a land disposal unit, including a "landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome formation, salt bed formation, or underground mine or cave." RCRA section 3004(k).

Movement of hazardous waste entirely within a unit does not constitute "land disposal" under Subtitle C of RCRA. However, movement of hazardous waste into a unit (i.e., across the boundary of a unit) does constitute "land disposal."

In many cases CERCLA sites contain areas of contamination (with differing levels of concentration, including hot spots, of hazardous substances, pollutants, or contaminants) that may be characterized as a unit, usually a landfill, under RCRA. In such cases where RCRA hazardous waste is moved into the area of contamination, RCRA disposal requirements are applicable to the disturbed waste and certain land disposal requirements (such as for closure) may be applicable to the area where the waste is received.

Therefore, the following activities constitute land disposal under RCRA Subtitle C where the waste involved is RCRA hazardous waste:

a. Wastes from different units are consolidated into one unit;

b. Waste is removed and treated outside a unit and redeposited into the same or another unit; or

c. Waste is picked up from the unit and treated within the area of contamination in an incinerator, surface impoundment, or tank and then redeposited into the unit (does not include in-situ treatment).

In contrast, an example of an activity that does not constitute "land disposal" is the mere consolidation of RCRA hazardous wastes within a unit. Similarly, the covering and sealing off of hazardous waste, called "capping with waste in place," is also not considered "land disposal" and RCRA Subtitle C requirements would not be applicable. If some of the waste at a site is moved into another unit, but other waste is left behind in the original unit (the unit in which such waste was found), "land disposal" applies only with regard to the waste that is moved into another unit. Under these examples, however, certain RCRA land disposal requirements might nevertheless be relevant and appropriate to such waste. (See ARARs preamble sections below, 16.iii. and 17.)

iii. *Hypothetical examples of compliance with RCRA: land disposal restrictions.* Land disposal restrictions under RCRA sections 3004 (d) through (k) are triggered whenever there is placement of RCRA hazardous wastes subject to land disposal restrictions ("banned waste") into a land-based unit. Such land disposal does not occur when

# A.3

# "Contained In" Policy Letter

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUN 19 1989

"CONTAINED-IN POLICY"

Mr. Thomas C. Jorling
Commissioner
Department of Environmental Conservation
State of New York
Albany, New York 12233-1010

Dear Mr. Jorling:

I am writing in response to your letter of May 5, 1989, in which you ask numerous questions concerning the regulatory status, under the Resource Conservation and Recovery Act (RCRA), of environmental media (ground water, soil, and sediment) contaminated with RCRA-listed hazardous waste.

As you point out in your letter, it is correct that the Agency's "contained-in" interpretation is that contaminated environmental media must be managed as if they were hazardous wastes until they no longer contain the listed waste, or are delisted. This leads to the critical question of when an environmental medium contaminated by listed hazardous waste ceases to be a listed hazardous waste. In your letter, you discuss three possible answers (based on previous EPA positions and documents) which you believe address this question, and request the Agency to clarify its interpretation. Each of these is discussed below.

The first possible answer you cite would be that the contaminated media would be a hazardous waste unless and until it is delisted, based on the "mixture" and "derived-from" rules. As you correctly state in your letter, a waste that meets a listing description due to the application of either of these rules remains a listed hazardous waste until it is delisted. However, these two rules do not pertain to contaminated environmental media. Under our regulations, contaminated media are not considered solid wastes in the sense of being abandoned, recycled, or inherently waste-like as those terms are defined in the regulations. Therefore, contaminated environmental media cannot be considered a hazardous waste via the "mixture" rule (i.e., to have a hazardous waste mixture, a hazardous waste must be mixed with a solid waste per 40 CFR 261.3(a)(2)(iv)). Similarly, the "derived-from" rule does not apply to contaminated media. Our basis for stating that contaminated environmental media must be managed as hazardous wastes is that they "contain"

listed hazardous waste. These environmental media must be managed as hazardous waste because, and only as long as, they "contain" a listed hazardous waste, (i.e., until decontaminated).

The second possibility you mention is that environmental media contaminated with a RCRA listed waste no longer have to be managed as a hazardous waste if the hazardous constituents are completely removed by treatment. This is consistent with the Agency's "contained-in" interpretation and represents the Agency's current policy.

The third possibility you discuss comes from Sylvia Lowrance's January 24, 1989, memorandum that you cited in your letter. This memorandum indicates that OSW has not issued any definitive guidance as to when, or at what levels, environmental media contaminated with listed hazardous waste are no longer considered to contain that hazardous waste. It also states that until such definitive guidance is issued, the Regions may determine these levels on a case-specific basis. Where this determination involves an authorized State, such as New York, our policy is that the State may also make such a determination.

Related to such a determination, you ask whether a risk assessment approach that addressed the public health and environmental impacts of hazardous constituents remaining in treatment residuals would be acceptable. This approach would be acceptable for contaminated media provided you assumed a direct exposure scenario, but would not be acceptable for "derived-from" wastes under our current rules. Additionally, consistent with the statute, you could substitute more stringent standards or criteria for contaminated environmental media than those recommended by the Federal EPA if you determined it to be appropriate.

The Agency is currently involved in a rulemaking effort directed at setting de minimis levels for hazardous constituents below which eligible listed wastes, treatment residuals from those wastes, and environmental media contaminated with those listed wastes would no longer have to be managed as hazardous wastes. The approach being contemplated in the De Minimis program would be similar to that used in the proposed RCRA Clean Closure Guidance in terms of the exposure scenario (direct ingestion), the management scenario (not in a waste management unit), and the levels (primarily health-based).

Your final question related to whether the "remove and decontaminate" procedure set forth in the March 19, 1987 Federal Register preamble to the conforming regulations on closing surface impoundments applies when making complete removal determinations for soil. These procedures do apply when one

chooses to clean close a hazardous waste surface impoundment by removing the waste. The preamble language states that the Agency interprets the term "remove" and "decontaminate" to mean removal of all wastes, liners, and/or leachate (including ground water) that pose a substantial present or potential threat to human health or the environment (52 FR 8706). Further discussion of these requirements is provided in a clarification notice published on March 28, 1988, (53 FR 1144) and in OSWER Policy Directive # 9476.00-18 on demonstrating equivalence of Part 265 clean closure with Part 264 requirements (copy enclosed).

I hope that this response will be helpful to you in establishing and implementing New York's hazardous waste policies on related issues. Should you have additional questions, please contact Bob Dellinger, Chief of the Waste Characterization Branch at (202) 475-6551.

Sincerely yours,

Jonathan Z. Cannon
Acting Assistant Administrator

# APPENDIX B

## Derivation of Health-Based Levels

## Derivation of Health-Based Levels

The proposed RCRA corrective action in Subpart S (*Federal Register* 30798-30884, July 27, 1990) contains methodology and criteria for calculating action levels for contaminants in soil, water, and air. The media action levels listed in Appendix A of Subpart S are stated in the proposed rule to be "*examples* of concentrations meeting criteria for action levels." For compounds that are not listed in RCRA Subpart S, the proposed rule provides the assumptions and methodology to be used for calculating action levels. As directed by the proposed Subpart S rule, action levels are to be updated as new data on hazardous constituents are developed (see preamble to Subpart S, Section VI.E.2.b).

Action levels for soil and water were calculated using recommended exposure assumptions presented in Appendix D of the proposed rule and health-based equations for calculating action levels presented in Appendix E of the proposed rule. Identical exposure assumptions and health-based equations are presented in Appendix 4 of EPA Region VI's Draft Preliminary Standards for RCRA Risk Assessment, 20 February, 1991. The risk assessment values used in calculating action levels are from the Electronic Handbook of Risk Assessment Values (except as noted in Table 2-1), updated as of June 2, 1993, which lists values from both the Integrated Risk Information System (IRIS) and the Health Effects Assessment Summary Tables (HEAST).

Concentrations used as action levels for carcinogens are associated with a $1 \times 10^{-6}$ upperbound excess cancer risk for Class A and B carcinogens, and a $1 \times 10^{-5}$ upperbound excess cancer risk for Class C carcinogens. Action levels for systemic toxicants are based on concentrations at which the human population could be exposed on a daily basis without appreciable risk of adverse effects.

## Calculations for Soil Action Levels

Soil action levels for noncarcinogenic effects or systemic toxicants are calculated by the following equation:

$$C_s = [RfD(mg/kg/day)*BW(kg)]/[I(g/day)*A*0.001(kg/g)]$$

Where: $C_s$ = action level in soil (mg/kg)

RfD = Reference Dose (mg/kg/day)

BW = body weight (16 kg for a child)

I = soil ingestion rate (0.2 g/day for a child)

A = fraction of soil ingested from contaminated source (1)

| This equation reduces to: |
|---|
| $C_s = RfD * 80{,}000$ |

The soil action levels for carcinogenic effects are calculated by the following equation:

$$C_s = [R*BW(kg)*LT(yrs)]/[CSF(mg/kg/day)^{-1}*I(g/day)*0.001(kg/g)*A*ED(yrs)]$$

Where: $C_s$ = action level in soil (mg/kg)

R = risk ($10^{-5}$ for group C carcinogens or $10^{-6}$ for group A or B carcinogens)

BW = body weight (70 kg for an adult)

LT = lifetime (70 years)

CSF = Carcinogenic Slope Factor

I = soil ingestion rate (0.1 g/day for an adult)

A = fraction of soil ingested from contaminated source (1)

ED = exposure duration (70 years)

| This equation reduces to: |
|---|
| $C_s = 0.7/CSF$ for Group A or B carcinogens |
| $C_s = 7/CSF$ for group C carcinogens |

## Calculations for Water Action Levels

Water action levels for noncarcinogenic effects or systemic toxicants are calculated by the following equation:

$$C_w = [RfD(mg/kg/day)*BW(kg)]/[I(L/day)*A]$$

Where: $C_w$ = action level in water (mg/L)

RfD = Reference Dose (mg/kg/day)

BW = body weight (70 kg for an adult)

I = water ingestion rate (2 L/day for an adult)

A = fraction of water ingested from contaminated source (1)

| This equation reduces to: |
|---|
| $C_w = RfD * 35$ |

The water action levels for carcinogenic effects are calculated by the following equation:

$$C_w = [R*BW(kg)*LT(yrs)]/[CSF(mg/kg/day)^{-1}*I(L/day)*A*ED(yrs)]$$

Where: $C_w$ = action level in water (mg/L)

R = risk ($10^{-5}$ for group C carcinogens or $10^{-6}$ for group A or B carcinogens)

BW = body weight (70 kg for an adult)

LT = lifetime (70 years)

CSF = Carcinogenic Slope Factor

I = water ingestion rate (2 L/day for an adult)

A = fraction of water ingested from contaminated source (1)

ED = exposure duration (70 years)

| This equation reduces to: |
|---|
| $C_w = 0.0035/CSF$ for Group A or B carcinogens |
| $C_w = 0.0035/CSF$ for group C carcinogens |

# APPENDIX C

## NMED Approval Letter for 1000 mg/kg TRPH Cleanup Standard

STATE OF NEW MEXICO
ENVIRONMENT DEPARTMENT

Rec'd CE 10/30/92

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

November 2, 1992

Mr. Howard E, Moffitt
Deputy Base Civil Engineer
49 CES/CEV
Holloman AFB, NM 88330-5000

RE: APPROVAL FOR CLEANUP OF SOILS CONTAMINATED WITH GREATER THAN 1000 PARTS PER MILLION TOTAL PETROLEUM HYDROCARBONS

Dear Mr. Moffitt:

The New Mexico Environment Department (NMED) has received your letter dated August 7, 1992 in which you requested a soil cleanup level of 1000 ppm TPH in lieu of remediating all "highly contaminated" soils (as they are defined in Section 1201G of the Underground Storage Tank Regulations) at Holloman AFB. As you mentioned in your letter, 1000 ppm, by weight, of diesel or gasoline is apparently a lower level of contamination than is "highly contaminated". The Environment Department approves your requested 1000 ppm TPH cleanup standard with the following stipulations:

1. determination of contaminant levels will be by laboratory analyses and not by field methods,

2. analysis for aromatic volatile organics by gas chromatograph and a photo-ionization detector will be done where soils are contaminated by gasoline, and analysis for non-halogenated semi-volatile organics by gas chromatograph and a flame-ionization detector will be done where the contaminant is a heavier-than-gasoline petroleum hydrocarbon,

3. samples will be taken from the areas of highest apparent (visual determination method) saturation, or contamination if the area is not saturated, and

4. an NMED representative will be notified prior to the cleanup to observe the removal of soils.

Please advise us when you've decided on the means for determining the lateral extent of contaminated soils, which method(s) you'll be using to remediate and dispose of the soils, and how you intend to sample the soils for contaminant levels.

Bruce King
Governor
Judith M. Espinosa
Secretary
Ron Curry
Deputy Secretary

If you have questions please contact Mr. Robert Sweeney at (505) 827-0214.

Sincerely,

James P. Bearzi
Acting Bureau Chief
Underground Storage Tank Bureau

cc: Bob Sweeney, UST Bureau
Steven Cary, GWPRB
David Morgan, GWPRB
NMED District III Office
NMED Alamogordo Field Office

# APPENDIX D

## Potential Disposal Facilities

# Potential Disposal Facilities

| Facility Name | Type of Facility | Approximate Distance from Holloman AFB | Comments |
|---|---|---|---|
| RCRA Permitted Facilities | | | |
| Texas Ecologists, Inc. (TECO)<br>Robstown, TX<br>(800)285-5489<br>Contact: Bill Campbell | Landfill | 800 miles | Stabilization facilities exist on site. PCBs accepted up to 50 ppm with approval from TNRCC & EPA. |
| USPCI<br>Knolls, UT<br>(801)580-8281<br>Contact: Michael Hall | Landfill | 800 miles | Stabilization facilities available. |
| USPCI--Lone Mountain Facility<br>Waynoka, OK<br>(405)697-3500<br>Contact: Tanya Phillips | Landfill | 650 miles | PCBs accepted up to 50 ppm. |
| Westinghouse/Aptus<br>Murray, UT<br>(801)265-2323<br>Contact: Jim Manning | Incinerator | 800 miles | Transportation services available. |
| Westinghouse/Aptus<br>Coffeyville, KS<br>(316)251-6380<br>Contact: | Incinerator | 800 miles | Accepts dioxins. |
| Chem Waste Management<br>Port Arthur, TX<br>(713)875-4632<br>Contact: Maryann Cutaia | Incinerator | 900 miles | No dioxins. Surcharges for hazardous metals. |

## Potential Disposal Facilities (Continued)

| Facility Name | Type of Facility | Approximate Distance from Holloman AFB | Comments |
|---|---|---|---|
| Rollins Environmental Services<br>Deer Park, TX<br>(713)930-2300<br>Contact: Roland Cain | Incinerator | 900 miles | Surcharges for hazardous metals. |
| Nonhazardous Waste Facilities | | | |
| Numex Landfill<br>Sunland Park, NM<br>(505)589-9440<br>Contact: Joe King | Industrial Landfill | 90 miles | Nonhazardous (below TC levels)<br>TPH < 50,000 ppm<br>BTEX < 500 ppm<br>Benzene < 100 ppm |
| Chem Waste Management<br>Rio Rancho, NM<br>(505)892-1200<br>Contact: Jim Jordan | Industrial Landfill | 220 miles | Nonhazardous (below TC levels)<br>TPH < 1000 ppm<br>Benzene < 500 ppm<br>No pesticide contaminated soil<br>No PCB contaminated soil |
| Chem Waste Management<br>Farmington, NM<br>(505)892-1200<br>Contact: Jim Jordan | Industrial Landfill | 400 miles | Nonhazardous (below TC levels)<br>TPH < 1000 ppm<br>Benzene < 500 ppm<br>No pesticide contaminated soil<br>No PCB contaminated soil |
| Western Waste<br>Conroe, TX<br>(800)544-9007<br>Contact: Helen Cecil | Industrial Landfill<br>(Class I) | 900 miles | Nonhazardous (below TC levels)<br>PCBs up to 50 ppm. |

LIBRARY COPY

*Headquarters, Air Combat Command*
*Langley Air Force Base,*
*Virginia*

# *CHEMICAL DATA ACQUISITION PLAN*

## *PRELIMINARY ASSESSMENTS/SITE INVESTIGATIONS AT WASTE SITES SS-06, SD-15, AOC-BBMS, AND AOC-RR*

## *VOLUME II - QUALITY ASSURANCE PROJECT PLAN*

*February 1995*

*49 CES/CEV*
*Holloman Air Force Base,*
*New Mexico*

# CHEMICAL DATA ACQUISITION PLAN
# PRELIMINARY ASSESSMENTS/SITE INVESTIGATIONS
# AT WASTE SITES
# SS-06, SD-15, AOC-BBMS, AND AOC-RR
# HOLLOMAN AIR FORCE BASE, NEW MEXICO

## VOLUME II - QUALITY ASSURANCE PROJECT PLAN

Prepared for:

49 CES/CEV
Holloman Air Force Base, NM

and

HQ ACC/CEVC
Langley Air Force Base, VA

Prepared by:

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dba Foster Wheeler Environmental Corporation
143 Union Blvd., Suite 1010
Lakewood, Colorado 80228-1824

Groundwater Technology
Government Services, Inc.
2501 Yale Blvd., S.E.
Albuquerque, NM 87106

Under Contract No. DACW45-94-D-0003 Delivery Order 1,
Delivery Order 1, Work Authorization Directives 3,5,9 with:

U.S. Army Corps of Engineers
Omaha District
Omaha, Nebraska

February 1995

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C-3 ASTM Standard D422-63 (Reapproved 1990) Standard Test Method for Particle-Size Analysis and Determination of Soil Constants

## LIST OF ACRONYMS

| | |
|---|---|
| AA | Atomic Absorption |
| AFB | Air Force Base |
| AOC | Area of Concern |
| ASTM | American Society for Testing and Materials |
| BBMS | Bare Base Mobility Squadron |
| BFB | 4-Bromo Fluorobenzene |
| BTEX | Benzene, Toluene, Ethylbenzene, and Xylenes |
| CCC | Calibration Check Compound |
| CCCS | Continuing Calibration Check Samples |
| CCV | Continuing Calibration Verification |
| CDAP | Chemical Data Acquisition Plan |
| CFR | Code of Federal Regulations |
| CLP | Contract Laboratory Program |
| CVAA | Cold Vapor Atomic Absorption |
| DDT | Dichloro-diphenyl-trichloroethane |

## LIST OF ACRONYMS (Continued)

| | |
|---|---|
| DFTPP | Decafluorotriphenylposphine |
| DOC | Demonstration of Capability |
| DPT | Direct Push Technology |
| DQCR | Daily Quality Control Report |
| DQO | Data Quality Objective |
| ECD | Electron Capture Detector |
| ELCD | Electron Conductivity Detector |
| EPA | United States Environmental Protection Agency |
| FID | Flame Ionization Detector |
| FCR | Field Change Request |
| FSDR | Field Sampling Data Report |
| FSP | Field Sampling Plan |
| GC/MS | Gas Chromatography/Mass Spectrometry |
| GFAA | Graphite Furnace Atomic Absorption |

## LIST OF ACRONYMS (Continued)

| | |
|---|---|
| IC | Initial Calibration |
| ICPES | Inductively Coupled Plasma Emission Spectroscopy |
| ICV | Initial Calibration Verification |
| IDW | Investigation-Derived Waste |
| IR | Infrared Spectrometry |
| IRP | Installation Restoration Program |
| LCS | Laboratory Quality Control Check Sample |
| MDL | Method Detection Limit |
| mg/l | Milligrams per Liter |
| mg/kg | Milligrams per Kilogram |
| MRD | Missouri River Division |
| MS | Matrix Spikes |
| MSD | MAtrix Spike Duplicates |
| NCR | Nonconformance Report |
| nm | Nanometer |

## LIST OF ACRONYMS (Continued)

| | |
|---|---|
| NMED | New Mexico Environment Department |
| OSHA | Occupational Safety and Health Administration |
| OVA | Organic Vapor Analyzer |
| PA/SI | Preliminary Assessment/Site Investigation |
| PCRF | Procedure Change Request Form |
| PID | Photo Ionization Detector |
| ppb | Parts per Billion |
| ppm | Parts per Million |
| PQL | Practical Quantitative Limit |
| QA | Quality Assurance |
| QAC | Quality Assurance Coordinator |
| QAPP | Quality Assurance Project Plan |
| QC | Quality Control |
| QCCS | Quality Control Check Sample |
| RCRA | Resource Conservation and Recovery Act |

## LIST OF ACRONYMS (Continued)

| | |
|---|---|
| RF | Response Factor |
| RL | Reporting Limits |
| RPD | Relative Percent Difference |
| RR | Railroad |
| RSD | Relative Standard Deviation |
| SQCSR | Site Quality Control Summary Report |
| SOP | Standard Operating Procedures |
| SPCC | System Performance Check Compound |
| SQCSR | Site Quality Control Summary Report |
| SSHP | Site Safety and Health Plan |
| SW | Solid Waste |
| SWMU | Solid Waste Management Unit |
| TCLP | Toxicity Characteristic Leaching Procedure |
| TDS | Total Dissolved Solids |
| TIC | Tentatively-Identified Compound |

## LIST OF ACRONYMS (Continued)

| | |
|---|---|
| TPH | Total Petroleum Hydrocarbon |
| TRPH | Total Recoverable Petroleum Hydrocarbon |
| ug/l | Micrograms per Liter |
| ug/kg | Micrograms per kilogram |
| um | Micrometer |
| USACE | United States Army Corps of Engineers |
| USEPA | United States Environmental Protection Agency |
| VOC | Volatile Organic Compounds |
| ZHE | Zero Headspace Extractor |

# 1.0 INTRODUCTION

This Chemical Data Acquisition Plan (CDAP) has been prepared as part of the work plan to perform Preliminary Assessments and Site Investigations (PA/SI) at four waste sites at Holloman Air Force Base (AFB), New Mexico. This CDAP is separated into two volumes consisting of a Field Sampling Plan (FSP) and a Quality Assurance Project Plan (QAPP). Volume I is the FSP and is comprised of site-specific sampling plans, field investigative procedures, waste management plans, and data management plans. Volume II of the CDAP (this volume) is the QAPP. The QAPP presents the procedures and information necessary for the analysis and evaluation of samples collected during the PA/SI. Data quality objectives and acceptance criteria are established in the QAPP. In addition, analytical methods to be used during the investigation are identified and described.

The purpose of the CDAP is to ensure that data collected during these activities are of adequate quality for the purposes of assessing potential impacts to the subsurface soil and for disposal of the investigation-derived wastes (IDW). This CDAP addresses the quality assurance elements required by "General Chemistry Supplement to the Scope of Services", U.S. Army Corps of Engineers (USACE), Omaha District, December 1993.

The sites at the base included in this investigation are:

- Site SS-06 JP-4 Fuel Line Spill No. 2 (Area of Concern - [AOC]-R);
- Site SD-15 Refrigeration/Heat Shop Washrack (Solid Waste Management Unit [SWMU]-82);
- AOC-BBMS Bare Base Mobility Squadron/Generator Run-up Area; and
- AOC-RR Building 80/Former Locomotive Repair Shop.

The remainder of this document is organized in the following manner: Section 2.0 presents the project organization and functional area responsibilities. Section 3.0 identifies the data quality

objectives for the project. Section 4.0 references the field activities of the project, which are described in greater detail in the FSP (Volume I). Section 5.0 details the laboratory analytical procedures to be used, and Section 6.0 addresses quality assurance audits for all project activities.

# 2.0 PROJECT ORGANIZATION AND FUNCTIONAL AREA RESPONSIBILITIES

The project team for the Holloman AFB PA/SI will be comprised of a project manager, a quality assurance coordinator (QAC), and one or more task leaders. The roles and responsibilities of these key personnel are discussed below.

## 2.1 Roles and Responsibilities

The contractor project manager will be responsible for organizing and directing the technical activities of the project and for reporting the results of these activities. This position will have overall responsibility, authority, and accountability for the project. The project manager will have daily interaction with the technical staff. This individual will perform the following:

- Establish technical objectives, review and modify the work plans in accordance with client directions;
- Be responsible for responding to work plan revisions;
- Be responsible for meeting all contractual requirements for the task;
- Be responsible for meeting, budget, and schedules;
- Ensure technical quality of reports, memoranda, and other communications through review of results;
- Maintain contact with the USACE project manager and provide information regarding all aspects of the project, including progress, problems, and recommended solutions;
- Be responsible for ensuring that required staffing levels and technical expertise are provided; and
- Be responsible for reviewing project staff performance through the program.

The Quality Assurance Coordinator (QAC) will be responsible for development and execution of quality assurance (QA) activities in all phases of the project, including implementation, data reduction and reporting. The responsibilities of the QAC include:

- Coordinating any external QA audit activities requested by the USACE;
- Serving as a resource to the project manager and task leaders in defining data quality goals or requirements;
- Developing a project specific internal quality control (QC) system that is responsive to the goals of this CDAP;
- Reviewing and validating field and laboratory analytical data generated during the PA/SI field activities;
- Coordinating preparation of the project QA reports that document the project specific activities designed to achieve data quality goals or requirements;
- Providing a mechanism for communication of QA problems to the project manager for implementation of corrective action; and
- Documenting QA/QC activity results for the project manager and the client.

A field task manager will be designated for all tasks related to the PA/SI activities. The responsibilities of these individuals include field activities and reporting. General responsibilities of field task managers include:

- Responsibility for ensuring that deliverables required for their specific task are delivered on schedule and within budget;
- Daily coordination of project team staff members;
- Communication with the project manager regarding technical problems, scheduling and budget;
- Coordination of daily QC activities required as part of the internal QC system;

- Ensuring compliance with all QC acceptance criteria as specified in this CDAP; and
- Communicating with the QAC and project manager regarding any quality problems that may arise.

The field task manager will be responsible for all on-site activities, including sample collection, field analysis, chain of custody and reporting. This individual will be responsible for management of the field staff. The field task manager will be responsible for completing daily quality control reports (DQCRs) (Appendix B).

## 2.2 Subcontractor Qualifications

Subcontractors to be used on this project will meet the minimum qualifications stated in the following subsections.

### *2.2.1 Off-Site Analytical Laboratory*

GTEL Environmental Laboratory in Wichita, Kansas is the primary analytical laboratory for this project. GTEL's qualifications include current USACE validation (January 1994-June 1995). GTEL will provide Level III data packages for this project. The analytical laboratory representative will have the ultimate responsibility for all analyses performed at the analytical laboratory. The assigned laboratory representative will ensure that the work is completed as outlined in the Holloman AFB FSP (Volume I) and the QAPP (Volume II) of this CDAP.

The secondary analytical laboratory (GTEL Environmental Laboratory in Concord, California) will be utilized in overflow situations which may result at the primary laboratory. The secondary analytical laboratory representative will have ultimate responsibility for all analyses performed at the secondary analytical laboratory. This individual will also ensure that the work is completed as outlined in the Holloman AFB FSP (Volume I) and the QAPP (Volume II) of this CDAP.

### *2.2.2 Mobile Analytical Laboratory*

The mobile analytical laboratory will have a current USACE validation. The mobile laboratory field operator will be responsible for conducting all the on-site analyses. As stated in the FSP (Volume I) all of the on-site analyses will meet Level III data quality objectives. The chosen laboratory will be responsible for performing the analyses as specified in the FSP (Volume I) and the QAPP (Volume II) of this CDAP.

### *2.2.3 Geotechnical Laboratory*

A geotechnical laboratory will be subcontracted to provide geotechnical testing of soil samples. The laboratory will be responsible for conducting the requested analyses in accordance with the appropriate American Society for Testing and Materials (ASTM) standards. Any equipment used during the testing process will be appropriately calibrated prior to conducting the testing on the project samples. The chosen laboratory will assign a representative who will ensure that the work is completed as outlined in the Holloman AFB FSP (Volume I) and the QAPP (Volume II) of the CDAP.

### *2.2.4 Direct Push Technology Sampling*

A firm capable of conducting direct push technology (DPT) sampling techniques will be subcontracted to provide services associated with conducting the soil gas survey, soil sampling, and groundwater sampling. An assigned representative will be responsible for completing the work as stipulated in the Holloman FSP (Volume I) and QAPP (Volume II) of this CDAP.

### *2.2.5 Drilling*

A drilling company will be subcontracted to provide drilling services associated with the installation of monitor wells. The company will be a licensed New Mexico water well driller. An assigned representative will be responsible for completing the work as stipulated in the Holloman FSP (Volume I) and QAPP (Volume II) of this CDAP.

### *2.2.6 Survey Activities*

Locations of soil gas survey points, boreholes, and monitor wells will be surveyed by a licensed surveyor. The surveyor will be registered in the State of New Mexico. The selected company will assign a representative who will be responsible for following the surveying protocols detailed in the Holloman AFB FSP (Volume I) and QAPP (Volume II) of this CDAP.

## 2.3 USACE Missouri River Division Laboratory

The USACE Missouri River Division (MRD) is responsible for providing QA services to the USACE project manager and chemist. This QA program includes validation of contractor laboratories, analysis of QA duplicate samples, and a review of the reported analytical data and the assessment of data quality. The analysis of QA duplicate samples by a laboratory independent of the contractor laboratory provides an assessment of data comparability.

# 3.0 DATA QUALITY OBJECTIVES

To support the overall project objectives, chemical data quality objectives (DQOs) must be established. The chemical DQOs are:

- Collect samples as outlined in the final specifications for conducting the PA/SI to assess potential releases, characterize waste materials, and provide data for closure;
- Ensure data comparability through the use of standard methods and controlled systems to collect and analyze samples;
- Provide analytical results with known and acceptable precision and accuracy; and
- Provide 90% data completeness for analytical results representing each matrix-method combination.
- The completeness objective for the project will be 95% valid data for each matrix-method combination. Minimum acceptable completeness will be 90%.

Measurement data representativeness is a function of sampling strategy and will be achieved using the procedures discussed in the Final Specifications for sampling at Holloman AFB. Potential for sample contamination will be minimized by the use of decontamination procedures specified in the FSP (Volume I) of this CDAP. Data comparability will be achieved using standard methods and standard units of measure as specified in the methods described in Section 5.1 and Table A-1. Analytical imprecisional bias will be controlled through the use of a QC program using prescribed QC samples and the corrective actions specified in Section 5.5 and Table A-3. Imprecision and bias in natural matrix samples will be estimated by standard QC methods such as matrix spikes and field duplicates.

A QA/QC program will be used to ensure that the analytical DQOs are met for this program. QA/QC efforts are twofold. First, they provide the mechanism for ongoing control and evaluation of measurement data quality throughout the course of the project (i.e., system

capability). Second, they specify QC data to be used to define natural matrix data quality for various measurement parameters in terms of precision and accuracy. Control of measurement data quality (i.e., control of error sources that affect data quality) is possible for sample collection and analysis. However, matrix interference, or non-homogeneity, is not amenable to control. Therefore, imprecision or bias due to these natural sources of error must be estimated from QC samples. For this project, sample collection error will be controlled through the use of standardized sample collection methods and field log books. Sample analysis error will be controlled through the use of standardized analytical methods, and adherence to standard operating procedures (SOPs). Natural matrix error will be estimated by standard QC methods such as field and laboratory duplicates.

## 3.1 Laboratory Analytical Quality

Efforts to control measurement error require that the analytical system be capable, in control, and appropriately sensitive for all analyses. System capability, in terms of accuracy and precision, may be documented by reporting system QC data (e.g., continuing calibration, laboratory quality control check samples (LCS), method matrix spikes (MS) and matrix spike duplicates (MSDs). System performance and sensitivity will be documented through the use of annual method detection limit studies and control charts.

MS and MSD-analyses will be conducted on field samples. These samples will be chosen by the laboratory and processed in the manner and frequency discussed in Section 5.5.2 and 5.5.3 of this QAPP. The soil and groundwater sampling plans in the FSP (Volume I, SOPs A-6 and A-9) account for the collection of sufficient amounts of samples for laboratory to conduct the MS and MSD analyses on any sample.

The stated objective for completeness is 95% for each matrix-method combination. Completeness is defined as the ratio of the valid data to total data collected over the course of the project. Data will be considered valid if they are adequate for their intended use and meet the precision, accuracy, and reporting limit objectives defined below.

### *3.1.1 Precision and Accuracy*

Precision and accuracy objectives for the various measurement parameters associated with site characterization efforts are presented in Table 3-1. Precision will be calculated from MS and MSD analyses and expressed in terms of relative percent difference (RPD). RPDs will be evaluated against the precision objectives in Table 3-1. Percent recovery values for MS samples include components of both random error (i.e., variability from imprecision) and systematic error (i.e., bias), and thus reflect the total analytical error for a given measurement, expressed as a percentage of the true spike value. Recovery values will be compared with accuracy objectives in Table 3-1. Other method controls will be followed in accordance with US Environmental Protection Agency (EPA) Solid Waste (SW)-846, and GTEL SOPs for each of the required analyses.

GTEL routinely utilizes statistically derived limits to evaluate method performance against method stated criteria. If statistically derived limits are broader than those in Table 3.1 and Appendix Table A-5, then the values in these tables will apply and control. The limits in this document are within method stated criteria. Note: That GTEL uses the published (CLP) limits for methods, SW8240, SW8270, and SW8080.

Accuracy and precision objectives presented in Table 3-1 may not be achievable in all cases because the sample matrix cannot be controlled. The stated objectives in Table 3-1 for precision and accuracy should be achieved for 90% of the control samples (95% completeness). When the objectives are not met, documentation will be provided explaining the suspected reason for the variance. The percent recovery between true and measured concentrations of LCS may be compared with accuracy objectives in Table A-4. The bases for these estimates are, in most cases, described in the methods. The analytical laboratory will be able to document that the QA/QC procedure in each standard method (Chapter One and Method 8000A of SW-846, Update 1, July 1992, or USACE Guidance Document ER 1110-1-263) was followed for all analytical work.

### *3.1.2 Method Reporting Limits*

Method reporting limits (RLs) for this project are presented in Table 3-2. Actual method RLs may not reach the project limits for all analytes in all cases, particularly when sample matrix issues dictate that sample dilution must be performed. Conditions that prevent complete data capture, such as significant sample matrix difficulties or sample loss, will be addressed in a timely fashion to determine which corrective actions should be taken.

For a number of compounds, the specified RL does not reach the Resource Conservation and Recovery Act (RCRA)-required limit for the methods included in this investigation. Although known limitations exist, data will be considered usable because they are generated using current promulgated method. In most cases, the sample-specific detection limit is lower than the RL. Natural sample RLs will also depend on dilution effects. In general, dilutions will be performed only as directed in each representative method. For target analytes on gas chromatography/mass spectrometry (GC/MS) and GC analyses, dilution will be performed if the target analyte concentrations exceed the calibration range. For nontarget analytes on GC/MS and GC analyses, dilutions will be performed when nontarget analyte response interferes with target analyte response. When samples are diluted after an initial undiluted analysis, data for target analytes with responses within the calibration range in the undiluted analysis will be collected. These values will be reported with target analytes that required diluted analyses, except in cases where RLs will not result in unusable data. If natural sample RLs exceed RCRA-required limits for any other compounds, the analytical laboratory must document what prompted the higher RLs. The maximum concentrations that were allowable on a sample-by-sample basis may not be applied to batches of samples.

QC procedures used as an ongoing control (i.e., feed-back mechanism) for the analytical system are presented in Section 5.5 and Tables A-3 through A-6 in Appendix A. Control procedures, acceptance criteria, and corrective actions are detailed for each method. Data for each control procedure will be evaluated against these acceptance criteria to prove the analytical system was in control during sample analyses and thus, the results are defensible. These tables are summaries of information from SW-846 Chapter One, Method 8000A and individual methods. As such, they are intended to be used as guides.

## Table 3-1. Analytical Precision and Accuracy Objectives for Natural Matrix Samples

| Parameter | Method | Precision[a] | Accuracy[b] |
|---|---|---|---|
| Metals[c] | SW6010A<br>ICPES | 20% | 80-120% |
| Arsenic | SW7060<br>GFAA | 20% | 75-125% |
| Lead | SW7421<br>GFAA | 20% | 75-125% |
| Mercury | SW7470/7471<br>CVAA | 20% | 75-125% |
| Selenium | SW7740<br>GFAA | 20% | 75-125% |
| Thallium | SW7841<br>GFAA | 20% | 75-125% |
| Volatile Organic Compounds | SW8240A<br>GC/MS | See Method 8240A<br>Table A-5 | See Method 8240A<br>Table A- 5 |
| TCLP Metals<br>TCLP Mercury | SW6010A ICPES and<br>SW7470 CVAA | 20%<br>20% | 80-120%<br>75-125% |
| TCLP Volatile Organic Compounds | SW8240A<br>GC/MS | See TCLP Method<br>8240A<br>Table A-5 | See TCLP Method<br>8240A<br>Table A-5 |
| TCLP Semi-volatile Organic Compounds | SW8270A<br>GC/MS | See TCLP Method<br>8270A<br>Table A-5 | See TCLP Method<br>8270<br>Table A-5 |
| TCLP Pesticides | SW8080<br>GC | See TCLP Method<br>8080<br>Table A-5 | See TCLP Method<br>8080<br>Table A-5 |
| TCLP Herbicides | SW8150A<br>GC | See TCLP-Method<br>8150A<br>Table A-5 | See TCLP Method<br>8150A<br>Table A-5 |

## Table 3-1 Analytical Precision and Accuracy Objectives for Natural Matrix Samples (Continued)

| Parameter | Method | Precision[a] | Accuracy[b] |
|---|---|---|---|
| pH | SW9040/9045A | 0.1 pH Unit | NA |
| TPH as Gasoline | Modified SW8015 GC/FID | See Mod. Method 8015 Table A-5 | See Mod. Method 8015 Table A-5 |
| TPH as Diesel | Modified SW8015 GC/FID | See Mod. Method 8015 Table A-5 | See Mod. Method 8015 Table A-5 |
| Mobile Lab Volatile Organic Compounds | SW8240A GC/MS | 35% | 60-140% |
| Mobile Lab Volatile Organic Compounds | SW8010/8020 GC/PID/ELCP | See Mod. Method 8010/8020 Table A-5 | See Mod. Method 8010/8020 Table A-5 |
| Mobile Lab TPH-as-Diesel | Modified SW8015 GC/FID | See Mod. Method 8015 Table A-5 | See Mod. Method 8015 Table A-5 |

a Relative percent difference for replicate analytical determinations (exclusive of sampling variability).

b Total error for a single measurement in a clean, laboratory-controlled matrix, including both systematic error (bias) and random error (variability from imprecision), expressed as a percentage of the measured value. Percent recovery for quality control check sample (QCCS) or continuing calibration samples will be compared to these objectives.

c ICPES metals: antimony, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, magnesium, manganese, nickel, potassium, silver, sodium, thallium, tin, vanadium and zinc.

d Used only in the event that 8010/8020 replaces 8240A as a field laboratory method.

SW = Test Methods for Evaluating Solid Wastes: Physical/Chemical Methods, U.S. EPA, Office of Solid Waste and Emergency Response, Update 1, July 1992.

CVAA = Cold Vapor Atomic Absorption
FIP = Flame Ionization Detector
GC/MS = Gas Chromatography/Mass Spectrometry
GFAA = Graphite Furnace Atomic Absorption
ICPES = Inductively Coupled Plasma Emission Spectroscopy
QCCS = Quality Control Check Sample
TCLP = Toxicity Characteristic Leaching Procedure
TPH = Total Petroleum Hydrocarbons
ELCP = Electron Conductivity Detector

## Table 3-2. Analytical Methods, Method Reporting Limits, and Maximum Contaminant Levels

| Parameter | Analysis | | Reporting Limits[a] | | Action Levels/Health-Based Levels | | |
|---|---|---|---|---|---|---|---|
| | Technique | Method | Water | Soil | MCL[b] (Water) (mg/l) | RCRA[c,e] (Water) (mg/l) | RCRA[c,e] (Soil) (mg/kg) |
| **TOTAL METALS (ug/l or mg/kg)** | | | | | | | |
| Aluminum | ICPES | 6010A | 200 | 20 | -- | -- | -- |
| Antimony | ICPES | 6010A | 200 | 20 | 0.006 | -- | 32 |
| Barium | ICPES | 6010A | 200 | 20 | 1 | -- | 5,600 |
| Beryllium | ICPES | 6010A | 5 | 0.5 | 0.004 | -- | 0.2 |
| Cadmium | ICPES | 6010A | 20 | 2.0 | 0.005 | -- | 80 |
| Calcium | ICPES | 6010A | 5000 | 500 | -- | -- | -- |
| Chromium (total) | ICPES | 6010A | 30 | 3.0 | 0.1 | -- | 400(VI)<br>80,000(III) |
| Cobalt | ICPES | 6010A | 50 | 5.0 | 0.05 | -- | -- |
| Copper | ICPES | 6010A | 25 | 2.5 | 1.3 | -- | 2,960 |
| Iron | ICPES | 6010A | 100 | 10 | -- | -- | -- |
| Magnesium | ICPES | 6010A | 5000 | 500 | -- | -- | -- |
| Manganese | ICPES | 6010A | 15 | 1.5 | -- | -- | -- |
| Nickel | ICPES | 6010A | 40 | 4.0 | 0.1 | 0.7 | 2,000 |
| Potassium | ICPES | 6010A | 5000 | 500 | -- | -- | -- |
| Silver | ICPES | 6010A | 20 | 2.0 | 0.05 | -- | 400 |
| Sodium | ICPES | 6010A | 5000 | 500 | -- | -- | -- |
| Thallium | ICPES | 6010A | 200 | 20 | 0.002 | 0.003 | 6 |
| Vanadium | ICPES | 6010A | 50 | 5.0 | -- | 0.2 | 560 |
| Zinc | ICPES | 6010A | 20 | 2.0 | 10 | -- | 24,000 |
| Arsenic | GFAA | 7060 | 10 | 1.0 | 0.05 | 0.05 | 0.4 |
| Lead | GFAA | 7421 | 4 | 0.4 | 0.05 | 0.05 | 400 |

## Table 3-2. Analytical Methods, Method Reporting Limits, and Maximum Contaminant Levels (Continued)

| Parameter | Analysis | | Reporting Limits[a] | | Action Levels/Health-Based Levels | | |
|---|---|---|---|---|---|---|---|
| | Technique | Method | Water | Soil | MCL[b] (Water) (mg/l) | RCRA[c,d] (Water) (mg/l) | RCRA[c,d] (Soil) (mg/kg) |
| Mercury | CVAA | 7470/7471 | 0.5 | 0.25 | 0.002 | -- | 24 |
| Selenium | GFAA | 7740A | 10 | 1.0 | 0.01 | -- | 400 |
| Thallium | GFAA | 7841A | 5 | 0.5 | 0.002 | 0.003 | 6 |
| VOLATILE ORGANICS (ug/l or ug/kg) | | | | | | | |
| Acetone | GC/MS | 8240A | 20 | 20 | -- | 3.5 | 8,000 |
| Benzene | GC/MS | 8240A | 5.0 | 5.0 | 0.005 | -- | 24 |
| Bromodichloromethane | GC/MS | 8240A | 5.0 | 5.0 | 0.01[f] | -- | 12 |
| Bromomethane | GC/MS | 8240A | 10 | 10 | -- | 0.05 | 112 |
| Carbon disulfide | GC/MS | 8240A | 5.0 | 5.0 | -- | 3.5 | 8,000 |
| Carbon tetrachloride | GC/MS | 8240A | 5.0 | 5.0 | 0.005 | -- | 56 |
| Chlorobenzene | GC/MS | 8240A | 5.0 | 5.0 | 0.1 | -- | 1,600 |
| Chloromethane | GC/MS | 8240A | 10 | 10 | 0.1 | -- | -- |
| 2-Chloroethyl vinyl ether | GC/MS | 8240A | 10 | 10 | -- | -- | -- |
| Chloroform | GC/MS | 8240A | 5.0 | 5.0 | 0.1[g] | -- | -- |
| Chloromethane | GC/MS | 8240A | 10 | 10 | 0.1[g] | 0.003 | 538 |
| Dibromochloromethane | GC/MS | 8240A | 5.0 | 5.0 | 0.1[g] | -- | 0.008 |
| 1,2 Dichlorobenzene | GC/MS | 8240A | 10 | 10 | 0.6 | -- | -- |
| 1,3 Dichlorobenzene | GC/MS | 8240A | 10 | 10 | -- | -- | -- |
| 1,4 Dichlorobenzene | GC/MS | 8240A | 10 | 10 | 0.005 | -- | -- |
| 1,2 Dichloroethane | GC/MS | 8240A | 5.0 | 5.0 | 0.005 | -- | -- |
| cis-1,2-Dichloroethene | GC/MS | 8240A | 5.0 | 5.0 | 0.07 | -- | 8 |

## Table 3-2. Analytical Methods, Method Reporting Limits, and Maximum Contaminant Levels (Continued)

| Parameter | Analysis | | Reporting Limits[a] | | Action Levels/Health-Based Levels | | |
|---|---|---|---|---|---|---|---|
| | Technique | Method | Water | Soil | MCL[b] (Water) (mg/l) | RCRA[c,e] (Water) (mg/l) | RCRA[c,e] (Soil) (mg/kg) |
| trans-1,2-Dichloroethene | GC/MS | 8240A | 5.0 | 5.0 | 0.1 | -- | 1,600 |
| 1,1-Dichloroethane | GC/MS | 8240A | 5.0 | 5.0 | -- | 3.5 | 8,000 |
| 1,1-Dichloroethene | GC/MS | 8240A | 5.0 | 5.0 | 0.007 | -- | 1.2 |
| 1,2-Dichloropropane | GC/MS | 8240A | 5.0 | 5.0 | 0.005 | -- | 10 |
| cis-1,3-Dichloropropene | GC/MS | 8240A | 5.0 | 5.0 | -- | 0.0002 | 4 |
| trans-1,3-Dichloropropene | GC/MS | 8240A | 5.0 | 5.0 | -- | 0.0002 | 4 |
| Ethyl benzene | GC/MS | 8240A | 5.0 | 5.0 | 0.7 | -- | 8,000 |
| 2-Hexanone | GC/MS | 8240A | 20 | 20 | -- | -- | -- |
| Methylene chloride | GC/MS | 8240A | 10 | 10 | 0.005 | -- | 93 |
| 2-Butanone (MEK) | GC/MS | 8240A | 20 | 20 | -- | 1.8 | 4,000 |
| 4-Methyl-2-pentanone(MIBK) | GC/MS | 8240A | 20 | 20 | -- | -- | -- |
| Styrene | GC/MS | 8240A | 5.0 | 5.0 | 0.1 | -- | 16,000 |
| 1,1,2,2-Tetrachloroethane | GC/MS | 8240A | 5.0 | 5.0 | 0.01[f] | -- | 35 |
| Tetrachloroethene | GC/MS | 8240A | 5.0 | 5.0 | 0.005 | -- | 14 |
| Toluene | GC/MS | 8240A | 5.0 | 5.0 | 0.75[f] | -- | 16,000 |
| Tribromomethane (Bromoform) | GC/MS | 8240A | 5.0 | 5.0 | 0.1[g] | -- | 88 |
| 1,1,1-Trichloroethane | GC/MS | 8240A | 5.0 | 5.0 | 0.06[f] | -- | -- |
| 1,1,2,-Trichloroethane | GC/MS | 8240A | 5.0 | 5.0 | 0.005 | -- | -- |
| Trichloroethene | GC/MS | 8240A | 5.0 | 5.0 | 0.005 | -- | -- |
| Vinyl acetate | GC/MS | 8240A | 20 | 20 | 0.005 | -- | -- |
| Vinyl chloride | GC/MS | 8240A | 10 | 10 | 0.002 | 35 | 80,000 |
| Xylenes (total) | GC/MS | 8240A | 5.0 | 5.0 | 10[f] | -- | 160,000 |

## Table 3-2. Analytical Methods, Method Reporting Limits, and Maximum Contaminant Levels (Continued)

| Parameter | Analysis | | Reporting Limits[a] | | Action Levels/Health-Based Levels | | |
|---|---|---|---|---|---|---|---|
| | Technique | Method | Water | Soil | MCL[b] (Water) (mg/l) | RCRA[c,d] (Water) (mg/l) | RCRA[c,d] (Soil) (mg/kg) |
| **MOBILE LAB VOLATILE ORGANICS (ug/l or ug/kg)** | | | | | | | |
| Acetone | GC/MS | 8240A | 20 | 500 | -- | 3.5 | 8,000 |
| Benzene | GC/MS | 8240A | 5.0 | 50 | 0.005 | -- | 24 |
| Bromodichloromethane | GC/MS | 8240A | 5.0 | 50 | 0.01[f] | -- | 12 |
| Bromomethane | GC/MS | 8240A | 10 | 500 | -- | 0.05 | 112 |
| Carbon disulfide | GC/MS | 8240A | 5.0 | 50 | -- | 3.5 | 8,000 |
| Carbon tetrachloride | GC/MS | 8240A | 5.0 | 50 | 0.005 | -- | 56 |
| Chlorobenzene | GC/MS | 8240A | 5.0 | 50 | 0.1 | -- | 1,600 |
| Chloromethane | GC/MS | 8240A | 10 | 50 | 0.1 | -- | -- |
| 2-Chloroethyl vinyl ether | GC/MS | 8240A | 10 | 500 | -- | -- | -- |
| Chloroform | GC/MS | 8240A | 5.0 | 50 | 0.1[g] | -- | -- |
| Chloromethane | GC/MS | 8240A | 10 | 500 | 0.1[g] | 0.003 | 538 |
| Dibromochloromethane | GC/MS | 8240A | 5.0 | 50 | 0.1[g] | -- | 0.008 |
| 1,2 Dichlorobenzene | GC/MS | 8240A | 10 | 500 | 0.6 | -- | -- |
| 1,3 Dichlorobenzene | GC/MS | 8240A | 10 | 500 | -- | -- | -- |
| 1,4 Dichlorobenzene | GC/MS | 8240A | 10 | 500 | 0.005 | -- | -- |
| 1,2 Dichloroethane | GC/MS | 8240A | 5.0 | 50 | 0.005 | -- | -- |
| cis-1,2-Dichloroethene | GC/MS | 8240A | 5.0 | 50 | 0.07 | -- | 8 |
| trans-1,2-Dichloroethene | GC/MS | 8240A | 5.0 | 50 | 0.1 | -- | 1,600 |
| 1,1-Dichloroethane | GC/MS | 8240A | 5.0 | 50 | -- | 3.5 | 8,000 |
| 1-1-Dichloroethene | GC/MS | 8240A | 5.0 | 50 | 0.007 | -- | 1.2 |
| 1,2-Dichloropropane | GC/MS | 8240A | 5.0 | 50 | 0.005 | -- | 10 |

## Table 3-2. Analytical Methods, Method Reporting Limits, and Maximum Contaminant Levels (Continued)

| Parameter | Analysis | | Reporting Limits[a] | | Action Levels/Health-Based Levels | | |
|---|---|---|---|---|---|---|---|
| | Technique | Method | Water | Soil | MCL[b] (Water) (mg/l) | RCRA[c,d] (Water) (mg/l) | RCRA[c,d] (Soil) (mg/kg) |
| cis-1,3-Dichloropropene | GC/MS | 8240A | 5.0 | 50 | -- | 0.0002 | 4 |
| trans-1,3-Dichloropropene | GC/MS | 8240A | 5.0 | 50 | -- | 0.0002 | 4 |
| Ethyl benzene | GC/MS | 8240A | 5.0 | 50 | 0.7 | -- | 8,000 |
| 2-Hexanone | GC/MS | 8240A | 20 | 500 | -- | -- | -- |
| Methylene chloride | GC/MS | 8240A | 10 | 300 | 0.005 | -- | 93 |
| 2-Butanone (MEK) | GC/MS | 8240A | 20 | 500 | -- | 1.8 | 4,000 |
| 4-Methyl-2-pentanone (MIBK) | GC/MS | 8240A | 20 | 500 | -- | -- | -- |
| Styrene | GC/MS | 8240A | 5.0 | 50 | 0.1 | -- | 16,000 |
| 1,1,2,2-Tetrachloroethane | GC/MS | 8240A | 5.0 | 50 | 0.10[f] | -- | 35 |
| Tetrachloroethene | GC/MS | 8240A | 5.0 | 50 | 0.005 | -- | 14 |
| Toluene | GC/MS | 8240A | 5.0 | 50 | 0.75[f] | -- | 16,000 |
| Tribromomethane (Bromoform) | GC/MS | 8240A | 5.0 | 300 | 0.1[g] | -- | 88 |
| 1,1,1-Trichloroethane | GC/MS | 8240A | 5.0 | 50 | 0.06[f] | -- | -- |
| 1,1,2-Trichloroethane | GC/MS | 8240A | 5.0 | 50 | 0.005 | -- | -- |
| Trichloroethene | GC/MS | 8240A | 5.0 | 50 | 0.005 | -- | -- |
| Vinyl acetate | GC/MS | 8240A | 20 | 500 | 0.005 | -- | -- |
| Vinyl chloride | GC/MS | 8240A | 10 | 50 | 0.002 | 35 | 80,000 |
| Xylenes (total) | GC/MS | 8240A | 5.0 | 50 | 10[f] | -- | 160,000 |
| **TOTAL PETROLEUM HYDROCARBONS (ug/l or mg/kg)** | | | | | | | |
| TPH as Gasoline | GC/FID | Mod.8015 | 100 | 10 | -- | -- | -- |
| TPH as Diesel | GC/FID | Mod.8015 | 100 | 10 | -- | -- | -- |

## Table 3-2. Analytical Methods, Method Reporting Limits, and Maximum Contaminant Levels (Continued)

| Parameter | Analysis | | Reporting Limits[a] | | Action Levels/Health-Based Levels | | |
|---|---|---|---|---|---|---|---|
| | Technique | Method | Water | Soil | MCL[b] (Water) (mg/l) | RCRA[c,d] (Water) (mg/l) | RCRA[c,d] (Soil) (mg/kg) |
| **MOBILE LAB TOTAL PETROLEUM HYDROCARBONS (ug/l or mg/kg)** | | | | | | | |
| TPH as Gasoline | GC/FID | Mod.8015 | 1000 | 10,000 | -- | -- | -- |
| TPH as Diesel | GC/FID | Mod.8015 | 1000 | 10,000 | -- | -- | -- |
| **MOBILE LAB VOLATILE ORGANIC HYDROCARBONS (ug/l or mg/kg)** | | | | | | | |
| Benzene | PID | 8020 | 0.5 | 0.025 | 0.005 | -- | 24 |
| Bromodichloromethane | ELCD | 8010 | 0.2 | 0.010 | 0.01[f] | -- | 12 |
| Bromomethane | ELCD | 8010 | 1.0 | 0.030 | -- | 0.05 | 112 |
| Bromoform | ELCD | 8010 | 0.5 | 0.010 | -- | -- | -- |
| Carbon tetrachloride | ELCD | 8010 | 0.2 | 0.010 | 0.005 | -- | 56 |
| Chlorobenzene | ELCD/PID | 8010/8020 | 0.5 | 0.025 | 0.1 | -- | 1,600 |
| Chloromethane | ELCD | 8010 | 0.5 | 0.025 | 0.1 | -- | -- |
| Chloroform | ELCD | 8010 | 0.5 | 0.060 | 0.1[g] | -- | -- |
| Chloromethane | ELCD | 8010 | 1.0 | 0.025 | 0.1[g] | 0.003 | 538 |
| Dibromochloromethane | ELCD | 8010 | 0.2 | 0.010 | 0.1[g] | -- | 0.008 |
| 1,2-dibromoethane (EDB) | ELCD | 8010 | 0.2 | 0.010 | -- | -- | -- |
| 1,2-dichlorobenzene | ELCD/PID | 8010/8020 | 0.5 | 0.025 | 0.6 | -- | -- |
| 1,3-dichlorobenzene | ELCD/PID | 8010/8020 | 0.5 | 0.025 | -- | -- | -- |
| 1,4-dichlorobenzene | ELCD/PID | 8010/8020 | 0.5 | 0.025 | -- | -- | -- |
| 1,1-dichloroethane | ELCD | 8010 | 0.2 | 0.010 | -- | 3.5 | 8,000 |
| 1,2-dichloroethane (EDC) | ELCD | 8010 | 0.5 | 0.010 | -- | -- | -- |
| 1,1-dichloroethene | ELCD | 8010 | 0.2 | 0.010 | 0.007 | -- | 1.2 |
| cis-1,2-dichloromethene | ELCD | 8010 | 0.2 | 0.010 | -- | -- | -- |

## Table 3-2. Analytical Methods, Method Reporting Limits, and Maximum Contaminant Levels (Continued)

| Parameter | Analysis | | Reporting Limits[a] | | Action Levels/Health-Based Levels | | |
|---|---|---|---|---|---|---|---|
| | Technique | Method | Water | Soil | MCL[b] (Water) (mg/l) | RCRA[c,e] (Water) (mg/l) | RCRA[c,e] (Soil) (mg/kg) |
| trans-1,2-dichloromethene | ELCD | 8010 | 1.0 | 0.010 | -- | -- | -- |
| 1,2-dichloropropene | ELCD | 8010 | 0.2 | 0.010 | -- | -- | -- |
| cis-1,3-dichloropropene | ELCD | 8010 | 0.2 | 0.010 | -- | 0.0002 | 4 |
| trans-1,3-dichloropropene | ELCD | 8010 | 0.2 | 0.010 | -- | 0.0002 | 4 |
| ethyl benzene | PID | 8020 | 0.5 | 0.025 | 01.7 | -- | 8,000 |
| methylene chloride | ELCD | 8010 | 2.0 | 0.50 | 0.005 | -- | 93 |
| 1,1,2,2-tetrachloroethane | ELCD | 8010 | 0.2 | 0.010 | 0.01[f] | -- | 35 |
| tetrachloroethylene | ELCD | 8010 | 0.5 | 0.025 | 0.005 | -- | 14 |
| toluene | PID | 8020 | 0.5 | 0.025 | 0.75[f] | -- | 16,000 |
| 1,1,1-trichloroethane | ELCD | 8010 | 1.0 | 0.050 | 0.06[f] | -- | -- |
| 1,1,2-trichloroethane | ELCD | 8010 | 0.2 | 0.010 | 0.005 | -- | -- |
| trichloroethene | ELCD | 8010 | 0.2 | 0.010 | 0.005 | -- | -- |
| trichlorofluoromethane | ELCD | 8010 | 0.2 | 0.010 | -- | -- | -- |
| vinyl chloride | ELCD | 8010 | 0.5 | 0.025 | 0.002 | -- | -- |
| total xylenes | PID | 8020 | 0.5 | 0.025 | 10[g] | - | 160,000 |
| 2-chloroethyl vinyl ether | ELCD | 8010 | 1.0 | 0.050 | -- | -- | -- |
| **GENERAL** | | | | | | | |
| pH | pH Electrode | 9040 | 0.1 pH unit | NA | -- | -- | -- |
| pH | Soil pH Extraction & Electrode | 9045A | NA | 0.1 pH unit | -- | -- | -- |

## Table 3-2. Analytical Methods, Method Reporting Limits, and Maximum Contaminant Levels (Continued)

[a] The method Reporting Limit (RL) is the minimum concentration of a substance that can be measured and reported for multiple instruments. RLs are highly matrix dependent and may not always be achievable. The RLs are set at 3-5 times the derived Method Detection Limit (MDL) determined in accordance with 40 CFR 136 App. B. RLs listed in this table are based on wet weight.

[b] Federal Drinking Water Standards Maximum Contaminant Levels (MCL), Office of Drinking Water, USEPA.

[c] Values calculated using the reference dose (RfD) or slope factor (SF) with EPA's method for calculating action levels (Appendix 4 of "Draft Preliminary Standards for RCRA Risk Assessment," EPA Region VI, 20 February 1991; and 27 July 1990 Fed. Reg., "Corrective Action for SWMUs at Hazardous Waste Management Facilities," Appendix E. The source of the RfD and SFs used in the calculation are designated by a footnote for each value in this column. Action levels may change over time, EPA IRIS database should be reviewed prior to using these levels in the decision-making process.

[d] Unless otherwise noted, RfDs or Sfs used to calculate HBL are from the Electronic Handbook of Risk Assessment Values, which lists values from both IRIS and HEAST.

[e] New Mexico Human Health Standard for Lead.

[f] SF used in calculation of HBL calculated using method in *Comparative Potency Approach for Estimating the Cancer Risk Associated with Exposure to Mixtures of Polycyclic Aromatic Hydrocarbons*, Interim Final, ICF-Clement Associates, Fairfax, Virginia, April 1, 1988.

[g] Total trihalomethanes (the sum of the concentrations of bromodichloromethane, dibromochloromethane, tribromethane (bromoform) and trichloromethane (Chloroform).....Federal Code of Federal Regulations 141.12, 1992.

[h] Used only in the event that 8010/8020 replaces 8240A as a field laboratory method.

| | |
|---|---|
| ICPES | = Inductively Coupled Plasma Emission Spectroscopy |
| GFAA | = Graphite Furnace Atomic Absorption |
| CVAA | = Cold Vapor Atomic Absorption |
| GC/MS | = Gas Chromatography/Mass Spectrometry |
| PID | = Photoionization Detector |
| ELCD | = Electron Conductivity Detector |
| ug/l | = Micrograms per Liter |
| mg/l | = Milligrams per Liter |
| ug/kg | = Micrograms per Kilogram |
| mg/kg | = Milligrams per Kilogram |

**Table 3-3. Analytical Methods, Method Reporting Limits and Maximum Concentration of Contaminants for the Toxicity Characteristic Leaching Procedure**

| Parameter | Preparation | | Analysis | | Reporting Limits | Action Level |
|---|---|---|---|---|---|---|
| | Technique | Method | Technique | Method | Soil or Water (mg/L) | Soil or Water (mg/L) |
| **TCLP METALS (mg/L)** | | | | | | |
| Arsenic | Extraction/ Acid Digestion | 1311/ 3010A | GFAA | 6010A | 0.5 | 5.0 |
| Barium | Extraction/ Acid Digestion | 1311/ 3010A | ICPES | 6010A | 1.0 | 100 |
| Cadmium | Extraction/ Acid Digestion | 1311/ 3010A | ICPES | 6010A | 0.05 | 1.0 |
| Chromium | Extraction/ Acid Digestion | 1311/ 3010A | ICPES | 6010A | 0.05 | 5.0 |
| Lead | Extraction/ Acid Digestion | 1311/ 3010A | GFAA | 6010A | 0.5 | 5.0 |
| Mercury | Extraction/ Acid Digestion | 1311/ 7470 | CVAA | 7470 | 0.002 | 0.2 |
| Silver | Extraction/ Acid Digestion | 1311/ 3010A | ICPES | 6010A | 0.05 | 5.0 |
| Selenium | Extraction/ Acid Digestion | 1311/ 3010A | GFAA | 6010A | 0.2 | 1.0 |
| **TCLP VOLATILE (mg/L)** | | | | | | |
| Benzene | Purge and Trap | 1311/ 5030A | GC/MS | 8240A | 0.05 | 0.5 |
| Carbon tetrachloride | Purge and Trap | 1311/ 5030A | GC/MS | 8240A | 0.05 | 0.5 |
| Chlorobenzene | Purge and Trap | 1311/ 5030A | GC/MS | 8240A | 0.05 | 100 |
| Chloroform | Purge and Trap | 1311/ 5030A | GC/MS | 8240A | 0.05 | 6.0 |
| 1,2 Dichloroethane | Purge and Trap | 1311/ 5030A | GC/MS | 8240A | 0.05 | 0.5 |

**Table 3-3. Analytical Methods, Method Reporting Limits, and Maximum Concentration of Contaminants for the Toxicity Characteristic Leaching Procedure (Continued)**

| Parameter | Preparation | | Analysis | | Reporting Limits | Action Level |
|---|---|---|---|---|---|---|
| | Technique | Method | Technique | Method | Soil or Water (mg/L) | Soil or Water (mg/L) |
| 1,1-Dichloroethylene | Purge and Trap | 1311/ 5030A | GC/MS | 8240A | 0.05 | 0.7 |
| Methyl ethyl ketone (MEK) | Purge and Trap | 1311/ 5030A | GC/MS | 8240A | 0.20 | 200 |
| Tetrachloroethylene | Purge and Trap | 1311/ 5030A | GC/MS | 8240A | 0.05 | 0.7 |
| Trichloroethylene | Purge and Trap | 1311/ 5030A | GC/MS | 8240A | 0.05 | 0.5 |
| Vinyl chloride | Purge and Trap | 1311/ 5030A | GC/MS | 8240A | 0.10 | 0.2 |
| TCLP PESTICIDES (mg/L) | | | | | | |
| Chlordane | TCLP | 1311/ 3510A | GC/ECD | 8080 | 0.0001 | 0.03 |
| Endrin | TCLP | 1311/ 3510A | GC/ECD | 8080 | 0.0001 | 0.02 |
| Heptachlor | TCLP | 1311/ 3510A | GC/ECD | 8080 | 0.0001 | 0.008 |
| Heptachlor Epoxide | TCLP | 1311/ 3510A | GC/ECD | 8080 | 0.0001 | 0.008 |
| Lindane (gamma-BHC) | TCLP | 1311/ 3510A | GC/ECD | 8080 | 0.0001 | 0.4 |
| Methoxychlor | TCLP | 1311/ 3510A | GC/ECD | 8080 | 0.0001 | 10 |
| Toxaphene | TCLP | 1311/ 3510A | GC/ECD | 8080 | 0.0004 | 0.5 |

**Table 3-3. Analytical Methods, Method Reporting Limits, and Maximum Concentration of Contaminants for the Toxicity Characteristic Leaching Procedure (Continued)**

| Parameter | Preparation | | Analysis | | Reporting Limits | Action Level |
|---|---|---|---|---|---|---|
| | Technique | Method | Technique | Method | Soil or Water (mg/L) | Soil or Water (mg/L) |
| **TCLP HERBICIDES (mg/L)** | | | | | | |
| 2,4-D | TCLP | 1311/ 3510A | GC/ECD | 8150A | 0.0004 | 10 |
| 2,4,5-TP (Silvex) | TCLP | 1311/ 3510A | GC/ECD | 8150A | 0.0001 | 1 |
| **TCLP SEMI - VOLATILES (mg/L)** | | | | | | |
| Pyridine | TCLP | 1311/ 3510A | GC/MS | 8270A | 0.033 | 5.0 |
| 1,4-Dichlorobenzene | TCLP | 1311/ 3510A | GC/MS | 8270A | 0.033 | 7.5 |
| 2-Methylphenol (o-Cresol) | TCLP | 1311/ 3510A | GC/MS | 8270A | 0.033 | 200 |
| 3 +4-Methylphenol (m-Cresol + p-Cresol) | TCLP | 1311/ 3510A | GC/MS | 8270A | 0.033 | 200 |
| Hexachloroethane | TCLP | 1311/ 3510A | GC/MS | 8270A | 0.033 | 3.0 |
| Nitrobenzene | TCLP | 1311/ 3510A | GC/MS | 8270A | 0.033 | 2.0 |
| Hexachloro-1,3-butadiene | TCLP | 1311/ 3510A | GC/MS | 8270A | 0.033 | 0.5 |
| 2,4,6-Trichlorophenol | TCLP | 1311/ 3510A | GC/MS | 8270A | 0.033 | 2.0 |
| 2,4,5-Trichlorophenol | TCLP | 1311/ 3510A | GC/MS | 8270A | 0.033 | 400 |
| 2,4-Dinitrotoluene | TCLP | 1311/ 3510A | GC/MS | 8270A | 0.033 | 0.13[c] |

**Table 3-3. Analytical Methods, Method Reporting Limits, and Maximum Concentration of Contaminants for the Toxicity Characteristic Leaching Procedure (Continued)**

| Parameter | Preparation | | Analysis | | Reporting Limits | Action Level |
|---|---|---|---|---|---|---|
| | Technique | Method | Technique | Method | Soil or Water (mg/L) | Soil or Water (mg/L) |
| Hexachlorobenzene | TCLP | 1311/ 3510A | GC/MS | 8270A | 0.033 | 0.13[c] |
| Pentachlorophenol | TCLP | 1311/ 3510A | GC/MS | 8270A | 0.17 | 100 |

a RL is the minimum concentration of a substance that can be measured and reported for multiple instruments. RLs are highly matrix dependent and may not always be achievable. RLs provided in this table are based on method detection limits and practical quantitation limit guidance found in SW-846, but are not MDLs or PQLs. RLs listed are on a wet-weight basis.

b Maximum Concentration of Contaminants for the Toxicity Characteristic 40 CFR 261.24, July 1, 1992

c Quantitation limit is greater than the calculated regulatory level. The Quantitation limit, therefore becomes the regulatory level.

TCLP = Toxicity Characteristic Leaching Procedure
ICPES = Inductively Coupled Plasma Emission Spectroscopy
GFAA = Graphite Furnace Atomic Absorption
CVAA = Cold Vapor Atomic Absorption
GC/MS = Gas Chromatography/Mass Spectrometry
ECD = Electron Capture Detector
mg/l = Milligrams per Liter

## 3.2 Data Quality Calculations

Precision and accuracy are the two most important indicators of measurement data quality. Precision is a measure of variability associated with a measurement system. Accuracy expresses the degree to which a measured value agrees with the true value for a given parameter. Accuracy includes elements of both bias and precision. This section provides instructions for calculating data quality in terms of precision and accuracy.

For this project, precision will be assessed and controlled through the use of MS and MSD analyses. Acceptance criteria are listed in Table 3-1.

The RPD will be used to estimate precision for duplicate analyses and is calculated by:

$$RPD = \frac{X_1 - X_2}{(X_1 + X_2)/2} \times 100$$

For this project, accuracy of the measurement data will be assessed and controlled by sample recovery. These results will be used to control accuracy within acceptable limits by requiring that they meet specific criteria. As spiked samples are analyzed, recoveries will be calculated and compared with preestablished acceptance limits (see Table 3-1). Percent recovery is calculated as the measured value of the spiked sample less the measured value of the sample divided by the actual value of the spike times 100.

# 4.0 FIELD ACTIVITIES

## 4.1 Field Sampling Procedures

Detailed descriptions of the sampling procedures to be used during the PA/SI activities at Holloman AFB are discussed in Sections 2 and 3 of the FSP (Volume I) of this CDAP.

## 4.2 Sample Chain-of-Custody, Packing, and Transportation Procedures

Any samples collected for analytical analyses will be submitted to the laboratory following the document, sample handling, chain-of-custody, and shipping procedures detailed in Section 3 and SOP A-1 of the FSP (Volume I) of this CDAP. A sample chain-of-custody is included in SOP A-1 .

# 5.0 LABORATORY ANALYTICAL PROCEDURES

## 5.1 Analytical Methods

The methods and procedures that will be used to prepare and analyze samples are discussed in this section. Most chemical analyses will be performed according to the following publication:

- SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, U.S. EPA, Office of Solid Waste and Emergency Response, Update 1, July 1992

Individual parameters and analytical methods to be followed are identified in Table A-1. Information is provided for soil and groundwater matrices.

The laboratory will perform instrument-specific demonstration of capability (DOC) and method detection limit (MDL) studies to demonstrate the ability to meet project-specific RLs. The DOC study consists of the analysis of a minimum of four mid-range Quality Control Check Samples (QCCS) to support method precision and accuracy. Seven QCCS's of an appropriate concentration (1-5x the estimated MDL, but not higher than the proposed RL) shall be analyzed to estimate or establish the MDL. The derived MDL is determined in accordance with 40 Code of Federal Regulations (CFR) 136 Appendix B. Analysis will only be performed on instruments with valid and current MDL and DOC studies.

### *5.1.1 Metals by ICPES--SW-846 Method 6010A*

Soil and groundwater samples will be analyzed to determine concentrations of aluminum, antimony, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, magnesium, manganese, nickel, potassium, silver, sodium, thallium, vanadium and zinc. Aqueous samples will be prepared according to SW-846 Method 3010A. After digestion, samples will be analyzed by SW-846 Method 6010A. Soil samples will be prepared according to SW-846 Method 3050A. This method describes acid digestion of soil samples for analysis by graphite

furnace atomic adsorption (GFAA) or inductively-coupled plasma emission spectroscopy (ICPES).

Following acid digestion, metals will be determined by SW 846 Method 6010A, which allows the simultaneous or sequential measurement of elements using ICPES. This method measures the element emitted by light optical spectrometry. Samples are nebulized and the resulting aerosol is transported to the plasma torch. Element-specific atomic-line emission spectra are produced, dispersed by a grating spectrometer, and monitored for intensity by photomultiplier tubes.

### *5.1.2 Arsenic by GFAA--SW-846 Method 7060*

Soil and groundwater samples will be analyzed to determine concentrations of arsenic. Aqueous samples will be prepared according to SW-846 Method 7060. After digestion, samples will be analyzed by SW-846 Method 7060. Soil samples will be prepared following SW-846 Method 3050A. This method describes acid digestion of soil samples for analysis by GFAA or ICPES.

Following acid digestion, a sample aliquot will be placed in a graphite tube in the furnace. The sample is then evaporated, charred and atomized. Radiation from a given excited element is passed through the vapor containing ground-state atoms of arsenic. The intensity of the radiation decreases in proportion to the amount of ground-state atoms present. A monochromator isolates the characteristic radiation from the hollow cathode tube or electrodeless discharge lamp, and a photosensitive device measures the attenuated transmitted radiation.

### *5.1.3 Lead by GFAA--SW-846 Method 7421*

Soil and groundwater samples will be analyzed to determine concentrations of lead. Aqueous samples will be prepared according to SW-846 Method 3020A. After digestion, samples will be analyzed by SW-846 Method 7421. Soil samples will be prepared following SW-846

Method 3050A. This method describes acid digestion of soil samples for analysis by GFAA or ICPES.

Following acid digestion, a sample aliquot will be placed in a graphite tube in the furnace. The sample is then evaporated, charred and atomized. Radiation from a given excited element is passed through the vapor containing ground-state atoms of lead. The intensity of the radiation decreases in proportion to the amount of ground-state atoms present. A monochromator isolates the characteristic radiation from the hollow cathode tube or electrodeless discharge lamp, and a photosensitive device measures the attenuated transmitted radiation.

### *5.1.4 Mercury by CVAA--SW-846 Method 7470 and SW-846 Method 7471*

Groundwater samples will be analyzed to determine concentrations of mercury by using cold vapor atomic absorption (CVAA). Groundwater samples will be prepared as directed in SW-846 Method 7470. Following SW-846 Method 7470 and the laboratory SOP, mercury in the sample is reduced to the elemental state and aerated from solution in a closed system. The mercury vapor passes through a cell positioned in the light path of an atomic adsorption spectrometer for detection and measurement.

Soil samples will be analyzed to determine concentrations of mercury by CVAA. Soil samples will be prepared as directed in SW-846 Method 7471. Following SW-846 Method 7471 and the laboratory SOP, mercury in the sample is reduced to the elemental state and aerated from solution in a closed system. The mercury vapor passes through a cell positioned in the light path of an atomic adsorption spectrometer for detection and measurement.

### *5.1.5 Selenium by GFAA--SW-846 Method 7740*

Soil and groundwater samples will be analyzed to determine the concentrations of selenium. Aqueous samples will be prepared according to SW-846 Method 7740. After digestion, samples will be analyzed by SW-846 Method 7740. Soil samples will be prepared following

SW-846 Method 3050A. This method describes acid digestion of soil samples for analysis by GFAA or ICPES.

Following acid digestion, a sample aliquot will be placed in a graphite tube in the furnace. The sample is then evaporated, charred and atomized. Radiation from a given excited element is passed through the vapor containing ground-state atoms of selenium. The intensity of the radiation decreases in proportion to the amount of ground-state atoms present. A monochromator isolates the characteristic radiation from the hollow cathode tube or electrodeless discharge lamp, and a photosensitive device measures the attenuated transmitted radiation.

### *5.1.6 Thallium by GFAA--SW-846 Method 7841*

Soil and groundwater samples will be analyzed to determine the concentrations of selenium. Aqueous samples will be prepared following SW-846 Method 3020A. This method describes acid digestion of aqueous samples for analysis by GFAA. Soil samples will be prepared following SW-846 Method 3050A. This method describes acid digestion of soil samples for analysis by GFAA or ICPES.

Following acid digestion, a sample aliquot will be placed in a graphite tube in the furnace, evaporated, charred and atomized. Radiation from a given excited element is passed through the vapor containing ground-state atoms of thallium. The intensity of the radiation decreases in proportion to the amount of ground-state atoms present. A monochromator isolates the characteristic radiation from the hollow cathode tube or electrodeless discharge lamp, and a photosensitive device measures the attenuated transmitted radiation.

### *5.1.7 Total Petroleum Hydrocarbons--SW-846 Method 8015 Modified (Both Mobile and Fixed Laboratory)*

Soil samples will be analyzed by both the fixed and mobile laboratories to determine the concentration of volatile and semivolatile petroleum hydrocarbons. The TPH as Diesel soil samples will be prepared using SW-846 Method 3550. The TPH as Gasoline soil samples are

prepared by Method 5030. Samples are introduced into a gas chromatograph using either injection of solvent extracts (prepared by modified SW-846 Method 3550) for semivolatile analytes or purge and trap (SW-846 Method 5030) for volatile analytes. Capillary columns and a temperature program are used in the gas chromatograph to separate the organic compounds. Detection is achieved by a flame ionization detector (FID). The method has been modified to allow determination for petroleum products. Qualitative and quantitative accuracy of this method may vary due to exact product composition, weathering, biodegradation, and the presence of product mixtures.

### *5.1.8 Organochlorine Pesticides--SW-846 Method 8080*

Selected IDW samples will be analyzed following the Toxicity Characteristic Leaching Procedure (TCLP) extraction procedures to determine the concentrations of certain organochlorine pesticides. The TCLP sample extraction is prepared with a separatory funnel liquid-liquid extraction (3510). Extracts are injected into a gas chromatograph, analytes are separated by a capillary column and detected by an electron capture detector (ECD). Interferences may affect method sensitivity. Extract cleanup techniques may be used to reduce interferences.

### *5.1.9 Chlorinated Herbicides by Gas Chromatography--SW-846 Method 8150A*

Selected IDW samples will be analyzed following the TCLP extraction procedures to determine the concentrations of certain chlorinated acid herbicides. Samples are extracted and converted to their methyl esters using diazomethane as the derivatizing agent. The esters are analyzed by gas chromatography employing an electron capture detector. Results are reported as the acid equivalent. Interferences may affect method sensitivity and derivitization efficiency.

### *5.1.10 Volatile Organics--SW-846 Method 8240A (Both Mobile and Fixed Laboratory)*

Soil and groundwater samples will be analyzed by both the mobile and fixed laboratories to determine concentrations of volatile organics. Samples will be prepared following SW-846

Method 5030, purge and trap. The procedure for low-level concentrations will be followed for all the fixed laboratory work when possible. For the mobile laboratory analyses, the procedure for low-level concentrations will be used for aqueous samples (when possible). Soil samples will follow the medium-level procedure at a 50x dilution.

The presence and concentration of purgeable organic compounds will be determined by SW-846 Method 8240A using a capillary column. This method uses a purge-and-trap GC/MS technique. An inert gas is bubbled through water to transfer the purgeable organic compounds from the liquid to the vapor phase. The vapor is then swept through the sorbent trap which is heated and backflushed with inert gas to desorb the organic compounds onto the GC capillary column where they are separated and then detected with a mass spectrometer.

### *5.1.11 Volatile Organics--SW-846 Method 8010/8020 (Mobile Laboratory)*

In the event that 8010/8020 replaces EPA Method 8240A as a field laboratory technique, soil and groundwater samples will be analyzed to determine volatile organics using the following procedures. Samples will be prepared following SW-846 Method 5030, purge and trap. The procedure for low-level concentrations will be followed for all the fixed laboratory work when possible. For the mobile laboratory analyses, the procedure for low-level concentrations will be used for aqueous samples (when possible). Soil samples will follow the medium-level procedure at a 50x dilution.

The presence and concentration of purgeable organic compounds (ELCP) will be determined by SW-846 Method 8010/8020 using a capillary column. This method uses a purge-and-trap GC/photoionization detector (PID)/electron conductivity detector (ELCD) technique. An inert gas is bubbled through water to transfer the purgeable organic compounds from the liquid to the vapor phase. The vapor is then swept through the sorbent trap which is heated and backflushed with inert gas to desorb the organic compounds. The trap is backflushed and heated to desorb the purgeable organics onto a GC capillary column where they are separated and then detected with a PID/ELCD.

### *5.1.12 Semi-Volatile Organics--SW-846 Method 8270A*

Selected IDW samples will be analyzed following the TCLP extraction procedures to determine concentrations of semi-volatile organics. Soil samples will be prepared using SW-846 Method 3550 and water samples will be prepared using SW-846 Method 3510.

Method 8270 is a GC/MS technique used for determining a specific list of semivolatile acidic, basic and neutral organic compounds that are soluble in methylene chloride and capable of being eluted as sharp peaks from a capillary column with a slightly polar liquid phase.

### *5.1.13 Toxicity Characteristic Leaching Procedure (TCLP)*

IDW soil and liquid waste samples will be analyzed for purposes of characterization. These analyses will include preparation by SW-846 Method 1311, which is the Toxicity Characteristic Leaching Procedure.

The TCLP is used to determine the concentration of organic (volatile and semi-volatile) and inorganic (metals) constituents that are leachable from waste or other material. Samples will be prepared according to TCLP procedures to characterize the material before disposal. Samples are extracted with acidic extraction fluid for an 18 $\pm$2-hour period using a solid-to-liquid ratio of 1:20. After the extraction period, the solids are filtered from the liquid and the liquid is analyzed by methods outlined in SW-846. Leachates prepared for volatile analysis are prepared in a zero headspace extractor (ZHE).

Additional leachate is prepared so that MS/MSD may be run at a rate of 5 % of samples. Matrix spikes for the TCLP analytes will be performed once per waste type group per batch. Analytical results will not be bias corrected. These QA measures are in accordance with requirements set forth in SW-846 Method 1311, Section 8.0 and 40 CFR Parts 261, 264, 265, 268, 271, and 302, Volume 55 Number 126, June 29, 1990.

### *5.1.14 pH--SW-846 Method 9045A*

Several soil samples will be analyzed by SW-846 Method 9045A to determine pH levels. Soil samples are mixed with reagent-grade water or a calcium chloride solution, depending on whether the soil is considered calcareous or non-calcareous, prior to analysis. pH of the solution is determined electrometrically.

### *5.1.15 pH--SW-846 Method 9040*

Several water samples will be analyzed by SW-846 Method 9040 to determine pH levels. The pH of the water is determined electrometrically.

### *5.1.16 Soil Moisture Content--ASTM D-2216*

The percent moisture content will be determined by removing the moisture using a heating oven. A pre-weighed sample aliquot is dried and weighed again after drying to determine the moisture content of the soil.

## 5.2 Geotechnical Analyses

Selected soil samples, as described in Section 2 of the FSP (Volume I) of this CDAP, will have the following geotechnical analyses conducted:

- Atterberg Limits - ASTM Standard D4318-93; and
- Grainsize - ASTM Standard D421-85 (Reapproved 1993) and D422-63 (Reapproved 1990) without the hydrometer test being conducted on particles that pass through No. 200 sieve [less than 75 micrometer (um)].

Copies of the standard methods to be used are included in Appendix C.

## 5.3 Calibration Procedures

Documented calibration procedures are necessary to provide consistency in preparing equipment for specific analytical measurements. Established calibration procedures then provide a mechanism for ensuring that measurements made with a specific type of equipment are comparable. Calibration requirements for each analytical method used for this project are described in the following subsections and are summarized in Table A-2.

### *5.3.1 Metals by ICPES--SW-846 Method 6010A*

SW-846 Method 6010A is used to measure elements by ICPES. Detailed calibration procedures for ICPES systems are described in SW-846, 3rd edition. A response factor (RF) is calculated daily for each metal on the basis of two determinations of a calibration standard and calibration blank. Following calibration, a high-level calibration check sample is reanalyzed; agreement between the measured value and the expected value must be within 5% for the analyses to proceed. Calibration is verified by analyzing a QC check standard which is prepared independently of calibration standards, at a frequency of every 10 samples. Agreement within 10% of the expected value is required for all target analytes; otherwise, the system must be recalibrated. When a calibration check does not agree with the expected value ($\pm$10%), the samples that have been analyzed since the last calibration check was made will be reanalyzed.

### *5.3.2 Metals by GFAA--SW-846 Methods 7060, 7421, 7740, and 7841*

SW-846 Methods 7060, 7421, 7740 and 7841 are GFAA techniques for determination of arsenic, lead, selenium, and thallium, respectively. The calibration procedures for the graphite furnace systems are described in the respective SW-846, 3rd edition methods. A multipoint calibration curve is generated daily for each element using a calibration blank and three up-scale standards. The correlation coefficient for the linear regression equation must exceed 0.995 to be acceptable. Calibration will be verified every 10 samples by analyzing a QC check sample and calibration blank. Agreement within $\pm$20 % of the expected value is required; otherwise, a new calibration curve must be generated.

### *5.3.3 Mercury by CVAA--SW-846 Methods 7470 and 7471*

SW-846 Methods 7470 and 7471 are CVAA techniques for determination of mercury in soil samples. The calibration procedures for the CVAA system are described in the respective SW-846, 3rd edition methods. A multipoint calibration curve is generated daily using a calibration blank and three up-scale standards. The correlation coefficient for the linear regression equation must exceed 0.995 to be acceptable. Calibration will be verified every 10 samples by analyzing a QC check sample and calibration blank. Agreement within $\pm 15$ % of the expected value is required; otherwise, a new calibration curve must be generated.

### *5.3.4 Volatile Organics--SW-846 Method 8240A*

Samples for volatile organics will be analyzed by GC/MS following SW-846 Method 8240A, 3rd edition. Analyte identification and quantitation will be performed using RFs and retention times generated from a five-point calibration curve, daily RF updates, and instrument specific mass spectra. At least three of the following five internal standards will be used:

- 1,4-Difluorobenzene;
- Chlorobenzene-$d_5$;
- Fluorobenzene;
- Pentafluorobenzene; and
- 1,4-Dichlorobenzene-$d_4$.

Tentatively-identified compounds (TICs) are identified only when a good match ( as defined by the qualitative identity criteria of the method) is obtained between the unknown spectra and the library spectra. The TIC is then quantitated using the total ion current and a RF of 1.0, with respect to the closest eluting internal standard free of interferences.

The mass spectrometer will be tuned daily to give an acceptable spectrum for bromofluorobenzene. Relative abundance criteria for bromofluorobenzene are given in SW-846.

System performance will be verified initially and after every 12 hours to ensure a minimum average RF of 0.3 (0.25 for bromoform) for the following system performance check compounds (SPCCs):

- Chloromethane;
- 1,1-Dichloroethane;
- 1,1,2,2-Tetrachloroethane; and
- Chlorobenzene.

A five-point calibration, used for generating RFs, will be performed initially. The relative standard deviation (RSD) must be less than 30% for the five RFs calculated for each of the following calibration check compounds (CCCs):

- 1,1-Dichloroethene;
- Chloroform;
- 1,2-Dichloropropane;
- Toluene;
- Ethylbenzene; and
- Vinyl chloride;

A continuing (every 12 hours) calibration check will be performed, containing four SPCCs and six CCCs as well as the other target analytes of interest. A RF will be calculated for all

analytes and the CCCs and SPCCs will be evaluated for acceptability against the method criteria.

### *5.3.5 Volatile Organics--SW-846 Method 8010/8020*

The system will be calibrated with at least five concentration levels of the entire constituent list. The average RF will be used when the Relative Standard Deviation (RSD) is less than 20%. If the RSD requirement is not met, than quantification will be accomplished by comparison to a curve drawn through the multi-point curve. A second source standard will be used at the mid-point to assure ongoing calibration. The criteria is given in Table 3 of Method 8010/8020. Failure to meet this criteria will result in reexamination of the standards or running a new curve. A check standard will verify the curve every tenth sample. If any compound fails the criteria, it may be reported if not found to be present. If present, the sample must be reanalyzed using a valid curve.

### *5.3.6 Semi-Volatile Organics--SW-846 Method 8270A*

Semi-volatile extracts are analyzed by GC/MS following SW-846 Method 8270A, 3rd edition. All samples are prepared following extraction procedures outlined in SW-846, 3rd edition. Qualitative identification is performed using method criteria for retention time and reference spectra matches of sample and calibration analyte peaks. Quantitation is performed using the internal standard technique and updated RFs every 12 hours that are verified against a five-point initial calibration mean RF, per method criteria. The six internal standards used are:

- 1,4-Dichlorobenzene-$d_4$;
- Naphthalene-$d_8$;
- Acenaphthene-$d_{10}$;
- Phenanthrene-$d_{10}$;
- Chrysene-$d_{12}$; and

- Perylene-$d_{12}$.

The mass spectrometer is tuned every 12 hours to give an acceptable spectrum for decafluorotriphenylphosphine (DFTPP); DFTPP ion abundance criteria are specified in SW-846 Method 8270A.

System performance is verified initially and every 12 hours to ensure a minimum average RF of 0.050 for the following SPCC:

- N-Nitroso-di-n-propylamine;
- Hexachlorocyclopentadiene;
- 2,4-Dichlorophenol; and
- 4-Nitrophenol.

A five-point calibration, used for generating RFs, is performed initially. The variability for specific ion RFs for Method 8270A CCCs must be less than 30 % RSD. The CCCS are:

- Phenol;
- 1,4-Dichlorobenzene;
- 2-Nitrophenol;
- 2,4-Dichlorophenol;
- Hexachlorobutadiene;
- 4-Chloro-3-methylphenol;
- Acenaphthene;
- 2,4,6-Trichlorophenol;
- N-Nitroso-di-n-phenylamine;

- Pentachlorophenol;
- Fluoranthene;
- Di-n-octylphthalate; and
- Benzo(a)pyrene.

A continuous calibration check is performed every 12 hours. This check consists of a single concentration of the CCCs, SPCCs and other compounds of interest from which a RF is calculated. The single-point RF for each CCCs must be within 30% difference of the average five-point RF. The SPCCs must have a minimum response of $\geq$ 0.05; otherwise, a new five-point calibration must be generated.

### *5.3.7 Total Petroleum Hydrocarbons--SW-846 Method 8015 Modified*

*5.3.7.1* ***Semivolatile Analytes, Extraction Method.*** Initial Calibration (IC) is performed by the external standard technique as described in SW-846. Method 8000A, a five-point calibration, is used for generating RFs. The RSD must be less than 20%. IC is required after instrument repair, column change or failure of Initial Calibration Verification (ICV) or Continuing Calibration Verification (CCV). An ICV consisting of a mid-range standard is analyzed after the calibration to verify the calibration. The CCV is analyzed daily before analysis starts and must be within 15% of the average multipoint RF.

*5.3.7.2* ***Volatile Analytes, Purge and Trap Method.*** IC is performed by the external standard technique as described in SW-846. Method 8000A, a five-point calibration, is used for generating RFs. The RSD must be less than 20%. IC is required after instrument repair, column change or failure of ICV or CCV. An ICV consisting of a mid-range standard is analyzed after the calibration to verify the calibration. The CCV is analyzed daily before analysis starts and must be within 15% of the average multipoint RF.

### *5.3.8 Organochlorine Pesticides and PCBs--SW-846 Method 8080*

IC is performed by the external standard technique as described in SW-846. Method 8000A, a five-point calibration, is used for generating RFs. The RSD must be less than 20% in order to use the mean RF for quantitation and presume linearity through the origin, otherwise a calibration curve must be used. IC is required after instrument repair, column change or failure of ICV or CCV. An ICV consisting of a mid-range standard is analyzed after the calibration to verify the calibration. The CCV is analyzed daily before analysis starts and thereafter at a 10% frequency. The CCV must be within 15% of the average multipoint RF or within 15% of the daily initial CCV for ongoing verification.

On a daily basis the dichloro-diphenyl-trichloroethane (DDT) and endrin degradation is checked. If degradation of either DDT and endrin exceeds 20%, corrective action is taken before proceeding with analysis of the CCV.

### *5.3.9 Chlorinated Herbicides by Gas Chromatography--SW-846 Method 8150A*

IC is performed by the external standard technique as described in SW-846. Method 8000A, a five-point calibration with methyl esters of the target analytes, is used for generating RFs. The RSD must be less than 20% in order to use the mean RF for quantitation and presume linearity though the origin, otherwise a calibration curve must be used. IC is required after instrument repair, column change or failure of ICV or CCV. An ICV consisting of a mid-range standard is analyzed after the calibration to verify the calibration. The CCV is analyzed daily before analysis starts and thereafter at a 10% frequency. The CCV must be within 15% of the average multipoint RF or within 15% of the daily initial CCV for ongoing verification.

### *5.3.10 pH--SW-846 Method 9040 for Water Matrix Samples and SW-846 Method 9045A for Solid Matrix Samples*

The SW-846 Methods 9040 and 9045A are followed to electrometrically analyze samples for pH levels. Prior to sample analysis, the pH meter is calibrated with two standard buffer solutions. This calibration is performed daily.

## 5.4 Preventative Maintenance

The primary objective of the preventive maintenance program is to help ensure the timely and effective completion of a measurement effort. A preventive maintenance program is designed to minimize the down-time of crucial sampling and/or analytical equipment because of expected or unexpected component failure. In implementing this program, efforts are focused in three primary areas:

- Establishment of maintenance responsibilities;
- Establishment of maintenance schedules for major and/or critical instrumentation and apparatus; and
- Establishment of an adequate inventory of critical spare parts and equipment.

Each of these efforts are discussed in the following sections.

### *5.4.1 Maintenance Responsibilities*

Equipment and apparatus used in environmental measurement programs fall into two general categories:

- Equipment that is permanently assigned to a specific laboratory (e.g., metals laboratory, GC/MS laboratory, etc.); and
- Equipment that is available for field or laboratory use on an as-needed basis (e.g., field sampling equipment, mobile laboratory, etc.).

Maintenance responsibilities for permanently-assigned equipment are assigned to the respective laboratory managers. The laboratory managers then establish maintenance procedures and schedules for each major equipment item. Specific responsibilities for specific items may be delegated to laboratory personnel, although the laboratory managers retain responsibility for ensuring adherence to prescribed protocol.

Non-assigned equipment includes field pH and conductivity meters, water-level meters, thermometers, real-time monitoring instrumentation, and organic vapor analysis instrumentation. Equipment in this category requires three related maintenance efforts:

- Ensuring that available equipment is functional and ready for use;
- Maintenance during use; and
- Check-out and servicing after use.

### *5.4.2 Maintenance Schedules*

The effectiveness of any maintenance program depends to a large extent on adherence to specific maintenance schedules for each major equipment item. A schedule is established for all routine maintenance activities, which is summarized in Table 5-1. Note that this schedule will be subject to change should conditions warrant. Other maintenance activities may also be identified as requiring attention on an as-needed basis. In addition, field testing equipment (e.g., pH meters) will be inspected prior to use and serviced or replaced as necessary. Manufacturers' recommendations provide the primary basis for the established maintenance schedules, and manufacturers' service personnel provide primary maintenance for many major instruments (e.g, GC/MS instruments, atomic absorption spectrometers, analytical balances, etc.). Maintenance activities are documented in a maintenance log, which indicates the required frequency for each procedure and provides for dated entries.

### *5.4.3 Spare Parts*

Along with a schedule for maintenance activities, an adequate inventory of spare parts required to minimize equipment down time. This inventory should emphasize those parts that:

- Are subject to frequent failure;
- Have limited useful lifetimes; or

- Cannot be obtained promptly should failure occur.

## Table 5-1 Instrument Maintenance Schedule

| Instrument | Maintenance | Frequency |
|---|---|---|
| AA | Tuning/Service Call<br>Clean Fan Filter<br>Replace Lamps<br>Change Tubing<br>Clean Windows<br>Clean of Replace Cones | Quarterly<br>Annually<br>As Needed<br>As Needed<br>As Needed<br>As Needed |
| ICPES | Check Disc Drive<br>Run Diagnostics<br>Clean Torch<br>Clean Nebulizer<br>Clean Fan Filter<br>Replace Pump Oil<br>Replace Tubing | Daily<br>Daily<br>Weekly<br>Weekly<br>Monthly<br>Quarterly<br>As Needed |
| GC/MS | Clean Fan Filter<br>Replace Vacuum Pump Oil<br>Replace Filaments<br>Clean Ion Source<br>Replace Electron Multipliers<br>Replace Septa<br>Replace Column<br>Replace Injector Liners<br>Replace Organic Filters<br>Replace Oxygen Traps | Quarterly<br>Semi-Annually<br>As Needed<br>As Needed<br>As Needed<br>As Needed<br>As Needed<br>As Needed<br>As Needed<br>As Needed |
| GC | Purge traps are baked out<br>Columns are baked out<br>Septa are replace after 30 injections<br>Teflon ferrules are replaced<br>Injector Liners replaced<br>Instrument electronics are visually inspected and cleaned<br>Detectors are cleaned on schedule recommended by the manufacturer | Daily<br>Daily<br>Daily<br>Weekly<br>Weekly<br>Quarterly<br>Quarterly<br>Quarterly |
| GC/PID/ELCD | Clean PID Lamp<br>Replace Lamp<br>Replace Furnace Tube<br>Replace Propanol<br>Replace Resin | As Needed<br>As Needed<br>As Needed<br>As Needed<br>As Needed |
| Balances | Service | Annually |

## Table 5-1 Instrument Maintenance Schedule (Continued)

| Instrument | Maintenance | Frequency |
|---|---|---|
| OVA/FID | Recharge or Replace Battery<br>Monitor Fuel and/or Combustion Air Supply Gauges<br>Perform Routine Maintenance as Described in the Manual<br>Check for Leaks | As Needed<br>Hourly<br>As Needed<br>Daily |
| PID | Recharge or Replace Battery<br>Replace or Clean Lamps<br>Clean or Replace Filter<br>Check for Leaks | As Needed<br>As Needed<br>As Needed<br>Daily |
| pH Meter | Check Fuse and Sensor<br>Clean Motor<br>Rinse Probe | Weekly<br>As Needed<br>After Each Measurement |
| Conductivity Meter | Clean Meter<br>Recharge or Replace Battery | As Needed<br>As Needed |
| Water Level Meter | Clean Meter<br>Wipe Probe Dry and Place Into Probe Holder<br>Recharge or Replace Battery | As Needed<br>After Each Measurement<br>As Needed |
| Thermometer | Clean<br>Replace | As Needed<br>If broken or mercury separates |

Notes:

AA = Atomic Absorption
ICPES = Inductively Coupled Plasma Emission Spectroscopy
GFAA = Graphite Furnace Atomic Absorption
GC/MS = Gas Chromatography/Mass Spectrometry
GC/PID/ELCD = Gas Chromatography/Photoionization Detector/Electron Conductivity Detector
PID = Photoionization Detector
OVA/FID = Organic Vapor Analyzer/Flameionization Detector

The supervising field task managers and the respective laboratory managers will be responsible for maintaining an adequate inventory of necessary spare parts. Field task leaders will have names and phone numbers of vendor contacts to ensure that replacement parts or instrumentation can be received within 24 hours of instrument failure.

## 5.5 Internal Quality Control

Internal QC procedures to be used for laboratory testing and analysis are presented in Table A-3. Tables A-4, A-5, and A-6 present detailed listings of tolerance limits for QCCs, matrix spike analyses, and surrogate spike recoveries, respectively. Preparation and analysis of QC samples will be performed according to the descriptions presented in this section.

Most analytical methods to be used in this project require the measurement system to initially satisfy specific criteria for calibration linearity, reference material recovery, and freedom from contamination. Control samples are analyzed at a 10% frequency to monitor any changes in the quality of data being produced. These results indicate which corrective actions are necessary to correct an out-of-control conditions. An out-of-control condition is defined as:

- Detection of any compounds of interest in a method blank at concentrations equal to or greater than the RL (or required detection limit);
- Failure to meet the acceptance criteria for recovery of any compound of interest in a QC sample; or
- Exceeding the acceptance criteria for matrix spike recovery and subsequent failure to meet the acceptance criteria for a QC check sample for the same parameter(s). Any parameter that fails the matrix spike test but passes the QC check sample test will be flagged as suspect for the parameter due to matrix effects.

When an out-of-control situation is detected, efforts will be undertaken to determine the case. Corrective actions for routine QC checks are outlined in Table A-3. Procedures related to corrective actions are described below.

During the course of this project, it will be the responsibility of the laboratory staff, project manager, task leaders, and other project team members to see that all measurement procedures are followed as specified and that measurements data meet the prescribed acceptance criteria. In the event a problem arises, it is imperative that prompt action be taken to correct the problem(s). Laboratory analysts and/or supervisors will initiate corrective

action in the event of QC results that exceed acceptance criteria specified in Table A-3. Corrective action may also be initiated upon identification of some other problems or potential problems. Corrective action may also be initiated by the laboratory quality officer if QC data problems or other anomalies are noted during data review. Within 24 hours of the identification of a QC problem that will compromise data quality, the USACE project manager or chemist will be verbally notified.

For this project, the following corrective actions will be implemented when surrogate spike compounds are recovered outside the acceptability limits:

- Check to be sure there are no errors in calculations, surrogate solutions, and internal standards;
- Check instrument performance;
- Recalculate the data and/or reanalyze the extract if any of the above checks reveal a problem;
- Analyze an extracted LCS;
- If the LCS compounds are recovered within criteria, flag data as matrix effect; and
- If the LCS compounds are recovered outside criteria, re-extract and reanalyze the sample.

The analysis with the fewest control problems will be reported. A brief description of the other analyses and the corrective action taken will be included in the laboratory report. These corrective actions are summarized in Table A-3.

### *5.5.1 Method Blank*

A method blank is an aliquot of reagent water or clean solid matrix, taken through the analytical process as though it were an actual sample. The purpose of a method blank analysis

is to monitor and control laboratory sources of contamination. At a minimum, one laboratory method blank will be analyzed daily for volatile organics and each preparatory batch will have a method blank analyzed for semivolatile organics.

### *5.5.2 Matrix Spike*

A MS for metals and inorganic analyses is an aliquot of a field sample spiked with known concentrations of reference materials and taken through the entire preparation and analytical measurement procedures. A MS for organic analyses is an extra field sample spiked with known concentrations of reference materials and taken through the entire preparation and analytical measurement procedures. The MS allows the laboratory to assess the efficiency of extraction/digestion, accuracy of the analysis, and possible matrix effects. MS analyses will be performed on a 5% frequency for each batch as required by SW-846. Note: The soil sampling for chemical analyses and groundwater sampling for chemical analyses SOPs (SOP A-6 and A-9, respectively) provided in the FSP (Volume I) contain tables that stipulate sufficient sample volumes to accommodate the laboratory conducting the MS tests.

If method accuracy or precision, as demonstrated with matrix spikes or real samples or laboratory duplicates, fall outside the acceptability limits a quality control sample will be analyzed immediately. If the analytical system is shown to be in control with acceptable QC sample results, then an investigation is initiated and the sample in question will be re-analyzed at no cost to the customer if required to verify that the problem is reproducible and hence related to the sample. If the analytical system is found to be at fault, then the problem will be corrected and all samples affected will be re-analyzed at no cost to the customer, including those prior to the sample in question, all of the way back to the previous in-control QC sample.

### *5.5.3 Matrix Spike Duplicate*

A MSD is a second aliquot of the matrix spike sample that is also spiked. Method precision for the matrix can be estimated by calculating the relative percent differences between the recoveries of the spiking compounds. MSD analyses will be performed on a 5% frequency for each batch. Note: As with the MS analyses, the soil and groundwater sampling SOPs (SOP A-

6 and A-9, respectively) in the FSP (Volume I) contain tables that stipulate sufficient sample volumes to accomodate the laboratory conducting of the MSD tests.

### *5.5.4 Duplicate Sample*

Duplicate solid samples will be collected by splitting a single sample into two equal parts for the purpose of analysis. Duplicate water samples will be included in the project by collecting two samples from the same location at the same time. Unique sample numbers will be assigned to field duplicates so that they will be indistinguishable from other analytical samples. The purpose of collecting and analyzing duplicate samples is to provide a measure of method variability (i.e., total variability from imprecision in both sampling and analytical procedures). Duplicate samples will be collected at a frequency of 10% (1 per 10 or fewer samples) and analyzed for all matrices and parameters. Both QA duplicates (analyzed by the USACE MRD laboratory) and QC duplicates (analyzed by the contractor laboratory) will be included.

### *5.5.5 Laboratory Control Sample*

A LCS is a sample having known concentrations of reference materials spiked into an aliquot of deionized water. It is taken through the sample preparation process as well as the analytical measurement process. The purpose of a LCS analysis is to determine whether failure to meet QC acceptance criteria is due to matrix interference in the sample or to out-of-control conditions associated with the analytical system.

### *5.5.6 Surrogate Compound*

Surrogates are organic compounds that are similar to analytes of interest in chemical composition, extraction, and chromatography, but which are not normally found in environmental samples. These compounds are spiked into all blanks, standards, samples, and spiked samples prior to extraction and analysis by Methods 8240A, 8015, 8010/8020, 8080, 8150A, and 8270A Modified. Percent recoveries are calculated and reported for each surrogate. Surrogate spike recoveries can be used to assess method accuracy of individual samples.

### *5.5.7 Internal Standard*

Internal standards are similar in analytical behavior to the compounds of interest and compensate to some extent for changes in instrument performance or matrix effects. Internal standard calibration procedures are followed for volatile GC/MS analyses. One or more internal standard is added to all samples analyzed including calibration standards.

## 5.6 Corrective Action

During the course of the field investigation, it will be the contractor project manager's responsibility to notify the USACE project manager of any situation prompting significant changes that may affect data quality or any nonconforming items or activities which would initiate the corrective action process. Any work or materials not conforming to the specifications or contract requirements will be identified and documented on a Nonconformance Report (NCR), as indicated in Appendix B. At a minimum, the NCR will detail the nonconforming condition, recommendedcorrective action(s) and disposition of the corrective action(s). The NCR will remain open until the nonconformaing condition has been satisfactorily resolved and verified by QC.

The disposition of the NCRs will include the necessary actions required to bring the nonconforming condition to an acceptable condition and may include reworking, replacing, retesting, or reinspecting. Implementation of the disposition may be done in accordance with the original procedural requirements, a specific procedure or instruction, or a Procedure Change Request Form (PCRF). Appropriate corrective actions to take will be determined by USACE. Monthly reports will include nonconfirmation notices of all circumstances associated with corrective actions taken.

The laboratory supervisor will be responsible to ensure that all measurement procedures are followed as specified and that measurement data meet the prescribed acceptance criteria. In the event a problem arises, it is imperative that prompt action be taken to correct the problem. Problems requiring major corrective action will be documented by the use of the "Malfunction Report" form. An example of such a form is presented in Appendix B. The project QAC will

be included in the distribution for each malfunction report issued for this program to ensure prompt notification of the USACE project manager or chemist. The laboratory supervisor will initiate corrective action in the event that QC results that exceed acceptability limits or if some other problem or potential problem is identified.

Potential problems identified by the QAC on the basis of QC data or audit results will be documented by use of the "Information Request" form. An example of such a form is presented in Appendix B. Corrective action may also be initiated by the QAC on the basis of QC data, audit results, or responses to information requests. The USACE project manager or chemist will be notified of significant problems for concurrence with implementation of corrective actions.

## 5.7 Quality Assurance Report

Effective management of a field sampling and analytical effort requires timely assessment and review of field activities. This will require effective interaction and feedback between the project manager, QAC, field team members, and USACE.

The project manager and appropriate project team members will be responsible for keeping the QAC up to date regarding the status of their respective tasks so that quick and effective solutions can be implemented should any data quality problems arise. The use of DQCRs also provides an effective mechanism for ensuring ongoing evaluation of measurement efforts. The DQCRs are submitted to the USACE project manager weekly. A DQCR is presented in Appendix B. These DQCRs address some or all of the following as appropriate:

- Weather conditions;
- Summary of activities and work performed;
- Summary of calibration data an QC data;
- Summary of unscheduled maintenance activities;

- Summary of problems and corrective actions taken;
- Health and safety levels and actions; and
- Work scheduled for the next day.

### *5.7.1 Quality Assurance Reporting*

Major project reports will include a Site Quality Control Summary Report (SQCSR) section that will summarize QC data collected during the program, as well as any major QA problems and resolutions. The QA/QC section in the final report will include an assessment of measurement accuracy, precision, and completeness as described in Sections 4 and 5 of this QAPP. It will also summarize any QC problems and resolutions that occurred during sample collection and any analytical anomalies experienced.

Problems requiring swift resolution will be brought to the immediate attention of the USACE project manager via the malfunction reporting/corrective action scheme discussed in Section 5.5.

### *5.7.2 CDAP/QAPP Revisions*

In the event that changes to the CDAP/QAPP are needed, the following steps will be taken:

- Identify and discuss the problems or deficiencies in the CDAP with the contractor's project manager;
- The project team determines changes to be made;
- Potential changes will be submitted to USACE project manager for approval; and
- When approved by the USACE project manager, the revisions will be implemented by the project team.

## 5.8 Data Reduction, Validation and Documentation

All analytical data generated will be extensively checked for accuracy and completeness. The data validation process consists of data generation, reduction, review, and reporting by the analytical laboratory. Data will be reviewed by the contractor QAC. Laboratory data reports will be submitted to USACE for QA review by USACE personnel.

### *5.8.1 Data Reduction, Validation, and Reporting by the Laboratory*

The data analysis required to calculate sample concentrations will proceed according to procedures outlined in the analytical methods identified in Table A-1. Data reduction involves taking instrument responses or other raw data and calculating concentrations for each target analyte. Data validation involves examining the systems producing the data to be sure they are operating properly and to be sure quality objectives have been met. Data will be reviewed and validated by the analyst and/or laboratory manager. Data will be validated for conformance with method specifications including:

- Calibration;
- Duplicate analysis;
- Blank analysis;
- Spike analysis;
- Sample data calculations; and
- Quality control sample frequency.

The QC activities implemented in this project will provide a basis for assessing the accuracy and precision of all data. Frequencies and acceptance criteria for these tests are presented in Table A-3. Calculations are presented in Section 3 of this QAPP.

# 6.0 QUALITY ASSURANCE AUDITS

The purpose of a QA audit is to provide an objective, independent assessment of a measurement effort. QA auditing ensures that sample collection, data generating, data gathering, and measurement activities produce reliable and useful results. Cases can occur in which inadequacies are identified in the measurement system. In such cases, audits provide the mechanism for beginning the process of corrective action implementation. With the exception of USACE MRD laboratory audits, no QA audits are scheduled for this project. However, at the discretion of the Base or USACE, QA audits may be implemented. QA audits play an important role in an overall QA/QC program. This section provides guidance descriptions of the role of the QA auditor and the nature of QA audits.

A QA auditor is the person who designs and/or performs QA performance and system audits. Since QA audits represent, by definition, independent assessments of a measurement system and associated data quality, the auditor must be functionally independent of the measurement effort to ensure objectivity. However, the auditor must be familiar enough with the objectives, principles, and procedures of the measurement efforts to be able to perform a thorough and effective evaluation of the measurement system. Especially important is the ability to identify components of the system that are critical to overall data quality. For this reason, the audit focuses heavily on those elements. The auditor's technical background and experience should also provide a basis for appropriate audit standard selection, audit design, and data interpretation.

QA audits may include both internal and external audits of field and laboratory activities. External audits are those conducted by an independent organization or technical support group and may include participation in inter-laboratory comparison studies and certification testing. Internal laboratory audits are conducted by the laboratory's QAC. External laboratory and field audits may be conducted by the contractor QAC if indicated during the program.

The following paragraphs describe the purpose of several types of audits and identify the questions that are and are not addressed by each type of audit.

## 6.1 Technical Systems Audits

A technical systems' audit is an on-site qualitative review of the various aspects of a total sampling and/or analytical system. It is an assessment of overall effectiveness. It represents an objective and insightful evaluation of a set of interactive systems with respect to strengths, deficiencies, and potential areas of concern. Typically, the audit consists of observations and documentation of all aspects of the measurement effort.

Technical system audits should be based on the approved CDAP. These audits review questions regarding:

- Calibration procedures and documentation;
- Completeness of data forms, notebooks, and other reporting requirements;
- Data review and validation procedures;
- Data storage, filing, and record-keeping procedures;
- Sample custody procedures;
- Quality control procedures and documentation;
- Operating conditions of facilities and equipment;
- Documentation of maintenance activities; and
- Systems and operations overview.

Detailed system audit checklists may be prepared prior to each audit. The checklists delineate the critical aspects of each methodology and measurement system, and are used by auditors to document all observations. The checklists are based on audit criteria specified by the QAC and the approved CDAP.

Technical systems audits do not answer quantitative questions about the measurement system. The organization's policies regarding the role of QA are not answered. Concerns involving assessments of the data quality indicators are also not addressed.

## 6.2 Performance Evaluation Audits

The purpose of performance evaluation audits is to quantitatively assess the measurement data quality. These audits provide a direct evaluation of the various measurement systems' capabilities to generate quality data. This is accomplished by challenging the measurement system with accepted reference standards. These reference standards may be submitted to the laboratory as if they were additional field samples, thereby providing a blind evaluation.

Performance evaluation audits answer questions regarding the following:

- Accuracy and precision of the measurement system;
- The quality control data as compared with the actual data collected;
- The measurement system as a function of established control limits; and
- Significant deviations of the quality over time.

Although the answers to these questions will help determine when a system is out of control, questions as to the appropriate corrective action may not always be evident. Questions regarding qualitative issues, such as management policies, sample custody procedures, record keeping, and data handling systems are not addressed in a performance evaluation audit.

## 6.3 Audits of Data Quality

The purpose of data quality audits is to assess data quality indicators. Audits for data quality provide information required to characterize data quality by answering questions regarding:

- Adequacy of data recording and transfer;
- Precision and bias of resultant data;
- Adequacy of data calculation, generation, and processing;
- Documentation of procedures; and
- Identification of data quality indicators to inform users of limitations and applicability.

Audits of data quality answer questions of whether the data collection efforts need modifications, and whether the use and documentation of QC procedures are adequate. Audits of data quality do not, however, answer technical questions such as those concerning the operating condition of facilities and equipment.

## 6.4 Post-audit Debriefing

Following each audit, a post-audit debriefing session is conducted. The purpose of this session is to discuss preliminary audit results with the audit participants. If the audit reveals a critical deficiency, recommendations for corrective action will be presented. The debriefing session is followed by a detailed audit report that identifies areas of concern and recommendations for corrective actions.

# APPENDIX A -- TABLES

A-1 Analytical Methods

A-2 Summary of Calibration Procedures

A-3 Summary of Internal Quality Control Procedures

A-4 Summary of Tolerance Limits for Quality Control Check Samples

A-5 Summary of Tolerance Limits for Matrix Spike Analyses

A-6 Summary of Surrogate Spike Tolerance Limits

A-7 Laboratory Sample Container and Preservation Requirements

**Table A-1. Analytical Methods**

| Parameter | Preparation | | | Analysis | | Reporting Limit | |
|---|---|---|---|---|---|---|---|
| | Technique | Method Water | Method Soil | Technique | Method (Water/ Soil) | Water | Soil |
| **METALS (ug/l or mg/kg)** | | | | | | | |
| Aluminum | Acid Digestion | 3010A | 3050A | ICPES | 6010A | 200 | 20 |
| Antimony | Acid Digestion | 3005A | 3050A | ICPES | 6010A | 200 | 20 |
| Arsenic | Acid Digestion | 3010A | 3050A | ICPES | 6010A | 400 | 40 |
| Barium | Acid Digestion | 3010A | 3050A | ICPES | 6010A | 200 | 20 |
| Beryllium | Acid Digestion | 3010A | 3050A | ICPES | 6010A | 5 | 0.5 |
| Cadmium | Acid Digestion | 3010A | 3050A | ICPES | 6010A | 20 | 2.0 |
| Calcium | Acid Digestion | 3010A | 3050A | ICPES | 6010A | 5000 | 500 |
| Chromium (total) | Acid Digestion | 3010A | 3050A | ICPES | 6010A | 30 | 3.0 |
| Cobalt | Acid Digestion | 3010A | 3050A | ICPES | 6010A | 50 | 5.0 |
| Copper | Acid Digestion | 3010A | 3050A | ICPES | 6010A | 25 | 2.5 |
| Iron | Acid Digestion | 3010A | 3050A | ICPES | 6010A | 100 | 10 |
| Lead | Acid Digestion | 3010A | 3050A | ICPES | 6010A | 70 | 7 |
| Magnesium | Acid Digestion | 3010A | 3050A | ICPES | 6010A | 5000 | 500 |
| Manganese | Acid Digestion | 3010A | 3050A | ICPES | 6010A | 15 | 1.5 |
| Nickel | Acid Digestion | 3010A | 3050A | ICPES | 6010A | 40 | 4.0 |
| Selenium | Acid Digestion | 3010A | 3050A | ICPES | 6010A | 200 | 20 |
| Silver | Acid Digestion | 3010A | 3050A | ICPES | 6010A | 20 | 2.0 |
| Sodium | Acid Digestion | 3010A | 3050A | ICPES | 6010A | 5000 | 500 |
| Potassium | Acid Digestion | 3010A | 3050A | ICPES | 6010A | 5000 | 500 |

**Table A-1. Analytical Methods (Continued)**

| Parameter | Preparation | | | Analysis | | Reporting Limit | |
|---|---|---|---|---|---|---|---|
| | Technique | Method Water | Method Soil | Technique | Method (Water/ Soil) | Water | Soil |
| Thallium | Acid Digestion | 3010A | 3050A | ICPES | 6010A | 200 | 20 |
| Vanadium | Acid Digestion | 3010A | 3050A | ICPES | 6010A | 50 | 5.0 |
| Zinc | Acid Digestion | 3010A | 3050A | ICPES | 6010A | 20 | 2.0 |
| Arsenic | Acid Digestion | 3020A | 3050A | GFAA | 7060 | 10 | 1.0 |
| Lead | Acid Digestion | 3020A | 3050A | GFAA | 7421 | 4 | 0.4 |
| Mercury | Acid Digestion | 7470 | 7471A | CVAA | 7470/7471 | 0.5 | 0.25 |
| Selenium | Acid Digestion | 3020A | 3050A | GFAA | 7740 | 10 | 1.0 |
| Thallium | Acid Digestion | 3020A | 3050 | GFAA | 7841 | 5 | 0.5 |
| **VOLATILE ORGANICS (Fixed Laboratory) (ug/l or ug/kg)** | | | | | | | |
| Acetone | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 20 | 20 |
| Benzene | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 5.0 | 5.0 |
| Bromodichloromethane | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 5.0 | 5.0 |
| Bromomethane | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 10 | 10 |
| Carbon disulfide | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 5.0 | 5.0 |
| Carbon tetrachloride | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 5.0 | 5.0 |
| Chloroethane | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 10 | 10 |
| 2-Chloroethyl vinyl ether | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 10 | 10 |
| Chlorobenzene | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 5.0 | 5.0 |
| Chloroform | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 5.0 | 5.0 |
| Chloromethane | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 10 | 10 |

**Table A-1. Analytical Methods (Continued)**

| Parameter | Preparation | | | Analysis | | Reporting Limit | |
|---|---|---|---|---|---|---|---|
| | Technique | Method Water | Method Soil | Technique | Method (Water/ Soil) | Water | Soil |
| Dibromochloromethane | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 5.0 | 5.0 |
| 1,2 Dichlorobenzene | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 10 | 10 |
| 1,3 Dichlorobenzene | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 10 | 10 |
| 1,4 Dichlorobenzene | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 10 | 10 |
| 1,2 Dichloroethane | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 5.0 | 5.0 |
| cis-1,2-Dichloroethene | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 5.0 | 5.0 |
| trans-1,2-Dichloroethene | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 5.0 | 5.0 |
| 1,1 Dichloroethane | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 5.0 | 5.0 |
| 1,1 Dichloroethene | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 5.0 | 5.0 |
| 1,2 Dichloropropane | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 5.0 | 5.0 |
| cis-1,3 Dichloropropene | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 5.0 | 5.0 |
| trans-1,3 Dichloropropene | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 5.0 | 5.0 |
| Ethylbenzene | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 5.0 | 5.0 |
| 2 - Hexanone | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 20 | 20 |
| Methylene chloride | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 10 | 10 |
| 2 Butanone (MEK) | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 20 | 20 |
| 4-Methyl-2-pentanone (MIBK) | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 20 | 20 |
| Styrene | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 5.0 | 5.0 |
| 1,1,2,2-Tetrachloroethane | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 5.0 | 5.0 |
| Tetrachloroethene | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 5.0 | 5.0 |

**Table A-1. Analytical Methods (Continued)**

| Parameter | Preparation | | | Analysis | | Reporting Limit | |
|---|---|---|---|---|---|---|---|
| | Technique | Method Water | Method Soil | Technique | Method (Water/ Soil) | Water | Soil |
| Toluene | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 5.0 | 5.0 |
| Tribromomethane (Bromoform) | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 5.0 | 5.0 |
| Trichloroethene | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 5.0 | 5.0 |
| 1,1,1-Trichloroethane | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 5.0 | 5.0 |
| 1,1,2-Trichloroethane | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 5.0 | 5.0 |
| Vinyl acetate | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 20 | 20 |
| Vinyl chloride | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 10 | 10 |
| Xylenes (total) | Purge and Trap | 5030A | 5030A | GC/MS | 8240A | 5.0 | 5.0 |
| **BTEX, VOLATILE ORGANIC (MOBILE LABORATORY) (ug/l or ug/kg)** | | | | | | | |
| Benzene | Purge and Trap | 5030A | 5030A | GC/PID | 8020 | 0.5 | 0.05 |
| Toluene | Purge and Trap | 5030A | 5030A | GC/PID | 8020 | 1 | 0.1 |
| Ethylbenzene | Purge and Trap | 5030A | 5030A | GC/PID | 8020 | 1 | 0.1 |
| Xylenes (total) | Purge and Trap | 5030A | 5030A | GC/PID | 8200 | 2 | 0.2 |
| **TOTAL VOLATILE ORGANICS (MOBILE LABORATORY) (ug/l or mg/kg)** | | | | | | | |
| Benzene | Purge and Trap | 5030 Low | 5030 Med | PID | 8020 | 0.5 | 0.025 |
| Bromodichloromethane | Purge and Trap | 5030 Low | 5030 Med | ELCD | 8010 | 0.2 | 0.010 |
| Bromomethane | Purge and Trap | 5030 Low | 5030 Med | ELCD | 8010 | 1.0 | 0.030 |
| Bromoform | Purge and Trap | 5030 Low | 5030 Med | ELCD | 8010 | 0.5 | 0.010 |
| Carbon tetrachloride | Purge and Trap | 5030 Low | 5030 Med | ELCD | 8010 | 0.2 | 0.010 |
| Chlorobenzene | Purge and Trap | 5030 Low | 5030 Med | ELCD/PID | 8010/8020 | 0.5 | 0.025 |

**Table A-1. Analytical Methods (Continued)**

| Parameter | Preparation | | | Analysis | | Reporting Limit | |
|---|---|---|---|---|---|---|---|
| | Technique | Method Water | Method Soil | Technique | Method (Water/ Soil) | Water | Soil |
| Chloroethane | Purge and Trap | 5030 Low | 5030 Med | ELCD | 8010 | 0.5 | 0.025 |
| Chloroform | Purge and Trap | 5030 Low | 5030 Med | ELCD | 8010 | 0.5 | 0.060 |
| Chloromethane | Purge and Trap | 5030 Low | 5030 Med | ELCD | 8010 | 1.0 | 0.025 |
| Dibromochloromethane | Purge and Trap | 5030 Low | 5030 Med | ELCD | 8010 | 0.2 | 0.010 |
| 1,2-dibromoethane (EDB) | Purge and Trap | 5030 Low | 5030 Med | ELCD | 8010 | 0.2 | 0.010 |
| 1,2-dichlorobenzene | Purge and Trap | 5030 Low | 5030 Med | ELCD/PID | 8010/8020 | 0.5 | 0.025 |
| 1,3-dichlorobenzene | Purge and Trap | 5030 Low | 5030 Med | ELCD/PID | 8010/8020 | 0.5 | 0.025 |
| 1,4-dichlorobenzene | Purge and Trap | 5030 Low | 5030 Med | ELCD/PID | 8010/8020 | 0.5 | 0.025 |
| 1,1-dichloroethane | Purge and Trap | 5030 Low | 5030 Med | ELCD | 8010 | 0.2 | 0.010 |
| 1,2-dichloroethane (EDC) | Purge and Trap | 5030 Low | 5030 Med | ELCD | 8010 | 0.5 | 0.010 |
| 1,1-dichloroethene | Purge and Trap | 5030 Low | 5030 Med | ELCD | 8010 | 0.2 | 0.010 |
| cis-1,2-dichloromethene | Purge and Trap | 5030 Low | 5030 Med | ELCD | 8010 | 0.2 | 0.010 |
| trans-1,2-dichloromethene | Purge and Trap | 5030 Low | 5030 Med | ELCD | 8010 | 1.0 | 0.010 |
| 1,2-dichloropropene | Purge and Trap | 5030 Low | 5030 Med | ELCD | 8010 | 0.2 | 0.010 |
| cis-1,3-dichloropropene | Purge and Trap | 5030 Low | 5030 Med | ELCD | 8010 | 0.2 | 0.010 |
| trans-1,3-dichloropropene | Purge and Trap | 5030 Low | 5030 Med | ELCD | 8010 | 0.2 | 0.010 |
| ethyl benzene | Purge and Trap | 5030 Low | 5030 Med | PID | 8020 | 0.5 | 0.025 |
| methylene chloride | Purge and Trap | 5030 Low | 5030 Med | ELCD | 8010 | 2.0 | 0.50 |
| 1,1,2,2-tetrachloroethane | Purge and Trap | 5030 Low | 5030 Med | ELCD | 8010 | 0.2 | 0.010 |
| tetrachloroethylene | Purge and Trap | 5030 Low | 5030 Med | ELCD | 8010 | 0.5 | 0.025 |

**Table A-1. Analytical Methods (Continued)**

| Parameter | Preparation | | | Analysis | | Reporting Limit | |
|---|---|---|---|---|---|---|---|
| | Technique | Method Water | Method Soil | Technique | Method (Water/ Soil) | Water | Soil |
| Toluene | Purge and Trap | 5030 Low | 5030 Med | PID | 8020 | 0.5 | 0.025 |
| 1,1,1-trichloroethane | Purge and Trap | 5030 Low | 5030 Med | ELCD | 8010 | 1.0 | 0.050 |
| 1,1,2-trichloroethane | Purge and Trap | 5030 Low | 5030 Med | ELCD | 8010 | 0.2 | 0.010 |
| trichloroethene | Purge and Trap | 5030 Low | 5030 Med | ELCD | 8010 | 0.2 | 0.010 |
| trichlorofluoromethane | Purge and Trap | 5030 Low | 5030 Med | ELCD | 8010 | 0.2 | 0.010 |
| vinyl chloride | Purge and Trap | 5030 Low | 5030 Med | ELCD | 8010 | 0.5 | 0.025 |
| total xylenes | Purge and Trap | 5030 Low | 5030 Med | PID | 8020 | 0.5 | 0.025 |
| 2-chloroethylvinyl ether | Purge and Trap | 5030 Low | 5030 Med | ELCD | 8010 | 1.0 | 0.050 |
| **SEMI-VOLATILE ORGANIC (ug/l or ug/kg)** | | | | | | | |
| Acenaphthene | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| Acenaphthylene | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| Anthracene | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| Benzo(a)antracene | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| Benzo(a)pyrene | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| Benzo(b)fluorathene | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| Benzo(g,h,i)perylene | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| Benzo(k)fluoranthene | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| Benzoic acid | Extraction | 3510A | 3550 | GC/MS | 8270A | 50 | 1700 |
| Benzyl alcohol | Extraction | 3510A | 3550 | GC/MS | 8270A | 20 | 670 |
| 4-Bromophenyl phenyl ether | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |

**Table A-1. Analytical Methods (Continued)**

| Parameter | Preparation | | | Analysis | | Reporting Limit | |
|---|---|---|---|---|---|---|---|
| | Technique | Method Water | Method Soil | Technique | Method (Water/ Soil) | Water | Soil |
| Butylbenzylphthalate | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| 4-Chloro-3-methylphenol | Extraction | 3510A | 3550 | GC/MS | 8270A | 20 | 670 |
| 4-Chloroaniline | Extraction | 3510A | 3550 | GC/MS | 8270A | 50 | 1700 |
| bis(2-Chloroethoxy)methane | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| bis(2-Chloroethyl)ether | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| bis(2-Chloroisoprophyl)ether | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| 2-Chloronaphthalene | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| 2-Chlorophenol | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| 4-Chlorophenyl phenyl ether | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| Chrysene | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| Dibenz(a,h)anthracene | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| Dibenzofuran | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| 1,2-Dichlorobenzene | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| 1,3-Dichlorobenzene | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| 1,4-Dichlorobenzene | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| 3,3-Dichlorobenzidine | Extraction | 3510A | 3550 | GC/MS | 8270A | 20 | 670 |
| 2,4-Dichlorophenol | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| Diethylphthalate | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| 2,4-Dimethylphenol | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| 4,6-Dinitro-2-methylphenol | Extraction | 3510A | 3550 | GC/MS | 8270A | 50 | 1700 |

**Table A-1. Analytical Methods (Continued)**

| Parameter | Preparation | | | Analysis | | Reporting Limit | |
|---|---|---|---|---|---|---|---|
| | Technique | Method Water | Method Soil | Technique | Method (Water/ Soil) | Water | Soil |
| Di-n-butylphthalate | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| Di-n-octylphthalate | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| 1,3-Dinitrobenzene | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| 2,4-Dinitrophenol | Extraction | 3510A | 3550 | GC/MS | 8270A | 50 | 1700 |
| 2,4-Dinitrotoluene | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| 2,6-Dinitrotoluene | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| bis(2-Ethylhexyl)phthalate | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| Fluorene | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| Hexachlorobenzene | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| Hexachlorobutadiene | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| Hexachlorocyclpentadiene | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| Hexachloroethane | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| Indeno(1,2,3-c,d)pyrene | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| Isophorone | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| 2-Methyl naphthalene | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| 2-Methylphenol | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| 4-Methylphenol | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| Naphthalene | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| 2-Nitroaniline | Extraction | 3510A | 3550 | GC/MS | 8270A | 50 | 1700 |
| 3-Nitroaniline | Extraction | 3510A | 3550 | GC/MS | 8270A | 50 | 1700 |

**Table A-1. Analytical Methods (Continued)**

| Parameter | Preparation | | | Analysis | | Reporting Limit | |
|---|---|---|---|---|---|---|---|
| | Technique | Method Water | Method Soil | Technique | Method (Water/ Soil) | Water | Soil |
| 4-Nitroaniline | Extraction | 3510A | 3550 | GC/MS | 8270 | 50 | 1700 |
| Nitrobenzene | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| 2-Nitrophenol | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| 4-Nitrophenol | Extraction | 3510A | 3550 | GC/MS | 8270A | 50 | 1700 |
| N-Nitrosodiphenylamine | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| N-Nitroso-di-n-propylamine | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| Pentachlorophenol | Extraction | 3510A | 3550 | GC/MS | 8270A | 50 | 1700 |
| Phenanthrene | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| Phenol | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| Pyrene | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| 1,2,4-Trichlorobenzene | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| 2,4,5-Trichlorophenol | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| 2,4,6-Trichorophenol | Extraction | 3510A | 3550 | GC/MS | 8270A | 10 | 330 |
| **ORGANOCHLORINE PESTICIDES and PCBs (ug/l or ug/kg)** | | | | | | | |
| Aldrin | Extraction | 3510A | 3550 | GC/EDC | 8080 | 0.02 | 1 |
| α-BHC | Extraction | 3510A | 3550 | GC/EDC | 8080 | 0.02 | 1 |
| β-BHC | Extraction | 3510A | 3550 | GC/EDC | 8080 | 0.02 | 1 |
| δ-BHC | Extraction | 3510A | 3550 | GC/EDC | 8080 | 0.02 | 1 |
| γ-BHC | Extraction | 3510A | 3550 | GC/EDC | 8080 | 0.02 | 1 |

**Table A-1. Analytical Methods (Continued)**

| Parameter | Preparation | | | Analysis | | Reporting Limit | |
|---|---|---|---|---|---|---|---|
| | Technique | Method Water | Method Soil | Technique | Method (Water/ Soil) | Water | Soil |
| Chlordane | Extraction | 3510A | 3550 | GC/EDC | 8080 | 0.2 | 10 |
| 4,4'-DDD | Extraction | 3510A | 3550 | GC/EDC | 8080 | 0.02 | 1 |
| 4,4'-DDE | Extraction | 3510A | 3550 | GC/EDC | 8080 | 0.02 | 1 |
| 4,4'-DDT | Extraction | 3510A | 3550 | GC/EDC | 8080 | 0.02 | 1 |
| Dieldrin | Extraction | 3510A | 3550 | GC/EDC | 8080 | 0.02 | 1 |
| Endosulfan I | Extraction | 3510A | 3550 | GC/EDC | 8080 | 0.02 | 1 |
| Endosulfan II | Extraction | 3510A | 3550 | GC/EDC | 8080 | 0.02 | 1 |
| Endosulfan Sulfate | Extraction | 3510A | 3550 | GC/EDC | 8080 | 0.02 | 1 |
| Endrin | Extraction | 3510A | 3550 | GC/EDC | 8080 | 0.02 | 1 |
| Endrin Aldehyde | Extraction | 3510A | 3550 | GC/EDC | 8080 | 0.02 | 1 |
| Heptachlor | Extraction | 3510A | 3550 | GC/EDC | 8080 | 0.02 | 1 |
| Heptachlor Epoxide | Extraction | 3510A | 3550 | GC/EDC | 8080 | 0.02 | 1 |
| Toxaphene | Extraction | 3510A | 3550 | GC/EDC | 8080 | 0.4 | 20 |
| PCB 1016 | Extraction | 3510A | 3550 | GC/EDC | 8080 | 0.2 | 10 |
| PCB 1221 | Extraction | 3510A | 3550 | GC/EDC | 8080 | 0.2 | 10 |
| PCB 1232 | Extraction | 3510A | 3550 | GC/EDC | 8080 | 0.2 | 10 |
| PCB 1242 | Extraction | 3510A | 3550 | GC/EDC | 8080 | 0.2 | 10 |
| PCB 1248 | Extraction | 3510A | 3550 | GC/EDC | 8080 | 0.2 | 10 |
| PCB 1254 | Extraction | 3510A | 3550 | GC/EDC | 8080 | 0.2 | 10 |

**Table A-1. Analytical Methods (Continued)**

| Parameter | Preparation | | | Analysis | | Reporting Limit | |
|---|---|---|---|---|---|---|---|
| | Technique | Method Water | Method Soil | Technique | Method (Water/ Soil) | Water | Soil |
| PCB 1260 | Extraction | 3510A | 3550 | GC/EDC | 8080 | 0.2 | 10 |
| **HERBICIDES (ug/l or ug/kg)** | | | | | | | |
| 2,4-D | Extraction | 3510A | 3550 | GC/EDC | 8150A | 10 | 330 |
| 2,4-DB | Extraction | 3510A | 3550 | GC/EDC | 8150A | 10 | 330 |
| 2,4,5-TP (Silvex) | Extraction | 3510A | 3550 | GC/EDC | 8150A | 2 | 67 |
| 2,4,5-T | Extraction | 3510A | 3550 | GC/EDC | 8150A | 2 | 67 |
| Dalapon | Extraction | 3510A | 3550 | GC/EDC | 8150A | 60 | 2000 |
| Dicamba | Extraction | 3510A | 3550 | GC/EDC | 8150A | 3 | 100 |
| Dichlorprop | Extraction | 3510A | 3550 | GC/EDC | 8150A | 10 | 330 |
| Dinoseb | Extraction | 3510A | 3550 | GC/EDC | 8150A | 1 | 33 |
| MCPA | Extraction | 3510A | 3550 | GC/EDC | 8150A | 25000 | 83000 |
| MCPP | Extraction | 3510A | 3550 | GC/EDC | 8150A | 2000 | 67000 |
| **TCLP METALS (mg/L)** | | | | | | | |
| Barium | Extraction/ Acid Digestion | N/A | 1311/3010A | ICPES | 6010A | 1.0 | N/A |
| Cadmium | Extraction/ Acid Digestion | N/A | 1311/3010A | ICPES | 6010A | 0.05 | N/A |
| Chromium | Extraction/ Acid Digestion | N/A | 1311/3010A | ICPES | 6010A | 0.05 | N/A |
| Silver | Extraction/ Acid Digestion | N/A | 1311/3010A | ICPES | 6010A | 0.05 | N/A |

**Table A-1. Analytical Methods (Continued)**

| Parameter | Preparation | | | Analysis | | Reporting Limit | |
|---|---|---|---|---|---|---|---|
| | Technique | Method Water | Method Soil | Technique | Method (Water/ Soil) | Water | Soil |
| Arsenic | Extraction/ Acid Digestion | N/A | 1311/3010A | GCAA | 6010A | 0.5 | N/A |
| Lead | Extraction/ Acid Digestion | N/A | 1311/3010A | GCAA | 6010A | 0.5 | N/A |
| Mercury | Extraction/ Acid Digestion | N/A | 1311/7470 | GCAA | 7470 | 0.002 | N/A |
| Selenium | Extraction/ Acid Digestion | N/A | 1311/3010A | GCAA | 6010A | 0.2 | N/A |
| **TCLP VOLATILES (mg/L)** | | | | | | | |
| 1,1-Dichloroethylene | Purge and Trap | N/A | 1311/5030A | GC/MS | 8240A | 0.05 | N/A |
| Benzene | Purge and Trap | N/A | 1311/5030A | GC/MS | 8240A | 0.05 | N/A |
| Carbon tetrachloride | Purge and Trap | N/A | 1311/5030A | GC/MS | 8240A | 0.05 | N/A |
| Chlorobenzene | Purge and Trap | N/A | 1311/5030A | GC/MS | 8240A | 0.05 | N/A |
| Chloroform | Purge and Trap | N/A | 1311/5030A | GC/MS | 8240A | 0.05 | N/A |
| 1,2 Dichloroethane | Purge and Trap | N/A | 1311/5030A | GC/MS | 8240A | 0.05 | N/A |
| Methyl ethyl ketone (MEK) | Purge and Trap | N/A | 1311/5030A | GC/MS | 8240A | 0.20 | N/A |
| Tetrachloroethylene | Purge and Trap | N/A | 1311/5030A | GC/MS | 8240A | 0.05 | N/A |
| Trichloroethylene | Purge and Trap | N/A | 1311/5030A | GC/MS | 8240A | 0.05 | N/A |
| Vinyl chloride | Purge and Trap | N/A | 1311/5030A | GC/MS | 8240A | 0.10 | N/A |
| **TCLP PESTICIDES (mg/L)** | | | | | | | |
| Chlordane | TCLP | N/A | 1311/3510A | GC/ECD | 8080 | 0.0001 | N/A |

**Table A-1. Analytical Methods (Continued)**

| Parameter | Preparation | | | Analysis | | Reporting Limit | |
|---|---|---|---|---|---|---|---|
| | Technique | Method Water | Method Soil | Technique | Method (Water/ Soil) | Water | Soil |
| Endrin | TCLP | N/A | 1311/3510A | GC/ECD | 8080 | 0.0001 | N/A |
| Heptachlor | TCLP | N/A | 1311/3510A | GC/ECD | 8080 | 0.0001 | N/A |
| Heptachlor Epoxide | TCLP | N/A | 1311/3510A | GC/ECD | 8080 | 0.0001 | N/A |
| Lindane (gamma-BHC) | TCLP | N/A | 1311/3510A | GC/ECD | 8080 | 0.0001 | N/A |
| Methoxychlor | TCLP | N/A | 1311/3510A | GC/ECD | 8080 | 0.0001 | N/A |
| Toxaphene | TCLP | N/A | 1311/3510A | GC/ECD | 8080 | 0.0004 | N/A |
| **TCLP HERBICIDES (mg/l)** | | | | | | | |
| 2,4-D | TCLP | N/A | 1311/3510A | GC/ECD | 8150A | 0.0004 | N/A |
| 2,4,5-TP (Silvex) | TCLP | N/A | 1311/3510A | GC/ECD | 8150A | 0.0001 | N/A |
| **TCLP SEMI - VOLATILES (mg/l)** | | | | | | | |
| Pyridine | TCLP | N/A | 1311/3510A | GC/MS | 8270A | 0.033 | N/A |
| 1,4-Dichlorobenzene | TCLP | N/A | 1311/3510A | GC/MS | 8270A | 0.033 | N/A |
| 2-Methylphenol (o-Cresol) | TCLP | N/A | 1311/3510A | GC/MS | 8270A | 0.033 | N/A |
| 3 +4-Methylphenol (m-Cresol + p-Cresol) | TCLP | N/A | 1311/3510A | GC/MS | 8270A | 0.033 | N/A |
| Hexachloroethane | TCLP | N/A | 1311/3510A | GC/MS | 8270A | 0.033 | N/A |
| Nitrobenzene | TCLP | N/A | 1311/3510A | GC/MS | 8270A | 0.033 | N/A |
| Hexachloro-1,3-butadiene | TCLP | N/A | 1311/3510A | GC/MS | 8270A | 0.033 | N/A |
| 2,4,6-Trichlorophenol | TCLP | N/A | 1311/3510A | GC/MS | 8270A | 0.033 | N/A |
| 2,4,5-Trichlorophenol | TCLP | N/A | 1311/3510A | GC/MS | 8270A | 0.033 | N/A |

**Table A-1. Analytical Methods (Continued)**

| Parameter | Preparation | | | Analysis | | Reporting Limit | |
|---|---|---|---|---|---|---|---|
| | Technique | Method Water | Method Soil | Technique | Method (Water/ Soil) | Water | Soil |
| 2,4-Dinitrotoluene | TCLP | N/A | 1311/3510A | GC/MS | 8270A | 0.033 | N/A |
| Hexachlorobenzene | TCLP | N/A | 1311/3510A | GC/MS | 8270A | 0.033 | N/A |
| Pentachlorophenol | TCLP | N/A | 1311/3510A | GC/MS | 8270A | 0.17 | N/A |
| **GENERAL** | | | | | | | |
| Alkalinity | Titration | E310.1 | E310.1 (Modified) | Titration | E310.1 | 50 mg/l | 250 mg/kg |
| Kjeldahl Nitrogen (Total) | Digestion | E351.2 | E351.2 (Modified | Colorimetric | E351.2 | 0.06 mg/l | 1.2 mg/kg |
| Phosphorous (Total) | Digestion | E365.4 | E365.4 (Modified) | Colorimetric | E365.4 | 0.2 mg/l | 4 mg/kg |
| Flashpoint | N/A | 1010 | N/A | Closed cup | 1010 | 60-200°F | N/A |
| pH (hydrogen ion concentration) | Electrode | 9045A | 9040 | Electrode | 9040/9045A | 1-14 | 1-14 |
| Soil Moisture | Thermal drying | N/A | ASTM D2216 | Weigh | ASTM D2216 | N/A | 0-100% |

**Table A-1. Analytical Methods (Continued)**

| Parameter | Preparation | | | Analysis | | Reporting Limit | |
|---|---|---|---|---|---|---|---|
| | Technique | Method Water | Method Soil | Technique | Method (Water/ Soil) | Water | Soil |
| **PETROLEUM HYDROCARBONS (FIXED AND MOBILE LABORATORY)** | | | | | | | |
| Oil and grease | Extraction | 413.1 | SW9071 | Gravimetric | 413.1/9071 | 5.0 mg/l | 100 mg/kg |
| Total Petroleum Hydrocarbons, TPH as Diesel | Extraction | 3510A or 3550 (soil) | Mod.8015 | GC/FID | Mod.8015 | 100 ug/l | 10 mg/kg |
| Total Petroleum Hydrocarbons TPH as Gas | Purge & Trap | 5030A | Mod.8015 | GC/FID | Mod.8015 | 100 ug/l | 10 mg/kg |
| Total Recoverable Petroleum Hydrocarbons (TRPH) | Extraction (SW9071 for soils) | 418.1 | SW9071 and 418.1 | IR | 418.1 | 0.5 mg/l | 10 mg/kg |

[a] Reporting limit is the minimum concentration of a substance that can be measured and reported for multiple instruments. Reporting limits are highly matrix dependent and may not always be achievable. Reporting limits provided in this table are based on method detection limits and practical quantitation limit guidance found in SW-846, but are not MDLs or PQLs. Reporting limits listed are on a wet-weight basis.

[b] Tentatively Identified Compound

ICPES = Inductively Coupled Plasma Emission Spectroscopy
GFAA = Graphite Furnace Atomic Absorption
GC/MS = Gas Chromatography/Mass Spectrometry
CVAA = Cold Vapor Atomic Absorption
PID = Photoionization Detector
ELCD = Electron Conductivity Detector
ECD = Electron Captive Detector
MDL = Method Detection Limit
IR = Infrared Spectrometry
N/A = Not Applicable

ug/l = Microgram per Liter
mg/l = Milligram per Liter
ug/kg = Microgram per Kilogram
mg/kg = Milligram per Kilogram
TCLP = Toxicity Characteristic Leaching Procedure
TPH = Total Petroleum Hydrocarbons
TRPH = Total Recoverable Petroleum Hydrocarbons
PQL = Practical Quantitative Limit

**Table A-2. Summary of Calibration Procedures**

| Analytical Method | Parameter | Quality Control Check | Frequency | Acceptance Criteria | Corrective Action |
|---|---|---|---|---|---|
| EPA:418.1 | TRPH | Multipoint Calibration (minimum of five concentrations) | Initial | $r \geq 0.99$ and RSD of RFs < 10% | Repeat calibration |
| | | Continuing Calibration Check | Daily and 10% | Measured value ± 10% of true value | Repeat calibration |
| SW-846:6010 | Metals (ICPES) | Mixed Calibration Standards (2 Concentrations) | Daily, and 10% | Measured value ± 10% of true value for element of interest | Repeat calibration |
| SW-846:7060<br>SW-846:7421<br>SW-846:7471<br>SW-846:7740<br>SW-846:7841 | Metals (AA)<br>Arsenic<br>Lead<br>Mercury<br>Selenium<br>Thallium | Multipoint calibration (minimum of three concentrations) | Daily prior to analyses | $r \geq 0.995$ | 1) Repeat test<br>2) Take corrective action<br>3) Repeat calibration and test |
| | | Calibration Blank | 10%, or minimum of one per batch | <MRL | 1) Clean system<br>2) Reanalyze |

**Table A-2. Summary of Calibration Procedures (Continued)**

| Analytical Method | Parameter | Quality Control Check | Frequency | Acceptance Criteria | Corrective Action |
|---|---|---|---|---|---|
| SW-846:8240A | Volatile Organic Compounds | Check of Mass Spectral Ion Intensities Using BFB | Daily prior to sample analyses or every 12 hours | Refer to Method 8240 Table 3 | 1) Retune instrument<br>2) Repeat BFB analyses |
| | | Multipoint Calibration (5-point calibration at 10-200 ppb range) | Initial calibration and as required by calibration check | RSD<30% for average RF for CCCs and all SPCCs meet minimum RF criteria | Repeat calibration |
| | | System Performance Check Compounds (SPCC) Calibration Check Compounds (CCC) | Every 12 hours | Minimum RF Criteria for SPCCs<br>% Difference <25% for CCCs | 1) Evaluate system<br>2) Repeat test<br>3) Recalibrate if repeat fails |
| SW-846:8270A | Semi-volatile Organic Compounds | Check of Mass Spectral Ion Intensities Using DFTPP | Daily and prior to sample analysis in every 12 hr.period | Refer to Method 8270 Table 3If | Retune instrument Repeat DFTPP analysis |
| | | 5-Point Calibration at 20-160 ppb Range | Initial and as required by daily check. | RF variability for specific CCC compounds <30% RSD | Repeat calibration |
| | Semi-volatile Organic Compounds | Calibration Verification for Calibration Check Compounds (CCC) | Every 12 hours | Single-point RF for each CCC within 30% of average multipoint RF | 1) Evaluate system<br>2) Correct problems<br>3) Repeat test<br>4) Recalibrate if fails |
| | | System Performance Check Compounds (SPCC) | Every 12 hours | RF > 0.05 for all SPCCs | 1) Evaluate system<br>2) Correct problems<br>3) Repeat test<br>4) Recalibrate if fails |
| SW-846:8080 | Organochlorine Pesticides and PCBs | Check Endrin and DDT Degradation | Daily prior to sample analysis | Degradation must be <20%,Refer to Method 8080 section 7.4.5 | 1) Retune instrument<br>2) Repeat DFTPP analysis |
| | | 5-Point Calibration | Initial and as required by daily check. | RSD for all RFs must be <20% if mean RF used for quant. | Repeat calibration or use a calibration curve for quant. |

**Table A-2. Summary of Calibration Procedures (Continued)**

| Analytical Method | Parameter | Quality Control Check | Frequency | Acceptance Criteria | Corrective Action |
|---|---|---|---|---|---|
| | | Continuing Calibration Verification (CCV) | Daily and at 10% of all client sample | CCV recoveries must be within 15% of the predicted response | 1) Evaluate system<br>2) Correct problems<br>3) Repeat test<br>4) Recalibrate if fails |
| SW-846:8150 | Chlorinated Herbicides | 5-Point Calibration | Initial and as required by daily check | RSD for all RFs must be <20% if mean RF used for quant. | Repeat calibration or use a calibration curve for quant. |
| | | Initial Calibration Verification (ICV) | After initial calibration | ICV recoveries must be within 15% of the predicted response | 1) Repeat calibration verification<br>2) Recalibrate if ICV fails |
| | | Continuing Calibration Verification (CCV) | Daily prior to sample analysis and at 10% of client samples | CCV recoveries must be within 15% of the predicted response | 1) Evaluate system<br>2) Correct problems<br>3) Repeat test<br>4) Recalibrate if fails |
| SW-846:8020 Modified for BTEX | Volatile Organics for BTEX | 5-Point Calibration | Initial and as required by daily check | RSD for all RFs must be <20% | Retune instrument Repeat calibration analysis |
| | | Initial Calibration Verification (ICV) | After initial calibration | ICV recoveries must be within 15% of the predicted response | Repeat verification<br>Repeat calibration if fails |
| | Volatile Organics for BTEX | Continuing Calibration Verification (CCV) | Daily prior to sample analysis and at 10% of all client samples ongoing | CCV recoveries must be within the method acceptance criteria | 1) Evaluate system<br>2) Corrective problems<br>3) Repeat test<br>4) Recalibrate if fails |

**Table A-2. Summary of Calibration Procedures (Continued)**

| Analytical Method | Parameter | Quality Control Check | Frequency | Acceptance Criteria | Corrective Action |
|---|---|---|---|---|---|
| SW-846:8015 Modified for TPH as Gasoline | TPH as Gasoline | 5-Point Calibration | Initial and as required by daily check | RSD for all RFs must be <20% | Retune instrument Repeat calibration analysis |
| | | Initial Calibration Verification (ICV) | After initial calibration | ICV recoveries must be within 15% of the predicted response | Repeat verification Repeat calibration if fails |
| | | Continuing Calibration Verification (CCV) | Daily prior to sample analysis | CCV must be within 15% of predicted response | 1) Evaluate system<br>2) Correct problem<br>3) Repeat test<br>4) Recalibrate if fails |
| SW-846:8015 Modified for TPH as Diesel Fuel | TPH as Diesel | 5-Point Calibration | Initial and as required by daily check | RSD for all RFs must be <20% | Retune instrument Repeat calibration analysis |
| | | Initial Calibration Verification (ICV) | After initial calibration | ICV recoveries must be within 15% of the predicted response | Repeat calibration |
| | | Continuing Calibration Verification (CCV) | Daily prior to sample analysis | CCV must be within 15% of predicted response | 1) Evaluate system<br>2) Correct problems<br>3) Repeat test<br>4) Recalibrate if fails |
| EPA;365.4 | Total Phosphorus | Calibration using eight standards | Daily | Refer to EPA 365.4 | Reprepare samples and standards and reanalyze. |
| EPA;351.2 | Total Kjehldahl Nitrogen | Calibration using two standards | Daily | Follow instrument manual | Repeat calibration |
| EPA;310.1 | Alkalinity | Standardization using carbonate | Daily | Refer to EPA 310.1 | Reprepare titrant |

**Table A-2. Summary of Calibration Procedures (Continued)**

| Analytical Method | Parameter | Quality Control Check | Frequency | Acceptance Criteria | Corrective Action |
|---|---|---|---|---|---|
| SW-846:9040<br>SW-846:9045A | pH | Calibration Using Two Standard Buffer Solutions | Daily | Follow instrument manual | Repeat calibration |
| SW-846:1010 | Flashpoint | Calibration with xylenes | Daily | Refer to Method 1010 | Repeat Calibration |
| EPA;413.1 | Oil and Grease | Check balance calibration | Daily | Follow laboratory SOP | Recalibrate balance |
| ASTM D2216 | Soil Moisture | Check balance calibration | Daily | Follow laboratory SOP | Recalibrate balance |

EPA = Environmental Protection Agency
BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes
TPH = Total Petroleum Hydrocarbons
AA = Atomic Absorption
DDT = Dichloro-diphenyl-trichloroethane
RF = Response Factor
RSD = Relative Standard Deviation
CCC = Calibration Check Compound
SPCC = System Performance Check Compound
PPB = Parts per Billion
TRPH = Total Recoverable Petroleum Hydrocarbons
SW = Solid Waste
ICPES = Inductively Emission Spectroscopy Coupled Plasma
BFB = 4-Bromofluorobenzene
DFTPP = Decafluorotriphenylphosphine
RPD = Relative Percent Difference
RL = Reporting Limit
CCV = Continuing Calibration Verification
SOP = Standard Operating Procedure
ICV = Initial Calibration Verification

**Table A-3. Summary of Internal Quality Control Procedures**

| Analytical Method | Parameter | Quality Control Check | Frequency | Acceptance Criteria | Corrective Action |
|---|---|---|---|---|---|
| EPA:418.1 | TRPH | Method Blank | 1 per batch | <RL | Used to assess analytical contamination. |
| | | Matrix Spike Duplicate | 5% | 66-136% Recovery | 1) Run check sample (QCCS).<br>2) Correct problem<br>3) Flag data |
| | | QA Duplicate Sample (USACE) | 0 | None | Will be used to determine precision |
| | | Field Equipment Blank | 0 | None | Will be used to determine sources of contamination. |
| | | Duplicate Field Sample | 0 | None | Used to assess sampling/analytical variability. |
| SW-846:6010A | Metals (ICEPS) | Laboratory QC check sample analysis (QCCS) | 1 per digestion batch ≤ 20 samples | Measured value within ± 20% of true value for element of interest | Repeat calibration |
| | | Method blank | 1 per digestion batch ≤ 20 samples | All analytes <MRL | 1) Reanalyze.<br>2) Recalibrate.<br>3) Reanalyze<br>4) Redigest samples if reanalysis fails. |
| | | Calibration blank | 10% | All analytes <MRL | 1) Rerun<br>2) Clean system<br>3) Reanalyze sample<br>4) Redigest samples if reanalysis fails. |
| | | Calibration Check | 10% | Measured value within ± 20% of true value for element of interest | Repeat calibration |
| | | Matrix spike analysis | 5% | 80-120% Recovery | 1) Analyze Method spike (or QCCS).<br>2) If method spike is ok, flag data.<br>3) If method spike not ok, see lab supervisor and reanalyze samples. |

**Table A-3. Summary of Internal Quality Control Procedures (Continued)**

| Analytical Method | Parameter | Quality Control Check | Frequency | Acceptance Criteria | Corrective Action |
|---|---|---|---|---|---|
| SW-846:6010A (Continued) | Metals (ICEPS) | Matrix Spike Duplicate | 5% | Relative percent difference ≤ 20% and 80-120% recovery | 1) Analyze Method spike (or QCCS). 2) If method spike is ok, flag data. 3) If method spike not ok, see lab supervisor and reanalyze samples. |
| | | ICPES interference check | Run at beginning and end of daily run | 80-120% of true value for EPA check sample elements | 1) Repeat calibration 2) See lab manager |
| | | ICP linear range check | Quarterly | Measured value within ± 5% of expected value | Tests upper limit of ICP linear range. |
| | | QA duplicate sample (USACEb) | 1 per site/matrix | None | Used to quantitate analytical variability. |
| | | Duplicate field sample | 1 per site/matrix | None | Determine sampling analytical variability. |
| | | Equipment Blanks | 0 | None | Used to determine sources of contamination. |
| SW-846:8270A | Semi-Volatile Organic Compounds | Laboratory Check of mass spectral ion intensities using DFTPP | Daily prior to sample analysis | Refer to method | Retune instrument Repeat DFTPP analysis |
| | | Quality Control Check Sample (QCCS) | 5% | See Table A-4 | 1) Evaluate system, correct as needed. 2) Recalculate data or reanalyze extract. 3) If QCCS still fails, reextract and reanalyze QCCS and all samples in batch. |
| | | System performance check | Every 12 hours | Minimum average response factor 0.050 | 1) Evaluate system 2) Repeat calibration. |

**Table A-3. Summary of Internal Quality Control Procedures (Continued)**

| Analytical Method | Parameter | Quality Control Check | Frequency | Acceptance Criteria | Corrective Action |
|---|---|---|---|---|---|
| SW-846:8270A (Continued) | Semi-Volatile Organic Compounds | Surrogate spikes | Every sample | See Table A-6 | 1) Evaluate system.<br>2) Recalculate data and/or reanalyze extract.<br>3) Analyze QCCS, if QCCS fails, reextract and reanalyze samples, or<br>4) Flag data and report analysis and re analysis results. |
| | | Method Blank | Daily prior to sample analysis | <RL | 1) Run solvent blank.<br>2) Evaluate system. |
| | | Matrix spike | 5% | See Table A-5 | 1) Run check sample (QCCS).<br>2) Correct problem<br>3) If QCCS fails, reanalyze samples.<br>4) Flag data if QCCS passes. |
| | | Matrix Spike Duplicate | 5% | See Table A-5 | 1) Run check sample (QCCS).<br>2) Correct problem<br>3) If QCCS fails, reanalyze samples.<br>4) Flag data if QCCS passes. |
| | | QA duplicate sample (USACEb ) | 0 | None | Used to quantitate analytical variability. |
| | | Field Equipment blank | 0 | None | Will be used to determine sources of contamination. |
| | | Duplicate field sample | 0 | None | Will be used to determine analytical variability. |
| SW-846:8240A | Volatile Organic Compounds | Laboratory Check of mass spectral ion intensities using BFB | Daily prior to sample analysis and/or every 12 hours | Method 8240A Table 3 | 1) Retune instrument<br>2) Repeat BFB analysis |

**Table A-3. Summary of Internal Quality Control Procedures (Continued)**

| Analytical Method | Parameter | Quality Control Check | Frequency | Acceptance Criteria | Corrective Action |
|---|---|---|---|---|---|
| SW-846:8240A (Continued) | Volatile Organic Compounds | System performance check | Every 12 hours | RF ≥ 0.300 (0.250 for bromoform) | 1) Evaluate system<br>2) Repeat calibration |
| | | Surrogate spikes | Every sample | See Table A-6 | 1) Evaluate system<br>2) Recalculate data and/or reanalyze extract.<br>3) Reanalyze sample, or<br>4) Flag data and report analysis and reanalysis results. |
| | | Method blank | Daily prior to analyses and/or every 12 hours | <RL except for acetone, MEK, or methylene chloride which may be 5 x RL | 1) Run solvent blank<br>2) Reanalyze blank and samples |
| | | Matrix spike | 5% | See Table A-5 | 1) Run check samples (QCCS).<br>2) Correct problem.<br>3) If QCCS is ok: flag data.<br>4) If QCCS is not ok; reanalyze samples |
| | | Matrix spike duplicate | 5% | See Table A-5 | 1) Run check samples (QCCS).<br>2) Correct problem.<br>3) If QCCS is ok: flag data.<br>4) If QCCS is not ok; reanalyze samples |
| | | QA duplicate sample (USACEb) | 1 per site/matrix | 1 per site/matrix | Used to quantitate analytical variability. |

**Table A-3. Summary of Internal Quality Control Procedures (Continued)**

| Analytical Method | Parameter | Quality Control Check | Frequency | Acceptance Criteria | Corrective Action |
|---|---|---|---|---|---|
| SW-846:8240A (Continued) | Volatile Organic Compounds (Continued) | Duplicate field samples | 1 per site/matrix | None | Used to determine sampling/analytical variability. |
| | | Equipment blank | 0 | None | Will be used to determine sources of contamination. |
| | | Trip blank | 1 per site/groundwater sampling | None | Will be used to determine potential sources of contamination. |
| SW-846:8020 , Modified | BTEX Volatile Organic Compounds | Surrogate spikes | Every sample | See Table A-6 | 1) Evaluate system<br>2) Recalculate data and/or reanalyze extract.<br>3) Reanalyze sample, or<br>4) Flag data and report analysis and reanalysis results. |
| | | Method blank | Daily prior to sample analyses | <RL | 1) Run solvent blank ( If methanol extracts)<br>2) Reanalyze blank and samples |
| | | Matrix spike | 5% | See Table A-5 | 1) Run check samples (QCCS).<br>2) Correct problem.<br>3) If QCCS is ok: flag data.<br>4) If QCCS is not ok; reanalyze samples |
| | | Matrix spike duplicate | 5% | See Table A-5 | 1) Run check samples (QCCS).<br>2) Correct problem.<br>3) If QCCS is ok: flag data.<br>4) If QCCS is not ok; reanalyze samples |
| | | QA duplicate sample (USACEb) | 1 per site/matrix | None | Used to quantitate analytical variability. |

**Table A-3. Summary of Internal Quality Control Procedures (Continued)**

| Analytical Method | Parameter | Quality Control Check | Frequency | Acceptance Criteria | Corrective Action |
|---|---|---|---|---|---|
| SW-846:8020, Modified (Continued) | BTEX Volatile Organic Compounds | Duplicate field samples | 1 per site/matrix | None | Used to determine sampling/analytical variability. |
| | | Equipment blank | 0 | None | Will be used to determine sources of contamination. |
| | | Trip blank | 0 | None | Will be used to determine potential sources of contamination. |
| SW-846 8010/8020 | Volatile Organic Compounds | Daily Check Standard | Daily | All components must meet criteria set in SW-846, Table 3 for each compound (Table A-3) | 1. Rerun Standard<br>2. Recalibrate |
| | | Continuing Standard | Every 10th Sample | Must pass criteria set in SW-846m Table 3. | Stop Analysis;<br>1. Rerun standard<br>2. Recalibrate |
| | | Surrogate | Each Sample | See Table A-6. | Repeat Analysis |
| | | Internal Standard | Each Sample | 50% - 200% | Repeat Analysis |
| | | Method Blanks | Daily | <RL, except (MEK; Acetone; and MeC12) | Rerun Blank, stop analyses until criteria met. |
| SW-846:8080 | Pesticides and PCBs | Surrogate spikes | Every sample | See Table A-6 | 1) Evaluate system<br>2) Recalculate data and/or reanalyze extract.<br>3) Reanalyze sample, or<br>4) Flag data and report analysis and reanalysis results. |
| | | Method blank | Daily prior to analyses | <RL | 1) Run solvent blank<br>2) Reanalyze blank and samples |

**Table A-3. Summary of Internal Quality Control Procedures (Continued)**

| Analytical Method | Parameter | Quality Control Check | Frequency | Acceptance Criteria | Corrective Action |
|---|---|---|---|---|---|
| SW-846:8080 (Continued) | Pesticides and PCBs | Matrix spike | 5% | See Table A-5 | 1) Run check samples (QCCS).<br>2) Correct problem.<br>3) If QCCS is ok: flag data.<br>4) If QCCS is not ok; reanalyze samples |
| | | Matrix spike duplicate | 5% | See Table A-5 | 1) Run check samples (QCCS).<br>2) Correct problem.<br>3) If QCCS is ok: flag data.<br>4) If QCCS is not ok; reanalyze samples |
| | | QA duplicate sample (USACEb) | 0 | None | Used to quantitate analytical variability. |
| | | Duplicate field samples | 0 | None | Used to determine sampling/analytical variability. |
| | | Equipment blank | 0 | None | Will be used to determine sources of contamination. |
| | | Trip blank | 0 | None | Will be used to determine potential sources of contamination. |
| SW-846:8150A | Chlorinated Herbicides | Surrogate spikes | Every sample | See Table A-6 | 1) Evaluate system<br>2) Recalculate data and/or reanalyze extract.<br>3) Reanalyze sample.<br>4) Flag data and report analysis and reanalysis results. |
| | | Method blank | Daily prior to analyses and/or every 12 hours sample | <RL | 1) Run solvent blank<br>2) Reanalyze blank and samples |

**Table A-3. Summary of Internal Quality Control Procedures (Continued)**

| Analytical Method | Parameter | Quality Control Check | Frequency | Acceptance Criteria | Corrective Action |
|---|---|---|---|---|---|
| SW-846:8150A (Continued) | Chlorinated Herbicides | Matrix spike | 5% | See Table A-5 | 1) Run check samples (QCCS).<br>2) Correct problem.<br>3) If QCCS is ok: flag data.<br>4) If QCCS is not ok; reanalyze samples |
| | | Matrix spike duplicate | 5% | See Table A-5 | 1) Run check samples (QCCS).<br>2) Correct problem.<br>3) If QCCS is ok: flag data.<br>4) If QCCS is not ok; reanalyze samples |
| | | QA duplicate sample (USACEb) | 0 | None | Used to quantitate analytical variability. |
| | | Duplicate field samples | 0 | None | Used to determine sampling/analytical variability. |
| | | Equipment blank | 0 | None | Will be used to determine sources of contamination. |
| | | Trip blank | 0 | None | Will be used to determine potential sources of contamination. |
| Modified SW-846:8015 Extraction 5030A | TPH as Gasoline | Surrogate spikes | Every sample | See Table A-6 | 1) Evaluate system<br>2) Recalculate data and/or reanalyze extract.<br>3) Reanalyze sample, or<br>4) Flag data and report analysis and reanalysis results. |
| | | Method blank | Daily prior to analyses and/or every 12 hours | <MRL except for acetone, MEK, or methylene chloride which may be 5 x MRL | 1) Run solvent blank<br>2) Reanalyze blank and samples |

**Table A-3. Summary of Internal Quality Control Procedures (Continued)**

| Analytical Method | Parameter | Quality Control Check | Frequency | Acceptance Criteria | Corrective Action |
|---|---|---|---|---|---|
| Modified SW-846:8015 Extraction 5030A (Continued) | TPH as Gasoline | Matrix spike | 5% | See Table A-5 | 1) Run check samples (QCCS).<br>2) Correct problem.<br>3) If QCCS is ok: flag data.<br>4) If QCCS is not ok; reanalyze samples |
| | | Matrix spike duplicate | 5% | See Table A-5 | 1) Run check samples (QCCS).<br>2) Correct problem.<br>3) If QCCS is ok: flag data.<br>4) If QCCS is not ok; reanalyze samples |
| | | QA duplicate sample (USACEb) | 0% | None | Used to quantitate analytical variability. |
| | | Duplicate field samples | 0 | None | Used to determine sampling/analytical variability. |
| | | Equipment blank | 0 | None | Will be used to determine sources of contamination. |
| | | Trip blank | 0 | None | Will be used to determine potential sources of contamination. |
| Modified SW-846:8015 Extraction 3010A/3550 | TPH as Diesel Fuel | Surrogate spikes | Every sample | See Table A-6 | 1) Evaluate system<br>2) Recalculate data and/or reanalyze extract.<br>3) Reanalyze sample, or<br>4) Flag data and report analysis and reanalysis results. |
| | | Method blank | Daily prior to analyses | <RL | 1) Run solvent blank<br>2) Reanalyze blank and samples |

**Table A-3. Summary of Internal Quality Control Procedures (Continued)**

| Analytical Method | Parameter | Quality Control Check | Frequency | Acceptance Criteria | Corrective Action |
|---|---|---|---|---|---|
| Modified SW-846:8015 Extraction 3010A/3550 (Continued) | TPH as Diesel Fuel | Matrix spike | 5% | See Table A-5 | 1) Run check samples (QCCS).<br>2) Correct problem.<br>3) If QCCS is ok: flag data.<br>4) If QCCS is not ok; reanalyze samples |
| | | Matrix spike duplicate | 5% | See Table A-5 | 1) Run check samples (QCCS).<br>2) Correct problem.<br>3) If QCCS is ok: flag data.<br>4) If QCCS is not ok; reanalyze samples |
| | | QA duplicate sample (USACEb) | 1 per site/matrix | None | Used to quantitate analytical variability. |
| | | Duplicate field samples | 1 per site/matrix | None | Used to determine sampling/analytical variability. |
| | | Equipment blank | 0 | None | Will be used to determine sources of contamination. |
| | | Trip blank | 0 | None | Will be used to determine potential sources of contamination. |
| SW-846:7060<br>SW-846:7421<br>SW-846:7471<br>SW-846:7740<br>SW-846:7841 | Metals (AA)<br>Arsenic<br>Lead<br>Mercury<br>Selenium<br>Thallium | Laboratory QC check sample (QCCS) | per sample batch | Measured value within ± 20% of expected value | Repeat calibration |
| | | Calibration Check Verification | 10% | Measured value within ± 20% of expected value | Repeat calibration |

**Table A-3. Summary of Internal Quality Control Procedures (Continued)**

| Analytical Method | Parameter | Quality Control Check | Frequency | Acceptance Criteria | Corrective Action |
|---|---|---|---|---|---|
| SW-846:7060<br>SW-846:7421<br>SW-846:7471<br>SW-846:7740<br>SW-846:7841 | Metals (AA)<br>Arsenic<br>Lead<br>Mercury<br>Selenium<br>Thallium | Laboratory QC check sample (QCCS) | per sample batch | Measured value within ± 20% of expected value | Repeat calibration |
| | | Calibration Check Verification | 10% | Measured value within ± 20% of expected value | Repeat calibration |
| | | Calibration blank | 10% | <MRL | 1) Clean system<br>2) Reanalyze |
| | | Preparation blank | 10% | <MRL | 1) Reanalyze<br>2) Clean system<br>3) Redigest and reanalyze |
| | | Matrix Spike | 5% | 75-125% Recovery | 1) Run check sample (QCCS).<br>2) Correct problem<br>3) if QCCS fails, reanalyze samples<br>4) If not, flag data |
| | | Matrix Spike Duplicate | 5% | Within 20% RPD and 75-125% Recovery | 1) Run check sample (QCCS).<br>2) Correct problem<br>3) if QCCS fails, reanalyze samples<br>4) If not, flag data |
| | | QA duplicate sample (USACEb ) | 1 per site/matrix | None | Will be used to determine sampling.analytical variability. |
| | | Duplicate field sample | 1 per site/matrix | None | Determine sampling/analytical variability. |
| | | Equipment Blank | 0 | None | Will be used to determine sources of contamination. |

**Table A-3. Summary of Internal Quality Control Procedures (Continued)**

| Analytical Method | Parameter | Quality Control Check | Frequency | Acceptance Criteria | Corrective Action |
|---|---|---|---|---|---|
| EPA;365.4<br><br>EPA;351.2<br><br>EPA;310.1 | Total Phosphorus<br><br>Total Kjehldahl Nitrogen<br><br>Alkalinity | Laboratory QC Check Sample | 5% | Measured value within ± 20% of expected value | Reprepare and reanalyze samples and standards |
| | | Preparation blank | 10% | <MRL | 1) Reanalyze<br>2) Clean system<br>3) Reprepare and reanalyze |
| | | Matrix Spike | 5% | 80-120% Recovery | 1) Run check sample (QCCS).<br>2) Correct problem<br>3) if QCCS fails, reanalyze samples<br>4) If not, flag data |
| | | Matrix Spike Duplicate Analysis | 5% | Within 20% RPD and 80-120% Recovery | Analyze third time. If still out, stop, identify, and correct problem. |
| | | QA duplicate sample (USACEb ) | 0 | None | Used to quantitate analytical variability |
| | | Duplicate field sample | 0 | None | Used to assess sampling/analytical variability. |
| | | Equipment Blank | 0 | None | Will be used to determine sources of contamination. |

**Table A-3. Summary of Internal Quality Control Procedures (Continued)**

| Analytical Method | Parameter | Quality Control Check | Frequency | Acceptance Criteria | Corrective Action |
|---|---|---|---|---|---|
| SW-846:9040<br>SW-846:9045A | pH | Laboratory QC Check Sample | 5% | ± 0.1 pH units | Recalibrate |
| | | Duplicate Analysis | 5% | RPD ≤ 15 | Analyze third time. If still out, stop, identify, and correct problem. |
| | | QA duplicate sample (USACEb ) | 0 | None | Used to quantitate analytical variability |
| | | Field Duplicate sample | 1 per site/matrix | None | Used to assess sampling/analytical variability. |

a Frequencies for duplicate samples and field blanks are computed based on the total number of samples taken for the number of analyses specified in the final specifications.

b USACE required QA duplicate samples to be analyzed by USACE Missouri River Division (MRD) Laboratory.

QCCS = Quality Control Check Sample
TRPH = Total Recoverable Petroleum Hydrocarbons
TPH = Total Petroleum Hydrocarbons
RF = Response Factor
RPD = Relative Percent Difference
RL = Reporting Limit
QA = Quality Assurance
MRL = Method Reporting Limit
ICEPS = Inductively Coupled Plasma Emission
AA = Atomic Absorption
BFB = 4-Bromofluorobenzene
DFTBB = Decafluorotriphenylposphine
MEK = 2 Butanone

**Table A-4. Summary of Tolerance Limits for Laboratory Control Samples**

| Analyte | % Recovery | |
|---|---|---|
| | Water | Soil |
| **METHOD E418.1** | | |
| Total Recoverable Petroleum Hydrocarbons | 78-122 | 77-120 |
| **METHOD E413.1** | | |
| Oil and Grease | 40-140 | 70-130 |
| **METHOD MOD.SW8015 TPH as Diesel and Hydrocarbon Screen** | | |
| TPH as Diesel | 16-128 | 48.2-107 |
| **METHOD SW6010A** | | |
| Aluminum | 80-120 | 80 -120 |
| Antimony | 80-120 | 80-120 |
| Arsenic | 80-120 | 80-120 |
| Barium | 80-120 | 80-120 |
| Beryllium | 80-120 | 80-120 |
| Cadmium | 80-120 | 80-120 |
| Calcium | 80-120 | 80-120 |
| Chromium | 80-120 | 80-120 |
| Cobalt | 80-120 | 80-120 |
| Copper | 80-120 | 80-120 |
| Iron | 80-120 | 80-120 |
| Lead | 80-120 | 80-120 |
| Magnesium | 80-120 | 80-120 |
| Manganese | 80-120 | 80-120 |
| Nickel | 80-120 | 80-120 |
| Potassium | 80-120 | 80-120 |
| Selenium | 80-120 | 80-120 |
| Silver | 80-120 | 80-120 |
| Sodium | 80-120 | 80-120 |
| Thallium | 80-120 | 80-120 |
| Vanadium | 80-120 | 80-120 |
| Zinc | 80-120 | 80-120 |
| **METHOD SW7060A** | | |

**Table A-4. Summary of Tolerance Limits for Laboratory Control Samples (Continued)**

| Analyte | % Recovery | |
|---|---|---|
| | Water | Soil |
| Arsenic | 80-120 | 80-120 |
| **METHOD SW7421** | | |
| Lead | 80-120 | 80-120 |
| **METHODS SW7470 AND SW7471** | | |
| Mercury | 80-120 | 80-120 |
| **METHOD SW7740** | | |
| Selenium | 80-120 | 80-120 |
| **METHOD SW7841** | | |
| Thallium | 80-120 | 80-120 |
| **METHOD SW8240A** | | |
| 1,1-Dichloroethane | 59-155 | 59-155 |
| 1,1-Dichloroethene | 59-172 | 59-172 |
| 1,1,1-Trichloroethane | 52-162 | 52-162 |
| 1,1,2-Trichloroethane | 52-150 | 52-150 |
| 1,1,2,2-Tetrachloroethane | 46-157 | 46-157 |
| 1,2-Dichloroethane | 49-155 | 49-155 |
| 1,2-dichloropropane | 10-210 | 10-210 |
| Benzene | 37-151 | 37-151 |
| Bromodichloromethane | 35-155 | 35-155 |
| Bromomethane | 10-242 | 10-242 |
| Carbon Tetrachloride | 70-140 | 70-140 |
| Chlorobenzene | 37-160 | 37-160 |
| Chloroform | 51-138 | 51-138 |
| Chloromethane | 10-273 | 10-273 |
| cis-1,3-Dichloropropene | 10-227 | 10-227 |
| Dibromochloromethane | 53-149 | 53-149 |
| Ethyl benzene | 37-162 | 37-162 |
| Methylene chloride | 10-221 | 10-221 |
| Tetrachloroethene | 64-148 | 64-148 |
| Toluene | 47-150 | 47-150 |

**Table A-4. Summary of Tolerance Limits for Laboratory Control Samples (Continued)**

| Analyte | % Recovery | |
|---|---|---|
| | Water | Soil |
| trans-1,2-Dichloroethene | 54-156 | 54-156 |
| trans-1,3-Dichloropropene | 17-183 | 17-183 |
| Tribromomethane (bromoform) | 45-169 | 45-169 |
| Trichlofluoromethane | 17-181 | 17-181 |
| Trichloroethene | 71-157 | 71-157 |
| Vinyl chloride | 10-251 | 10-251 |
| **METHOD Mod. SW8020 BTEX and Mod. SW 8015 TPH as Gasoline** | | |
| Benzene | 67-110 | 67-122 |
| Toluene | 68-115 | 66-126 |
| Ethylbenzene | 65-120 | 63-138 |
| Xylenes (Total) | 62-119 | 61-137 |
| **METHOD 8010/8020** | | |
| 1,1-Dichloroethane | 84-116 | 84-116 |
| 1,1-Dichloroethene | 63-137 | 63-137 |
| 1,1,1-Trichloroethane | 71-129 | 71-129 |
| 1,1,2-Trichloroethane | 79-122 | 79-122 |
| 1,1,2,2-Tetrachloroethane | 49-151 | 49-151 |
| 1,2-Dichloroethane | 72-129 | 72-129 |
| 1,2-dichloropropane | 72-126 | 72-126 |
| Benzene | 77-123 | 77-123 |
| Bromodichloromethane | 76-124 | 76-124 |
| Bromomethane | 59-142 | 59-142 |
| Carbon Tetrachloride | 69-132 | 69-132 |
| Chlorobenzene | 72-128 | 72-128 |
| Chloroform | 75-125 | 75-125 |
| Chloromethane | 60-141 | 60-141 |
| cis-1,3-Dichloropropane | 64-136 | 64-136 |
| Dibromochloromethane | 66-155 | 66-155 |
| Ethyl benzene | 63-137 | 63-137 |
| Methylene chloride | 78-123 | 78-123 |

**Table A-4. Summary of Tolerance Limits for Laboratory Control Samples (Continued)**

| Analyte | % Recovery | |
|---|---|---|
| | Water | Soil |
| Tetrachloroethane | 70-130 | 70-130 |
| Toluene | 78-122 | 78-122 |
| trans-1,2-dichloroethene | 64-136 | 64-136 |
| Tribromomethane (bromoform) | 74-123 | 74-123 |
| Trichlofluoromethane | 67-134 | 67-134 |
| Trichloroethane | 77-123 | 77-123 |
| Vinyl chloride | 69-132 | 69-132 |
| 2-chloroethyl vinyl ether | 60-140 | 60-140 |
| Chloroethane | 77-123 | 77-123 |
| Xylene | 85-115 | 85-115 |
| 1,2-dichlorobenzene | 70-130 | 70-130 |
| 1,3-dichlorobenzene | 50-151 | 50-151 |
| 1,4-dichlorobenzene | 70-131 | 70-131 |
| **METHOD SW8270A** | | |
| Phenol | 12-110 | 26-90 |
| 2-Chlorophenol | 27-123 | 25-102 |
| 1,4-Dichlorobenzene | 36-97 | 28-104 |
| N-Nitroso-di-n-propylamine | 41-116 | 41-126 |
| 1,2,4-Trichlorobenzene | 39-98 | 38-107 |
| 4,Chloro-3-methylphenol | 23-97 | 26-103 |
| Acenaphthene | 46-118 | 31-137 |
| 4-Nitrophenol | 10-80 | 11-114 |
| 2,4-Dinitrotoluene | 24-96 | 28-89 |
| Pentachlorophenol | 9-103 | 17-109 |
| Pyrene | 26-127 | 35-142 |
| **METHOD SW 8080** | | |
| Aldrin | 40-120 | 34-132 |
| α-BHC | 37-134 | 37-134 |
| β-BHC | 17-147 | 17-147 |
| δ-BHC | 19-140 | 19-140 |
| γ-BHC | 46-127 | 46-127 |

**Table A-4. Summary of Tolerance Limits for Laboratory Control Samples (Continued)**

| Analyte | % Recovery | |
|---|---|---|
| | Water | Soil |
| 4,4'-DDD | 31-141 | 31-141 |
| 4,4'-DDE | 30-145 | 30-145 |
| 4,4'-DDT | 38-127 | 23-134 |
| Dieldrin | 52-126 | 31-134 |
| Endosulfan I | 45-153 | 45-153 |
| Endosulfan II | 10-202 | 10-202 |
| Endosulfan Sulfate | 26-144 | 26-144 |
| Endrin | 56-121 | 42-139 |
| Endrin Aldehyde | 20-200 | 10-200 |
| Heptachlor | 40-131 | 35-130 |
| Heptachlor Epoxide | 37-142 | 37-142 |
| **METHOD SW8080 PCB's** | | |
| PCB 1260 | 10-127 | 10-127 |
| **METHOD SW 8150A** | | |
| 2,4-D | 20-160 | 20-160 |
| 2,4,5-TP (Silvex) | 20-160 | 20-160 |
| **GENERAL** | | |
| Alkalinity E310.1 | 80-120 | 80-120 |
| Kjeldahl Nitrogen (Total) E351.2 | 80-120 | 80-120 |
| Phosphorous E365.4 | 80-120 | 80-120 |
| pH SW9040 /SW9045A | 0.1 pH Unit | 0.1 pH Unit |
| **TCLP-METHOD SW6010A and SW7470** | | |
| Arsenic | N/A | 80-120 |
| Barium | N/A | 80-120 |
| Cadmium | N/A | 80-120 |
| Calcium | N/A | 80-120 |
| Chromium | N/A | 80-120 |
| Mercury (SW7470) | N/A | 80-120 |
| Lead | N/A | 80-120 |
| Selenium | N/A | 80-120 |
| Silver | N/A | 80-120 |

**Table A-4. Summary of Tolerance Limits for Laboratory Control Samples (Continued)**

| Analyte | % Recovery | |
|---|---|---|
| | Water | Soil |
| **TCLP - METHOD SW8240A** | | |
| Benzene | N/A | 76-127 |
| 2-Butanone | N/A | 28-180 |
| Carbon Tetrachloride | N/A | 70-140 |
| Chlorobenzene | N/A | 75-130 |
| Chloroform | N/A | 51-138 |
| 1,4-Dichlorobenzene | N/A | 18-190 |
| 1,2-Dichloroethane | N/A | 49-155 |
| 1,1-Dichloroethene | N/A | 61-145 |
| Trichloroethene | N/A | 71-120 |
| Tetrachloroethene | N/A | 64-148 |
| Vinyl Chloride | N/A | 10-251 |
| **TCLP - METHOD SW8270A** | | |
| Pyridine | N/A | 10-150 |
| 1,4-Dichlorobenzene | N/A | 36-97 |
| 2-Methylphenol | N/A | 32-119 |
| 3,4-Methylphenol | N/A | 32-119 |
| Hexachloroethane | N/A | 40-113 |
| Nitrobenzene | N/A | 35-180 |
| Hexachlorobutadiene | N/A | 24-116 |
| 2,4,6-Trichlorophenol | N/A | 37-144 |
| 2,4,5-Trichlorophenol | N/A | 37-144 |
| 2,4-Dinitrotoluene | N/A | 24-96 |
| Hexachlorobenzene | N/A | 10-152 |
| Pentachlorophenol | N/A | 10-103 |
| **TCLP - METHOD SW8080** | | |
| gamma-BHC (Lindane) | N/A | 46-127 |
| Heptachlor | N/A | 35-130 |
| Heptachlor Epoxide | N/A | 37-142 |
| Aldrin | N/A | 34-132 |
| Dieldrin | N/A | 31-134 |

**Table A-4. Summary of Tolerance Limits for Laboratory Control Samples (Continued)**

| Analyte | % Recovery | |
|---|---|---|
| | Water | Soil |
| Endrin | N/A | 42-139 |
| 4,4'- DDT | N/A | 23--134 |
| **TCLP - METHOD SW8150A** | | |
| 2,4-D | N/A | 20-160 |
| 2,4,5-TP (Silvex) | N/A | 20-160 |

LCS = Laboratory Control Samples
TPH = Total PEtroleum Hydrocarbons
BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes
N/A = Not Applicable

## Table A-5. Summary of Tolerance Limits for Matrix Spike Analyses

| Analyte | Water Spike Concent Analyte (ug/l) | Soil Spike Concent (mg/kg) | % Recovery | | Precision (RPD) | |
|---|---|---|---|---|---|---|
| | | | Water | Soil | Water | Soil |
| METHOD E418.1 | | | | | | |
| Total Recoverable Petroleum Hydrocarbons | 5,000 | 3 | 66-136 | 42-141 | 70 | 50 |
| **METHOD E413.1** | | | | | | |
| Oil and Grease | 30,000 | 1,500 | 40-140 | 70-130 | 50 | 50 |
| **METHOD Mod. SW 8015 TPH as Diesel and Hydrocarbon Screen** | | | | | | |
| TPH as Diesel | 2,000 | 66.7 | 16-126 | 48-107 | 67.4 | 26.8 |
| **METHOD SW6010A** | | | | | | |
| Aluminum | 10,000 | 1,000 | 80-120 | 80-120 | 20 | 20 |
| Antimony | 2,000 | 200 | 80-120 | 80-120 | 20 | 20 |
| Arsenic | 2,500 | 200.5 | 80-120 | 80-120 | 20 | 20 |
| Barium | 10,000 | 1,000 | 80-120 | 80-120 | 20 | 20 |
| Beryllium | 100 | 10 | 80-120 | 80-120 | 20 | 20 |
| Cadmium | 500 | 50 | 80-120 | 80-120 | 20 | 20 |
| Calcium | 10,020 | 1,002 | 80-120 | 80-120 | 20 | 20 |
| Chromium | 200 | 20 | 80-120 | 80-120 | 20 | 20 |
| Cobalt | 2,005 | 200.5 | 80-120 | 80-120 | 20 | 20 |
| Copper | 2,000 | 200 | 80-120 | 80-120 | 20 | 20 |
| Iron | 10,000 | 1,000 | 80-120 | 80-120 | 20 | 20 |
| Lead | 2,000 | 200 | 80-120 | 80-120 | 20 | 20 |
| Magnesium | 10,000 | 1,000 | 80-120 | 80-120 | 20 | 20 |
| Manganese | 5,000 | 500 | 80-120 | 80-120 | 20 | 20 |
| Nickel | 5,000 | 500 | 80-120 | 80-120 | 20 | 20 |
| Potassium | 20,000 | 2,000 | 80-120 | 80-120 | 20 | 20 |
| Selenium | 1,000 | 100 | 80-120 | 80-120 | 20 | 20 |
| Silver | 1,000 | 100 | 80-120 | 80-120 | 20 | 20 |
| Sodium | 10,000 | 1,001 | 80-120 | 80-120 | 20 | 20 |
| Thallium | 2,000 | 200 | 80-120 | 80-120 | 20 | 20 |
| Vanadium | 2,000 | 200 | 80-120 | 80-120 | 20 | 20 |
| Zinc | 5,005 | 500.5 | 80-120 | 80-120 | 20 | 20 |

## Table A-5. Summary of Tolerance Limits for Matrix Spike Analayses (Continued)

| Analyte | Water Spike Concent Analyte (ug/l) | Soil Spike Concent (ug/kg) | % Recovery | | Precision (RPD) | |
|---|---|---|---|---|---|---|
| | | | Water | Soil | Water | Soil |
| **METHOD SW7060** | | | | | | |
| Arsenic | 40 | 4,000 | 75-125 | 75-125 | 20 | 20 |
| **METHOD SW7421** | | | | | | |
| Lead | 20 | 2,000 | 75-125 | 75-125 | 20 | 20 |
| **METHODS SW7470 AND SW7471** | | | | | | |
| Mercury | 40.0 | 4,000 | 75-125 | 75-125 | 20 | 20 |
| **METHOD SW7740** | | | | | | |
| Selenium | 1 | 2 | 75-125 | 75-125 | 20 | 20 |
| **METHOD SW7841** | | | | | | |
| Thallium | 20.0 | 2,000 | 75-125 | 75-125 | 20 | 20 |
| **METHOD Mod. SW8020 BTEX and Mod. SW8015 TPH as Gasoline (Fixed Laboratory)** | | | | | | |
| Benzene | 20 | 5,000 | 67-110 | 67-122 | 23.9 | 28.3 |
| Toluene | 20 | 5,000 | 68-115 | 66-126 | 27.2 | 30.0 |
| Ethylbenzene | 20 | 5,000 | 65-120 | 63-138 | 21.6 | 30.0 |
| Xylenes (Total) | 20 | 5,000 | 62-119 | 61-137 | 22.0 | 30.0 |
| **METHOD SW8240A (Fixed Laboratory)** | | | | | | |
| Benzene | 50 | 50 | 76-127 | 66-142 | 11 | 21 |
| Chlorobenzene | 50 | 50 | 75-130 | 60-133 | 13 | 21 |
| 1,1-Dichloroethane | 50 | 50 | 61-145 | 59-172 | 14 | 22 |
| Toluene | 50 | 50 | 71-120 | 62-137 | 14 | 24 |
| Trichloroethene | 50 | 50 | 76-125 | 59-139 | 13 | 21 |
| **METHOD Mod. SW8020 BTEX & Mod. SW8015 TPH-as-Gasoline (Mobile Laboratory)** | | | | | | |
| Benzene | 20 | 1,000 | 67-110 | 67-122 | 23.9 | 28.3 |
| Toluene | 20 | 1,000 | 68-115 | 66-126 | 27.2 | 30.0 |
| Ethylbenzene | 20 | 1,000 | 65-120 | 63-138 | 21.6 | 30.0 |
| Xylenes (Total) | 20 | 1,000 | 62-119 | 61-137 | 22.0 | 30.0 |
| **METHOD SW8240A (Mobile Laboratory)** | | | | | | |
| Benzene | 50 | 2,500 | 76-127 | 66-142 | 11 | 21 |
| Chlorobenzene | 50 | 2,500 | 75-130 | 60-133 | 13 | 21 |
| 1,1-Dichloroethane | 50 | 2,500 | 61-145 | 59-172 | 14 | 22 |
| Toluene | 50 | 2,500 | 71-120 | 62-137 | 14 | 24 |

## Table A-5. Summary of Tolerance Limits for Matrix Spike Analyses (Continued)

| Analyte | Water Spike Concent Analyte (ug/l) | Soil Spike Concent (ug/kg) | % Recovery | | Precision (RPD) | |
|---|---|---|---|---|---|---|
| | | | Water | Soil | Water | Soil |
| Trichloroethene | 50 | 2,500 | 76-125 | 59-139 | 13 | 21 |
| **METHOD 8010/8020 (Mobile Laboratory)** | | | | | | |
| 1,1-Dichloroethane | 20 | 1,000 | 28-167 | 28-167 | 20 | 20 |
| Benzene | 20 | 1,000 | 39-150 | 39-150 | 20 | 20 |
| Chlorobenzene | 20 | 1,000 | 38-150 | 38-150 | 20 | 20 |
| Chloroform | 20 | 1,000 | 49-133 | 49-133 | 20 | 20 |
| Tetrachloroethene | 20 | 1,000 | 26-162 | 26-162 | 20 | 20 |
| Toluene | 20 | 1,000 | 46-148 | 46-148 | 20 | 20 |
| Trichloroethene | 20 | 1,000 | 35-146 | 35-146 | 20 | 20 |
| **METHOD SW8080** | | | | | | |
| gamma-BHC (Lindane) | 0.5 | 16.7 | 56-123 | 46-127 | 15 | 35.4 |
| Heptachlor | 0.5 | 16.7 | 40-131 | 35-130 | 20 | 21.9 |
| Aldrin | 0.5 | 16.7 | 40-120 | 34-132 | 22 | 30.4 |
| Dieldrin | 0.5 | 16.7 | 52-126 | 31-134 | 18 | 26.9 |
| Endrin | 0.5 | 16.7 | 56-121 | 42-139 | 21 | 31.8 |
| 4,4'- DDT | 0.5 | 16.7 | 38-127 | 23-134 | 27 | 35.4 |
| **METHOD SW8080 PCB's** | | | | | | |
| PCB 1260 | 1 | 33.4 | 10-127 | 10-127 | 26.1 | 26.1 |
| **METHOD SW 8150A** | | | | | | |
| 2,4-D | 0.75 | 25 | 20-160 | 20-160 | 40 | 40 |
| 2,4,5-TP (Silvex) | 0.75 | 8.3 | 20-160 | 20-160 | 40 | 40 |
| **GENERAL** | | | | | | |
| Alkalinity E310.1 | N/A | N/A | N/A | N/A | 20 | 20 |
| Kjeldahl Nitrogen (Total) E351.2 | 1,000 | 20,000 | 80-120 | 80-120 | 20 | 20 |
| Phosphorous E 365.4 | 2,500 | 25,000 | 80-120 | 80-120 | 20 | 20 |
| pH SW9040/SW9045A | N/A | N/A | N/A | N/A | 0.2 pH Unit | 0.2 pH Unit |
| **METHOD SW8270A** | | | | | | |
| Phenol | 200 | 6,700 | 12-110 | 26-90 | 42 | 35 |
| 2-Chlorophenol | 200 | 6,700 | 27-123 | 25-102 | 40 | 50 |
| 1,4-Dichlorobenzene | 100 | 3,300 | 36-97 | 28-104 | 28 | 27 |
| N-Nitrosodi-n-propylamine | 100 | 3,300 | 41-116 | 41-126 | 38 | 38 |

## Table A-5. Summary of Tolerance Limits for Matrix Spike Analayses (Continued)

| Analyte | Water Spike Concent Analyte (ug/l) | Soil Spike Concent (ug/kg) | % Recovery | | Precision (RPD) | |
|---|---|---|---|---|---|---|
| | | | Water | Soil | Water | Soil |
| 1,2,4-Trichlorobenzene | 100 | 3,300 | 39-98 | 38-107 | 28 | 23 |
| 4-Chloro-3-Methylphenol | 200 | 6,700 | 23-97 | 26-103 | 42 | 33 |
| Acenaphthene | 100 | 3,300 | 46-118 | 31-137 | 31 | 19 |
| 4-Nitrophenol | 200 | 6,700 | 10-80 | 11-114 | 50 | 50 |
| 2,4-Dinitrotoluene | 100 | 3,300 | 24-96 | 28-89 | 38 | 47 |
| Pentachlorophenol | 200 | 6,700 | 9-103 | 17-103 | 50 | 47 |
| Pyrene | 100 | 3,300 | 26-127 | 35-142 | 31 | 36 |

| Analyte | TCLP Spike Concent (mg/l) | % Recovery | | Precision (RPD) | |
|---|---|---|---|---|---|
| | | Water | Soil | Water | Soil |
| **TCLP-METHOD SW6010A and SW7470** | | | | | |
| Arsenic | 8.0 | N/A | 80-120 | N/A | 20 |
| Barium | 40 | N/A | 80-120 | N/A | 20 |
| Cadmium | 2.0 | N/A | 80-120 | N/A | 20 |
| Chromium | 0.8 | N/A | 80-120 | N/A | 20 |
| Mercury (SW7470) | 0.004 | N/A | 80-120 | N/A | 20 |
| Lead | 8.0 | N/A | 80-120 | N/A | 20 |
| Selenium | 4.0 | N/A | 80-120 | N/A | 20 |
| Silver | 4.0 | N/A | 80-120 | N/A | 20 |
| **TCLP - METHOD SW8240A** | | | | | |
| Benzene | 0.1 | N/A | 76-127 | N/A | 11 |
| 2-Butanone | 0.1 | N/A | 28-180 | N/A | 25 |
| Carbon Tetrachloride | 0.1 | N/A | 70-140 | N/A | 11.3 |
| Chlorobenzene | 0.1 | N/A | 75-130 | N/A | 13 |
| Chloroform | 0.1 | N/A | 51-138 | N/A | 18.2 |
| 1,4-Dichlorobenzene | 0.1 | N/A | 18-190 | N/A | 28.8 |
| 1,2-Dichloroethane | 0.1 | N/A | 49-155 | N/A | 20.6 |
| 1,1-Dichloroethene | 0.1 | N/A | 61-145 | N/A | 14 |
| Trichloroethene | 0.1 | N/A | 71-120 | N/A | 14 |
| Tetrachloroethene | 0.1 | N/A | 64-148 | N/A | 15.6 |
| Vinyl Chloride | 0.1 | N/A | 10-251 | N/A | 65 |

## Table A-5. Summary of Tolerance Limits for Matrix Spike Analayses (Continued)

| Analyte | TCLP Spike Concent (mg/l) | % Recovery | | Precision (RPD) | |
|---|---|---|---|---|---|
| | | Water | Soil | Water | Soil |
| **TCLP - METHOD SW8080** | | | | | |
| gamma-BHC (Lindane) | 1.67 | N/A | 46-127 | N/A | 10.6 |
| Heptachlor | 1.67 | N/A | 35-130 | N/A | 14.1 |
| Heptachlor Epoxide | 1.67 | N/A | 37-142 | N/A | 15.3 |
| Aldrin | 1.67 | N/A | 34-132 | N/A | 15.6 |
| Dieldrin | 1.67 | N/A | 31-134 | N/A | 12.7 |
| Endrin | 1.67 | N/A | 42-139 | N/A | 14.8 |
| 4,4'- DDT | 1.67 | N/A | 23-134 | N/A | 19.1 |
| **TCLP-METHOD SW8150A** | | | | | |
| 2,4-D | 0.0025 | N/A | 20-160 | N/A | 40 |
| 2,4,5-TP (Silvex) | | N/A | 20-160 | N/A | 40 |
| **TCLP - METHOD SW8270A** | | | | | |
| Pyridine | 0.33 | N/A | 10-150 | N/A | 50 |
| 1,4-Dichlorobenzene | 0.33 | N/A | 36-97 | N/A | 27 |
| 2-Methylphenol | 0.33 | N/A | 32-119 | N/A | 34 |
| 3,4-Methylphenol | 0.33 | N/A | 32-119 | N/A | 34 |
| Hexachloroethane | 0.33 | N/A | 40-113 | N/A | 26 |
| Nitrobenzene | 0.33 | N/A | 35-180 | N/A | 39 |
| Hexachlorobutadiene | 0.33 | N/A | 24-116 | N/A | 38 |
| 2,4,6-Trichlorophenol | 0.33 | N/A | 37-144 | N/A | 34 |
| 2,4,5-Trichlorophenol | 0.33 | N/A | 37-144 | N/A | 34 |
| 2,4-Dinitrotoluene | 0.33 | N/A | 24-96 | N/A | 47 |
| Hexachlorobenzene | 0.33 | N/A | 10-152 | N/A | 60 |
| Pentachlorophenol | 0.33 | N/A | 10-103 | N/A | 47 |

N/A = Not Applicable
ug/l = Microgram per Liter
mg/l = Milligram per Liter
ug/kg = Microgram per Kilogram
mg/kg = Milligram per Kilogram
TPH = Total Petroleum Hydrocarbons
BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes
RPD = Relative Percent Difference
[illegible] = Solid Waste
[illegible]LP = Toxicity Characteristic Leaching Procedure

**Table A-6. Summary of Surrogate Spike Tolerance Limits**

| Surrogate Compound | Water (% Recovery) | Soil (% Recovery) |
|---|---|---|
| **METHOD SW8020/8010** | | |
| a,a,a,-Trifluorotoluene | N/A | N/A |
| 1,4-Bromofluorobenzene | 43-133 | 46-133 |
| Bromochloromethane | 68-132 | 54-129 |
| **METHOD SW8240** | | |
| Toluene-$d_8$ | 88-110 | 81-117 |
| 4-Bromofluorobenzene | 86-115 | 74-121 |
| 1,2-Dichloroethane-$d_4$ | 76-114 | 70-121 |
| **METHOD SW8270** | | |
| 2-Fluorobiphenyl | 43-116 | 30-115 |
| 2-Fluorophenol | 21-100 | 25-121 |
| 2,4,6-Tribromophenol | 10-123 | 19-122 |
| Nitrobenzene-$d_5$ | 35-114 | 23-120 |
| p-Terphenyl-$d_{14}$ | 33-141 | 18-137 |
| Phenol-$d_5$ | 10-94 | 24-113 |
| **METHOD SW 8080** | | |
| 2,4,5,6-Tetrachloro-meta-xylene | 19.6-132 | 35.4-126 |
| Dibutychlorendate | 51.2-135 | 23.0-144 |
| **METHOD SW 8150** | | |
| Dichlorophenylacetic acid (DCPAA) | 24-154 | 24-154 |
| **METHOD SW Mod. 8015 TPH as Diesel and Hydrocarbon Screens** | | |
| ortho-Terphenyl | 43.3-126 | 21.5-128 |

N/A = Not Applicable
TPH = Total Petroleum Hydrocarbons

**Table A-7. Laboratory Sample Container and Preservation Requirements**

| Sample Matrix | Reference Method | Analytical Parameter | Sample Containers Type[2] | Required Preservation[1] | Maximum Holding Times[3] |
|---|---|---|---|---|---|
| Soil Samples | SW-846: 8240A | Volatile Organics | a | | 14 day |
| | SW-846: 8270A | Semi-volatile Organics | b | | 7 day to extraction , 40 day |
| | SW-846: Mod.8015 TPH as Gasoline (Volatiles Purge and Trap) | TPH GC/FID | a | | 14 day |
| | SW-846: Mod.8015 TPH as Diesel or Hydrocarbon screen (Extractable) | TPH GC/FID | b | | 14 day ext, 40 day |
| | SW-846: 8080 | Pesticides and PCBs | b | | 7 day to extraction , 40 day |
| | SW-846: 8150A | Chlorinated Herbicides | b | | 7 day to extraction , 40 day |
| | SW-846: 6010A | TAL Metals | a | | 6 months |
| | SW-846: 7060 | Arsenic | a | | 6 months |
| | SW-846: 7470 | Mercury | a | | 28 day |
| | SW-846: 7421 | Lead | a | | 6 months |
| | SW-846: 7740 | Selenium | a | | 6 months |
| | SW-846: 9045 | pH | a | | |
| | ASTM: D-2216 | Soil Moisture | a | | |

**Table A-7. Laboratory Sample Container and Preservation Requirements (Continued)**

| Sample Matrix | Reference Method | Analytical Parameter | Sample Containers Type[2] | Required Preservation[1] | Maximum Holding Times[3] |
|---|---|---|---|---|---|
| Soil Samples | SW-846: 1311/8240A | TCLP Volatiles | b | | 14 day ext, 14 day |
| | SW-846: 1311/8270A | TCLP Semi-volatile | b | | 14 day ext, 7 day prep, 40 day |
| | SW-846: 1311/8080 | TCLP Pesticides | b | | 14 day ext, 7 day prep, 40 day |
| | SW-846: 1311/8150 | TCLP Herbicides | b | | 14 day ext, 7 day prep, 40 day |
| | SW-846:1311/6010A/7000(series) | TCLP Metals and TCLP Mercury | b | | 180 day ext, 180 day<br>28 day ext, 28 day |

**Table A-7. Laboratory Sample Container and Preservation Requirements (Continued)**

| Sample Matrix | Reference Method | Analytical Parameter | Sample Containers Type[2] | Required Preservation[1] | Maximum Holding Times[3] |
|---|---|---|---|---|---|
| Groundwater Samples | SW-846: 8240A | Volatile Organics | c | pH<2, HCl | 14 day |
| | SW-846: 8270A | Semi-volatile Organics | d | | 7 day |
| | SW-846: Mod.8015 TPH as Gasoline (Volatiles Purge and Trap) | TPH GC/FID | c | pH<2, HCl | 14 day |
| | SW-846: Mod.8015 TPH as Diesel | TPH GC/FID | d | pH<2, HCl | 14 day ext, 40 day |
| | or Hydrocarbon Screens (Extractable) | Pesticides and PCBs | d | 5<pH <9 | 7 day ext., 40 day |
| | SW-846: 8080 | Chlorinated Herbicides | d | | 7 day ext., 40 day |
| | SW-846: 8150A | TAL Metals | d | pH<2, $HNO_3$ | 6 months |
| | SW-846: 6010A | Arsenic | d | pH<2, $HNO_3$ | 6 months |
| | SW-846: 7060 | Mercury | d | pH<2, $HNO_3$ | 28 day |
| | SW-846: 7470 | Lead | d | pH<2, $HNO_3$ | 6 months |
| | SW-846: 7421 | Selenium | d | pH<2, $HNO_3$ | 6 months |
| | SW-846: 7740<br>SW-846: 9040 | pH | e | | Analyze Immediately |

**Table A-7. Laboratory Sample Container and Preservation Requirements (Continued)**

[1] - All samples will be cooled to at least 4°C immediately after collection.
[2] - All containers will have Teflon-lined lids. The container volume may vary pending laboratory-specific requirements.
[3] - The hold times for extraction and analysis are the same unless otherwise specified.

Sample containers:
a - 120 ml wide mouth glass jar with a teflon lined lid.
b - 250 ml wide mouth glass jar with a teflon lined lid.
c - 40 ml volatiles organics vial with a teflon lined lid.
d - 1 liter wide mouth amber glass bottle with a teflon lined lid.

# APPENDIX B -- FORMS

Daily Quality Control Report (DQCR)

Nonconformance Report (NCR)

Procedure Change Request Form (PCRF)

Information Request

Malfunction Report

(FIRM NAME)

DAILY QUALITY CONTROL REPORT

Daily Report No.:_____ Date:_____
Contract No.:_____
Project Title & Location:_____
Weather:_____ Precipitation:_____ In.:___ Temp.:_____ Min.:_____ Max.:_

1. Contract/Subcontractors and Area of Responsibility:

| NUMBER | TRADE | HOURS | EMPLOYER | LOCATION/DESCRIPTION WORK |
|---|---|---|---|---|
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| | | | | |

2. Operating Plant or Equipment. (Not hand tools)

| Plant/Equipment | Date of Arrival/ Departure | Date of Safety Check | Hours Used | Hours Idle | Hours Repair |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

3. Work Performed Today: (Indicate location and description of work performed by prime and/or subcontractors. When network analysis is used, identify work by NAS activity number).

_____

4. Control Activities Performed:
Preparatory Inspections: (Identify feature of work and attached minutes).
Initial Inspections: (Identify feature of work and attach minutes).
Follow-Up Inspections: (List inspections performed, results of inspection compared to specification requirements, and corrective actions taken when deficiencies are noted).

5. Tests Performed and Test Results: (Identify test requirement byu paragraph number in specifications and/or sheet number in plans).

6. Material Received: (Note inspection results and storage provided).

7. Submittals Reviewed:

| (a) Submittal No. | (b) Spec/Plan Reference | (c) By Whom | (d) Action |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

8. Off-site Surveillance Activities, Including Action Taken:

9. Job Safety: (List items checked, results, instructions and corrective actions taken).

10.Remarks: (Instructions received or given. Conflicts(s) in Plans and/or specifications. Delays encountered.).

Contractor's Verification: On behalf of the Contractor, I certify this report is complete and correct, and all materials and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications, to the best of my knowledge, except as may be noted above.

CQC System Manager Date

# Nonconformance Report

EBASCO
Quality
Programs
Division

| | |
|---|---|
| Client | NCR No. |
| Project | Date |
| Responsible Contractor | Drawing / Specification No. |
| Applicable Daily Report | |

Description of Component

| Name and Signature | Title and Company | Date |
|---|---|---|

Recommended Disposition

| Name and Signature | Title and Company | Date |
|---|---|---|

Corrective Action

Required ☐ Not Required ☐

Review Proposed Action

Accepted ☐ Rejected ☐ Accepted with Comments ☐

| Name and Signature | Title and Company | Date |
|---|---|---|

Verification of Disposition

Required ☐ Not Required ☐

| Name and Signature | Title and Company | Date |
|---|---|---|

| Inspector (Signature) | Date | Reviewed by | Date |
|---|---|---|---|

*HAFB Form No. 35*
*Rev.2 2.14.95 jb*

# PROCEDURE CHANGE REQUEST FORM

Page ___ of ___

Procedure No._____
Procedure Change Requested:_____

## DESCRIPTION

1. Current Description: (Include SOP No., Page(s), Paragraph No., etc.)

_____
_____
_____
_____
_____
_____
_____
_____
_____

2. Recommended Change:

_____
_____
_____
_____
_____
_____
_____
_____
_____

3. Initiator Signature/Date: _____

4. QA Manager Signature/Date: _____

5. Responsible Project Manager: _____

6. Reason For Change:

_____
_____
_____
_____
_____
_____

## RESOLUTION

7. Is change implemented? Yes: _____ No: _____
8. If yes, attach procedure and mark Procedure Change Notice.

## APPROVAL

9. QA Manager Signature/Date: _____
10. Program Manager Signature/Date: _____

NOTE: All appropriate signatures/dates must be obtained prior to disposition.

## INFORMATION REQUEST

IR #: _____ Distribution Copies To: _____

TO: _____ _____

FROM: _____ _____

DATE: _____ _____

Project Reference: _____ LAB Reference: _____

Information Required:

Support Documentation Required: ☐ Yes ☐ No

Date Information Required: _____

Response:

Follow-up Required: ☐ Yes ☐ No

Additional Comments:

Date Resolved: _____ Verified by: _____

## MALFUNCTION REPORT

Malfunction Report Number_____

Malfunction Type_____
1 - QC Limits Exceeded
2 - Documentation
3 - Other (explain)

Urgency Level_____
1 - Required immediate attention
2 - Should be addressed within 7 days
3 - Requires written explanation within 14 days

Laboratory:_____ Reported to:_____

Location:_____ Position:_____

Contract:_____

Date/Time of Malfunction:_____ Date Reported:_____

Malfunction Reported by:_____

Matrix: ☐ Solid ☐ Water ☐ Air ☐ Other_____

Description of Problem:_____

_____

_____

_____

Action:_____

_____

_____

_____

_____

Date/Time Resolved:_____ By Whom:_____

(Upon completion, send copies to distribution listed and return original to person who reported the malfunction).

Distribution: _____ _____ _____
_____ _____ _____
_____ _____ _____

# APPENDIX C -- GEOTECHNICAL LABORATORY PROCEDURES

# C-1 ASTM Standard D4318-93 Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index Soils

Designation: D 4318 – 93

# Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils[1]

This standard is issued under the fixed designation D 4318; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This test method covers the determination of the liquid limit, plastic limit, and the plasticity index of soils as defined in Section 3.

1.1.1 Two procedures for preparing test specimens are provided as follows: *Wet preparation procedure*, as described in 10.1. *Dry preparation procedure*, as described in 10.2. The procedure to be used shall be specified by the requesting authority. If no procedure is specified, use the wet preparation procedure.

1.1.2 Two methods for determining the liquid limit are provided as follows: *Method A*, Multipoint test as described in Sections 11 and 12. *Method B*, One-point test as described in Sections 14 and 15. The method to be used shall be specified by the requesting authority. If no method is specified, use Method A.

1.1.3 The plastic limit test procedure is described in Sections 16, 17, and 18. The plastic limit test is performed on material prepared for the liquid limit test.

1.1.4 The procedure for calculating the plasticity index is given in Section 19.

1.2 The liquid limit and plastic limit of soils (along with the shrinkage limit) are often collectively referred to as the Atterberg limits. These limits distinguished the boundaries of the several consistency states of plastic soils.

1.3 The multipoint liquid limit method is generally more precise than the one-point method. It is recommended that the multipoint method be used in cases where results may be subject to dispute, or where greater precision is required.

1.4 Because the one-point method requires the operator to judge when the test specimen is approximately at its liquid limit, it is particularly not recommended for use by inexperienced operators.

1.5 The correlations on which the calculations of the one-point method are based may not be valid for certain soils, such as organic soils or soils from a marine environment. It is strongly recommended that the liquid limit of these soils be determined by the multipoint method.

1.6 The liquid and plastic limits of many soils that have been allowed to dry before testing may be considerably different from values obtained on undried samples. If the liquid and plastic limits of soils are used to correlate or estimate the engineering behavior of soils in their natural moist state, samples should not be permitted to dry before testing unless data on dried samples are specifically desired.

1.7 The composition and concentration of soluble salts in a soil affect the values of the liquid and plastic limits as well as the water content values of soils (see Method D 2216). Special consideration should therefore be given to soils from a marine environment or other sources where high soluble salt concentrations may be present. The degree to which the salts present in these soils are diluted or concentrated must be given careful consideration.

1.8 Since the tests described herein are performed only on that portion of a soil which passes the 425-μm (No. 40) sieve, the relative contribution of this portion of the soil to the properties of the sample as a whole must be considered when using these tests to evaluate properties of a soil.

1.9 The values stated in acceptable metric units are to be regarded as the standard. The values given in parentheses are for information only.

1.10 *This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

2.1 *ASTM Standards:*

C 670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials[2]

C 702 Methods for Reducing Field Samples of Aggregate to Testing Size[3]

D 75 Practice for Sampling Aggregates[2]

D 420 Practice for Investigating and Sampling Soil and Rock for Engineering Purposes[2]

D 653 Terminology Relating to Soil, Rock, and Contained Fluids[2]

D 1241 Specification for Materials for Soil-Aggregate Subbase, Base, and Surface Courses[2]

D 2216 Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock[2]

D 2487 Classification of Soils for Engineering Purposes (Unified Soil Classification System)[2]

D 2488 Practice for Description and Identification of Soils (Visual-Manual Procedure)[2]

D 3282 Practice for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes[3]

D 4753 Specification for Evaluating, Selecting, and Specifying Balances and Scales for Use in Soil and Rock Testing[3]

This test method is under the jurisdiction of ASTM Committee D-18 on Soil and Rock and is the direct responsibility of Subcommittee D18.03 on Texture, Plasticity and Density Characteristics of Soils.

Current edition approved Nov. 15, 1993. Published January 1994. Originally published as D 4318 – 83. Last previous edition D 4318 – 83ε1.

[2] *Annual Book of ASTM Standards*, Vol 04.02.

[3] *Annual Book of ASTM Standards*, Vol 04.08.

DIMENSIONS

| LETTER | A[A] | B[A] | C[A] | E[A] | F | G | H | J[A] | K[A] | L[A] | M[A] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 54 ± 0.5 | 2 ± 0.1 | 27 ± 0.5 | 56 ± 2.0 | 32 | 10 | 16 | 60 ± 1.0 | 50 ± 2.0 | 150 ± 2.0 | 125 ± 2.0 |

| LETTER | N | P | R | T | U[A] | V | W | Z |
|---|---|---|---|---|---|---|---|---|
| | 24 | 28 | 24 | 45 | 47 ± 1.0 | 3.8 | 13 | 6.5 |

ESSENTIAL DIMENSIONS

| CAM ANGLE DEGREES | CAM RADIUS |
|---|---|
| 0 | 0.742 R |
| 30 | 0.753 R |
| 60 | 0.764 R |
| 90 | 0.773 R |
| 120 | 0.784 R |
| 150 | 0.796 R |
| 180 | 0.818 R |
| 210 | 0.854 R |
| 240 | 0.901 R |
| 270 | 0.945R |
| 300 | 0.974R |
| 330 | 0.995R |
| 360 | 1.000R |

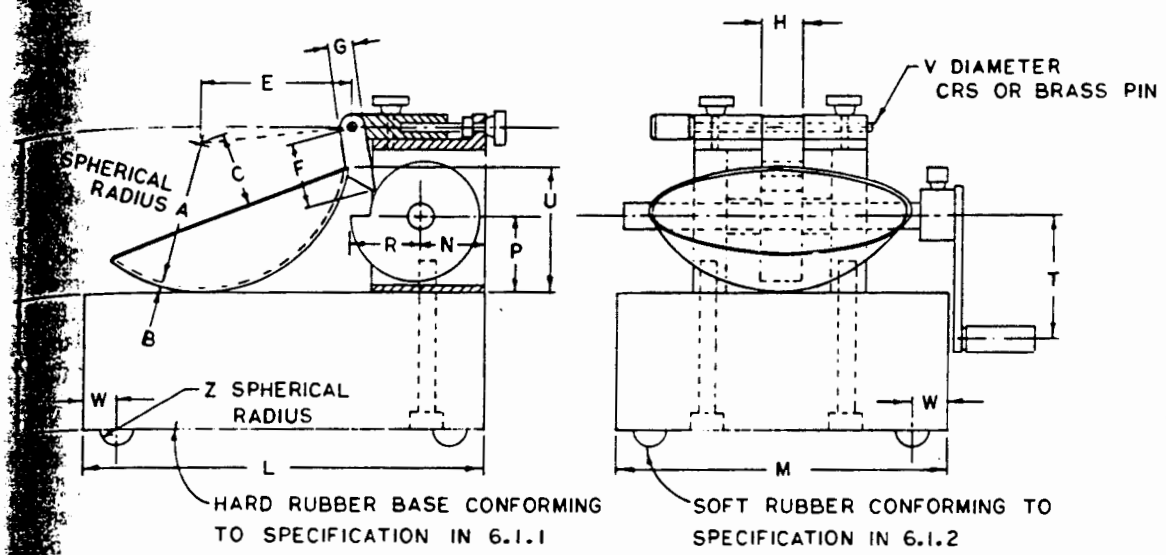



**FIG. 1 Hand-Operated Liquid Limit Device**

the cam. (The preferred cam motion is a uniformly accelerated lift curve.)

NOTE 1—The cam and follower design in Fig. 1 is for uniformly accelerated (parabolic) motion after contact and assures that the cup has no velocity at drop off. Other cam designs also provide this feature and may be used. However, if the cam-follower lift pattern is not known, zero velocity at drop off can be assured by carefully filing or machining the cam and follower so that the cup height remains constant over the last 20 to 45° of cam rotation.

6.1.5 *Carriage*, constructed in a way that allows convenient but secure adjustment of the height of drop of the cup to 10 mm (0.394 in.), and designed such that the cup and cup hanger assembly is only attached to the carriage by means of a removable pin.

6.1.6 *Motor Drive (Optional)*—As an alternative to the hand crank shown in Fig. 1, the device may be equipped with a motor to turn the cam. Such a motor must turn the cam at 2 ± 0.1 revolutions per second and must be isolated from the rest of the device by rubber mounts or in some other way that prevents vibration from the motor being transmitted to the rest of the apparatus. It must be equipped with an ON-OFF switch and a means of conveniently positioning the cam for height of drop adjustments. The results obtained using a motor-driven device must not differ from those obtained using a manually operated device.

6.2 *Flat Grooving Tool*—A tool made of plastic or noncorroding-metal having the dimensions shown in Fig. 2. The design of the tool may vary as long as the essential dimensions are maintained. The tool may, but need not, incorporate the gage for adjusting the height of drop of the liquid limit device.

NOTE 2—Prior to the adoption of this test method, a curved grooving tool was specified as part of the apparatus for performing the liquid limit test. The curved tool is not considered to be as accurate as the flat tool described in 6.2 since it does not control the depth of the soil in the liquid limit cup. However, there are some data which indicate that typically the liquid limit is slightly increased when the flat tool is used instead of the curved tool.

6.3 *Gage*—A metal gage block for adjusting the height of drop of the cup, having the dimensions shown in Fig. 3. The design of the tool may vary provided the gage will rest securely on the base without being susceptible to rocking, and the edge which contacts the cup during adjustment is straight, at least 10 mm (3/8 in.) wide, and without bevel or radius.

6.4 *Containers*—Small corrosion-resistant containers with snug-fitting lids for water content specimens. Aluminum or stainless steel cans 2.5 cm (1 in.) high by 5 cm (2 in.) in diameter are appropriate.

6.5 *Balance*, conforming to Specification D 4753, Class GP1.

6.6 *Storage Container*—A container in which to store the prepared soil specimen that will not contaminate the specimen in any way, and will prevent moisture loss. A porcelain, glass, or plastic dish about 11.4 cm (4½ in.) in diameter and a plastic bag large enough to enclose the dish and be folded over is adequate.

6.7 *Ground Glass Plate*—A ground glass plate at least 30

combine the various components in such proportions that the resultant sample represents the actual construction case.

8.3 Where data from this test method are to be used for correlation with other laboratory or field test data, use the same material as used for these tests where possible.

8.4 Obtain a representative portion from the total sample sufficient to provide 150 to 200 g of material passing the 425-µm (No. 40) sieve. Free flowing samples may be reduced by the methods of quartering or splitting. Cohesive samples shall be mixed thoroughly in a pan with a spatula, or scoop and a representative portion scooped from the total mass by making one or more sweeps with a scoop through the mixed mass.

## 9. Calibration of Apparatus

9.1 *Inspection of Wear:*

9.1.1 *Liquid Limit Device*—Determine that the liquid limit device is clean and in good working order. Check the following specific points.

9.1.1.1 *Wear of Base*—The spot on the base where the cup makes contact should be worn no greater than 10 mm (3/8 in.) in diameter. If the wear spot is greater than this, the base can be machined to remove the worn spot provided the resurfacing does not make the base thinner than specified in 5.1 and the other dimensional relationships are maintained.

9.1.1.2 *Wear of Cup*—Replace the cup when the grooving tool has worn a depression in the cup 0.1 mm (0.004 in.) deep or when the rim of the cup has been reduced to half its original thickness. Verify that the cup is firmly attached to the cup hanger.

9.1.1.3 *Wear of Cup Hanger*—Verify that the cup hanger pivot does not bind and is not worn to an extent that allows more than 3 mm (1/8 in.) side-to-side movement of the lowest point on the rim.

9.1.1.4 *Wear of Cam*—The cam shall not be worn to an extent that the cup drops before the cup hanger (cam follower) loses contact with the cam.

9.1.2 *Grooving Tools*—Inspect grooving tools for wear on a frequent and regular basis. The rapidity of wear depends on the material from which the tool is made and the types of soils being tested. Soils containing a large proportion of sand particles may cause rapid wear of grooving tools; therefore, when testing these materials, tools should be inspected more frequently than for other soils.

NOTE 3—The width of the tip of grooving tools is conveniently checked using a pocket-sized measuring magnifier equipped with a millimetre scale. Magnifiers of this type are available from most laboratory supply companies. The depth of the tip of grooving tools can be checked using the depth measuring feature of vernier calipers.

9.2 *Adjustment of Height of Drop*—Adjust the height of drop of the cup so that the point on the cup that comes in contact with the base rises to a height of 10 ± 0.2 mm. See Fig. 4 for proper location of the gage relative to the cup during adjustment.

NOTE 4—A convenient procedure for adjusting the height of drop is as follows: place a piece of masking tape across the outside bottom of the cup parallel with the axis of the cup hanger pivot. The edge of the tape away from the cup hanger should bisect the spot on the cup that contacts the base. For new cups, placing a piece of carbon paper on the base and allowing the cup to drop several times will mark the contact spot. Attach the cup to the device and turn the crank until the cup is raised to its maximum height. Slide the height gage under the cup from the front, and observe whether the gage contacts the cup or the tape. (See Fig. 4.) If the tape and cup are both contacted, the height of drop is approximately correct. If not, adjust the cup until simultaneous contact is made. Check adjustment by turning the crank at 2 revolutions per second while holding the gage in position against the tape and cup. If a faint ringing or clicking sound is heard without the cup rising from the gage, the adjustment is correct. If no ringing is heard or if the cup rises from the gage, readjust the height of drop. If the cup rocks on the gage during this checking operation, the cam follower pivot is excessively worn and the worn parts should be replaced. Always remove tape after completion of adjustment operation.

## 10. Preparation of Test Specimens

10.1 *Wet Preparation*—Except where the dry method of specimen preparation is specified (10.2), prepare specimens for test as described in the following sections.

10.1.1 *Samples Passing the 425-µm (No. 40) Sieve:*

10.1.1.1 When by visual and manual procedures it is determined that the sample has little or no material retained on a 425-µm (No. 40) sieve, prepare a specimen of 150 to 200 g by mixing thoroughly with distilled or demineralized water on the glass plate using the spatula. If desired, soak the soil in a storage dish with a small amount of water to soften the soil before the start of mixing. Adjust the water content of the soil to bring it to a consistency that would require 25 to 35 blows of the liquid limit device to close the groove (Note 5).

10.1.1.2 If, during mixing, a small percentage of material is encountered that would be retained on a 425-µm (No. 40)

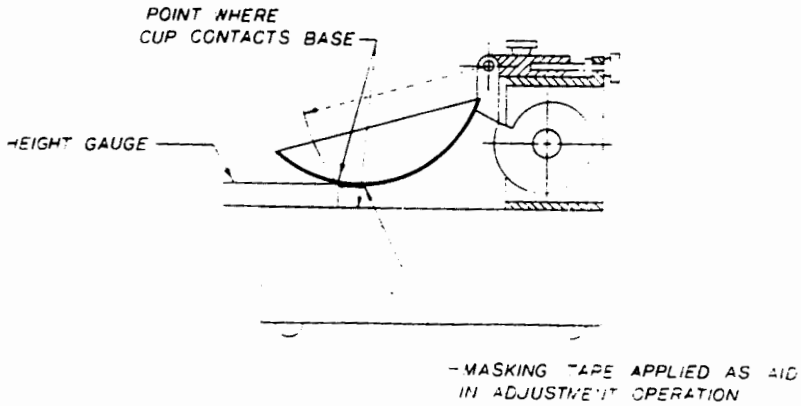



FIG. 4 Calibration for Height of Drop

liquid limit device at the point where the cup rests on the base, squeeze it down, and spread it into the cup to a depth of about 10 mm at its deepest point, tapering to form an approximately horizontal surface. Take care to eliminate air bubbles from the soil pat, but form the pat with as few strokes as possible. Keep the unused soil in the storage dish. Cover the storage dish with a wet towel (or use other means) to retain the moisture in the sample.

11.2 Form a groove in the soil pat by drawing the tool, beveled edge forward, through the soil on a line joining the highest point to the lowest point on the rim of the cup. When cutting the groove, hold the grooving tool against the surface of the cup and draw in an arc, maintaining the tool perpendicular to the surface of the cup throughout its movement. See Fig. 5. In soils where a groove cannot be made in one stroke without tearing the soil, cut the groove with several strokes of the grooving tool. Alternatively, cut the groove to slightly less than required dimensions with a spatula and use the grooving tool to bring the groove to final dimensions. Exercise extreme care to prevent sliding the soil pat relative to the surface of the cup.

11.3 Verify that no crumbs of soil are present on the base or the underside of the cup. Lift and drop the cup by turning the crank at a rate of 1.9 to 2.1 drops per second until the two halves of the soil pat come in contact at the bottom of groove along a distance of 13 mm (½ in.). See Fig. 6.

NOTE 7—Use of a scale is recommended to verify that the groove has closed 13 mm (½ in.)

11.4 Verify that an air bubble has not caused premature closing of the groove by observing that both sides of the groove have flowed together with approximately the same shape. If a bubble has caused premature closing of the groove, reform the soil in the cup, adding a small amount of soil to make up for that lost in the grooving operation and repeat 11.1 to 11.3. If the soil slides on the surface of the cup, repeat 11.1 through 11.3 at a higher water content. If, after several trials at successively higher water contents, the soil pat continues to slide in the cup or if the number of blows required to close the groove is always less than 25, record that the liquid limit could not be determined, and report the soil as nonplastic without performing the plastic limit test.

11.5 Record the number of drops, $N$, required to close the groove. Remove a slice of soil approximately the width of the spatula, extending from edge to edge of the soil cake at right angles to the groove and including that portion of the groove in which the soil flowed together, place in a weighed container, and cover.

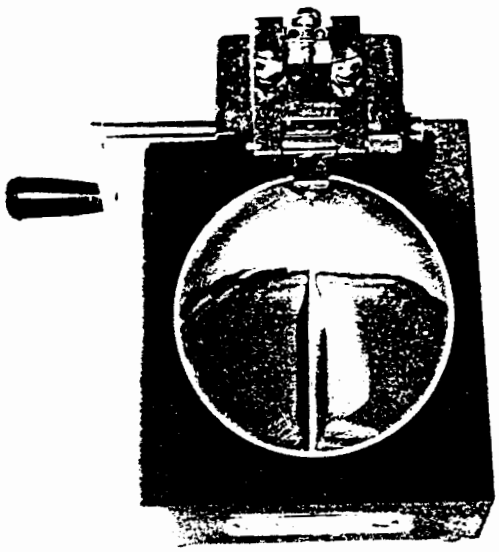
11.6 Return the soil remaining in the cup to the storage dish. Wash and dry the cup and grooving tool and reattach the cup to the carriage in preparation for the next trial.

11.7 Remix the entire soil specimen in the storage dish adding distilled water to increase the water content of the soil and decrease the number of blows required to close the groove. Repeat 11.1 through 11.6 for at least two additional trials producing successively lower numbers of blows to close the groove. One of the trials shall be for a closure requiring 25 to 35 blows, one for closure between 20 and 30 blows, and one trial for a closure requiring 15 to 25 blows.

11.8 Determine the water content, $W^n$, of the soil specimen from each trial in accordance with Test Method D 2216. Initial weighings should be performed immediately after completion of the test. If the test is to be interrupted for more than about 15 minutes, the specimens already obtained should be weighed at the time of the interruption.

## 12. Calculation

12.1 Plot the relationship between the water content, $W^n$, and the corresponding number of drops, $N$, of the cup on a semilogarithmic graph with the water content as ordinates on the arithmetical scale, and the number of drops as abscissas



## PLASTIC LIMIT

### 16. Preparation of Test Specimen

16.1 Select a 20-g portion of soil from the material prepared for the liquid limit test, either after the second mixing before the test, or from the soil remaining after completion of the test. Reduce the water content of the soil to a consistency at which it can be rolled without sticking to the hands by spreading or mixing continuously on the glass plate or in the storage dish. The drying process may be accelerated by exposing the soil to the air current from an electric fan, or by blotting with paper that does not add any fiber to the soil, such as hard surface paper toweling or high wet-strength filter paper.

### 17. Procedure

17.1 From the 20-g mass, select a portion of 1.5 to 2.0 g. Form the test specimen into an ellipsoidal mass. Roll this mass between the palm or fingers and the ground-glass plate with just sufficient pressure to roll the mass into a thread of uniform diameter throughout its length (Note 9). The thread shall be further deformed on each stroke so that its diameter reaches 3.2 mm (1/8 in.), taking no more than 2 min (Note 10). The amount of hand or finger pressure required will vary greatly, according to the soil. Fragile soils of low plasticity are best rolled under the outer edge of the palm or at the base of the thumb.

NOTE 9—A normal rate of rolling for most soils should be 80 to 90 strokes per minute, counting a stroke as one complete motion of the hand forward and back to the starting position. This rate of rolling may have to be decreased for very fragile soils.

NOTE 10—A 3.2-mm (1/8-in.) diameter rod or tube is useful for frequent comparison with the soil thread to ascertain when the thread has reached the proper diameter.

17.1.1 When the diameter of the thread becomes 3.2 mm, break the thread into several pieces. Squeeze the pieces together, knead between the thumb and first finger of each hand, reform into an ellipsoidal mass, and reroll. Continue this alternate rolling to a thread 3.2 mm in diameter, gathering together, kneading and rerolling, until the thread crumbles under the pressure required for rolling and the soil can no longer be rolled into a 3.2-mm diameter thread (see Fig. 7). It has no significance if the thread breaks into threads of shorter length. Roll each of these shorter threads to 3.2 mm in diameter. The only requirement for continuing the test is that they are able to be reformed into an ellipsoidal mass and rolled out again. The operator shall at no time attempt to produce failure at exactly 3.2 mm diameter by allowing the thread to reach 3.2 mm, then reducing the rate of rolling or the hand pressure, or both, while continuing the rolling without further deformation until the thread falls apart. It is permissible, however, to reduce the total amount of deformation for feebly plastic soils by making the initial diameter of the ellipsoidal mass nearer to the required 3.2-mm final diameter. If crumbling occurs when the thread has a diameter greater than 3.2 mm, this shall be considered a satisfactory end point, provided the soil has been previously rolled into a thread 3.2 mm in diameter. Crumbling of the thread will manifest itself differently with the various types of soil. Some soils fall apart in numerous small aggregations of particles, others may form an outside tubular layer that starts splitting at both ends. The splitting progresses toward the middle, and finally, the thread falls apart in many small platy particles. Fat clay soils require much pressure to deform the thread, particularly as they approach the plastic limit. With these soils, the thread breaks into a series of barrel-shaped segments about 3.2 to 9.5 mm (1/8 to 3/8 in.) in length.

17.2 Gather the portions of the crumbled thread together and place in a weighed container. Immediately cover the container.

17.3 Select another 1.5 to 2.0-g portion of soil from the

CLEAR PLASTIC (SUCH AS ACRYLIC)
CAP AND TUBE

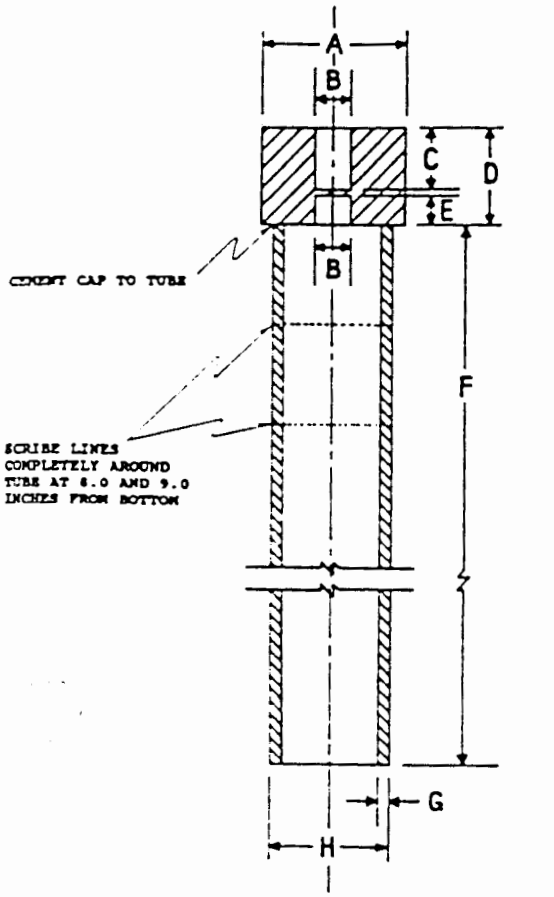



TABLE OF MEASUREMENTS

| DIMENSION | DESCRIPTION | ENGLISH, in. | METRIC, mm |
|---|---|---|---|
| A | DIAM. OF CAP | 1 1/2 | 38.10 |
| B | DIAM. OF HOLE | 3/8 | 9.52 |
| C | DEPTH OF HOLE | 10/16 | 15.88 |
| D | HEIGHT OF CAP | 1 | 25.40 |
| E | DEPTH OF HOLE | 5/16 | 7.94 |
| F | LENGTH OF TUBE | 10 | 254.00 |
| G | WALL THICKNESS | 1/8 | 3.18 |
| H | O.D. OF TUBE | 1 1/4 | 31.75 |

**FIG. X1.1 Resilience Tester**

*The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.*

*This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 1916 Race St., Philadelphia, PA 19103.*

# C-2 ASTM Standard D421-85 (Reapproved 1993) Standard Practice for Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants

# Standard Practice for Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants[1]

This standard is issued under the fixed designation D 421; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the Department of Defense. Consult the DoD Index of Specifications and Standards for the specific year of issue which has been adopted by the Department of Defense.*

$^{\epsilon 1}$ NOTE—Editorial changes were made throughout in September 1993.

## 1. Scope

1.1 This practice covers the dry preparation of soil samples as received from the field for particle-size analysis and the determination of the soil constants.

1.2 *This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

2.1 *ASTM Standards:*

D 2217 Practice for Wet Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants[2]

E 11 Specification for Wire-Cloth Sieves for Testing Purposes[3]

## 3. Significance and Use

3.1 This practice can be used to prepare samples for particle-size and plasticity tests where it is desired to determine test values on air-dried samples, or where it is known that air drying does not have an effect on test results relative to samples prepared in accordance with Practice D 2217.

## 4. Apparatus

4.1 *Balance*, sensitive to 0.1 g.

4.2 *Mortar and Rubber-Covered Pestle*, suitable for breaking up the aggregations of soil particles.

4.3 *Sieves*—A series of sieves, of square mesh woven wire cloth, conforming to Specification E 11. The sieves required are as follows:

No. 4 (4.75-mm)
No. 10 (2.00-mm)
No. 40 (425-μm)

4.4 *Sampler*—A riffle sampler or sample splitter, for quartering the samples.

## 5. Sampling

5.1 Expose the soil sample as received from the field to the air at room temperature until dried thoroughly. Break up the aggregations thoroughly in the mortar with a rubber-covered pestle. Select a representative sample of the amount required to perform the desired tests by the method of quartering or by the use of a sampler. The amounts of material required to perform the individual tests are as follows:

5.1.1 *Particle-Size Analysis*—For the particle-size analysis, material passing a No. 10 (2.00-mm) sieve is required in amounts equal to 115 g of sandy soils and 65 g of either silt or clay soils.

5.1.2 *Tests for Soil Constants*—For the tests for soil constants, material passing the No. 40 (425-μm) sieve is required in total amount of 220 g, allocated as follows:

| Test | Grams |
|---|---|
| Liquid limit | 100 |
| Plastic limit | 15 |
| Centrifuge moisture equivalent | 10 |
| Volumetric shrinkage | 30 |
| Check tests | 65 |

## 6. Preparation of Test Sample

6.1 Select that portion of the air-dried sample selected for purpose of tests and record the mass as the mass of the total test sample uncorrected for hygroscopic moisture. Separate the test sample by sieving with a No. 10 (2.00-mm) sieve. Grind that fraction retained on the No. 10 sieve in a mortar with a rubber-covered pestle until the aggregations of soil particles are broken up into the separate grains. Then separate the ground soil into two fractions by sieving with a No. 10 sieve.

6.2 Wash that fraction retained after the second sieving free of all fine material, dry, and weigh. Record this mass as the mass of coarse material. Sieve the coarse material, after being washed and dried, on the No. 4 (4.75-mm) sieve and record the mass retained on the No. 4 sieve.

## 7. Test Sample for Particle-Size Analysis

7.1 Thoroughly mix together the fractions passing the No. 10 (2.00-mm) sieve in both sieving operations, and by the method of quartering or the use of a sampler, select a portion

[1] This practice is under the jurisdiction of ASTM Committee D-18 on Soil and Rock and is the direct responsibility of Subcommittee D18.03 on Texture, Plasticity, and Density Characteristics of Soils.

Current edition approved July 26, 1985. Published September 1985. Originally published as D 421 – 35 T. Last previous edition D 421 – 58 (1978)$^{\epsilon 1}$.

[2] *Annual Book of ASTM Standards*, Vol 04.08.

[3] *Annual Book of ASTM Standards*, Vol 14.02.

# C-3 ASTM Standard D422-63 (Reapproved 1990) Standard Test Method for Particle-Size Analysis and Determination of Soil Constants

Designation: D 422 – 63 (Reapproved 1990)$^{\epsilon 1}$

# Standard Test Method for Particle-Size Analysis of Soils[1]

This standard is issued under the fixed designation D 422; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

$^{\epsilon 1}$ NOTE—Section 19 was added editorially in September 1990.

## 1. Scope

1.1 This test method covers the quantitative determination of the distribution of particle sizes in soils. The distribution of particle sizes larger than 75 µm (retained on the No. 200 sieve) is determined by sieving, while the distribution of particle sizes smaller than 75 µm is determined by a sedimentation process, using a hydrometer to secure the necessary data (Notes 1 and 2).

NOTE 1—Separation may be made on the No. 4 (4.75-mm), No. 40 (425-µm), or No. 200 (75-µm) sieve instead of the No. 10. For whatever sieve used, the size shall be indicated in the report.

NOTE 2—Two types of dispersion devices are provided: (*1*) a high-speed mechanical stirrer, and (*2*) air dispersion. Extensive investigations indicate that air-dispersion devices produce a more positive dispersion of plastic soils below the 20-µm size and appreciably less degradation on all sizes when used with sandy soils. Because of the definite advantages favoring air dispersion, its use is recommended. The results from the two types of devices differ in magnitude, depending upon soil type, leading to marked differences in particle size distribution, especially for sizes finer than 20 µm.

## 2. Referenced Documents

2.1 *ASTM Standards:*

D 421 Practice for Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants[2]

E 11 Specification for Wire-Cloth Sieves for Testing Purposes[3]

E 100 Specification for ASTM Hydrometers[4]

## 3. Apparatus

3.1 *Balances*—A balance sensitive to 0.01 g for weighing the material passing a No. 10 (2.00-mm) sieve, and a balance sensitive to 0.1 % of the mass of the sample to be weighed for weighing the material retained on a No. 10 sieve.

3.2 *Stirring Apparatus*—Either apparatus A or B may be used.

3.2.1 Apparatus A shall consist of a mechanically operated stirring device in which a suitably mounted electric motor turns a vertical shaft at a speed of not less than 10 000 rpm without load. The shaft shall be equipped with a replaceable stirring paddle made of metal, plastic, or hard rubber, as shown in Fig. 1. The shaft shall be of such length that the stirring paddle will operate not less than ¾ in. (19.0 mm) nor more than 1½ in. (38.1 mm) above the bottom of the dispersion cup. A special dispersion cup conforming to either of the designs shown in Fig. 2 shall be provided to hold the sample while it is being dispersed.

3.2.2 Apparatus B shall consist of an air-jet dispersion cup[5] (Note 3) conforming to the general details shown in Fig. 3 (Notes 4 and 5).

NOTE 3—The amount of air required by an air-jet dispersion cup is of the order of 2 $ft^3$/min; some small air compressors are not capable of supplying sufficient air to operate a cup.

NOTE 4—Another air-type dispersion device, known as a dispersion tube, developed by Chu and Davidson at Iowa State College, has been shown to give results equivalent to those secured by the air-jet dispersion cups. When it is used, soaking of the sample can be done in the sedimentation cylinder, thus eliminating the need for transferring the slurry. When the air-dispersion tube is used, it shall be so indicated in the report.

NOTE 5—Water may condense in air lines when not in use. This water must be removed, either by using a water trap on the air line, or by blowing the water out of the line before using any of the air for dispersion purposes.

3.3 *Hydrometer*—An ASTM hydrometer, graduated to read in either specific gravity of the suspension or grams per litre of suspension, and conforming to the requirements for hydrometers 151H or 152H in Specifications E 100. Dimensions of both hydrometers are the same, the scale being the only item of difference.

3.4 *Sedimentation Cylinder*—A glass cylinder essentially 18 in. (457 mm) in height and 2½ in. (63.5 mm) in diameter, and marked for a volume of 1000 mL. The inside diameter shall be such that the 1000-mL mark is 36 ± 2 cm from the bottom on the inside.

3.5 *Thermometer*—A thermometer accurate to 1°F (0.5°C).

3.6 *Sieves*—A series of sieves, of square-mesh woven-wire cloth, conforming to the requirements of Specification E 11. A full set of sieves includes the following (Note 6):

[1] This test method is under the jurisdiction of ASTM Committee D-18 on Soil and Rock and is the direct responsibility of Subcommittee D18.03 on Texture, Plasticity, and Density Characteristics of Soils.

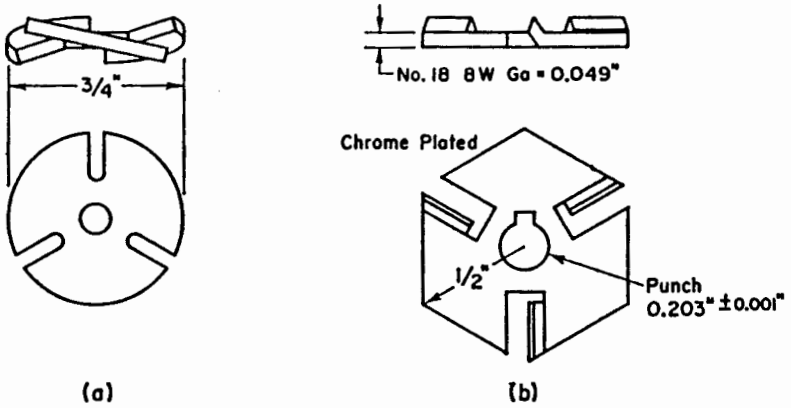
Current edition approved Nov. 21, 1963. Originally published 1935. Replaces D 422 – 62.

[2] *Annual Book of ASTM Standards*, Vol 04.08.

[3] *Annual Book of ASTM Standards*, Vol 14.02.

[4] *Annual Book of ASTM Standards*, Vol 14.03.

[5] Detailed working drawings for this cup are available at a nominal cost from the American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19103. Order Adjunct No. 12-404220-00.




| Metric Equivalents | | | | | |
|---|---|---|---|---|---|
| in. | 0.001 | 0.049 | 0.203 | ½ | ¾ |
| mm | 0.03 | 1.24 | 5.16 | 12.7 | 19.0 |

FIG. 1 Detail of Stirring Paddles

| | |
|---|---|
| 3-in. (75-mm) | No. 10 (2.00-mm) |
| 2-in. (50-mm) | No. 20 (850-µm) |
| 1½-in. (37.5-mm) | No. 40 (425-µm) |
| 1-in. (25.0-mm) | No. 60 (250-µm) |
| ¾-in. (19.0-mm) | No. 140 (106-µm) |
| ⅜-in. (9.5-mm) | No. 200 (75-µm) |
| No. 4 (4.75-mm) | |

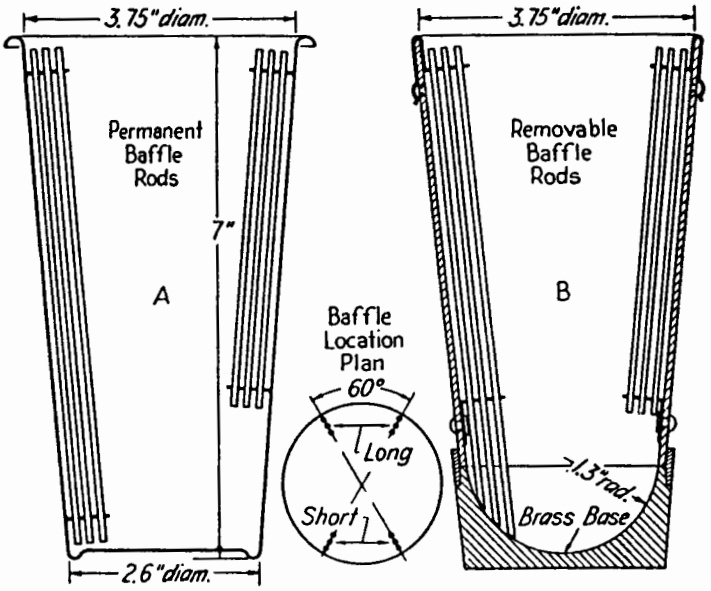
NOTE 6—A set of sieves giving uniform spacing of points for the graph, as required in Section 17, may be used if desired. This set consists of the following sieves:

| | |
|---|---|
| 3-in. (75-mm) | No. 16 (1.18-mm) |
| 1½-in. (37.5-mm) | No. 30 (600-µm) |
| ¾-in. (19.0-mm) | No. 50 (300-µm) |
| ⅜-in. (9.5-mm) | No. 100 (150-µm) |
| No. 4 (4.75-mm) | No. 200 (75-µm) |
| No. 8 (2.36-mm) | |

3.7 *Water Bath or Constant-Temperature Room*—A water bath or constant-temperature room for maintaining the soil suspension at a constant temperature during the hydrometer analysis. A satisfactory water tank is an insulated tank that maintains the temperature of the suspension at a convenient constant temperature at or near 68°F (20°C). Such a device is illustrated in Fig. 4. In cases where the work is performed in a room at an automatically controlled constant temperature, the water bath is not necessary.

3.8 *Beaker*—A beaker of 250-mL capacity.

3.9 *Timing Device*—A watch or clock with a second hand.




| Metric Equivalents | | | |
|---|---|---|---|
| in. | 1.3 | 2.6 | 3.75 |
| mm | 33 | 66 | 95.2 |

FIG. 2 Dispersion Cups of Apparatus

## 4. Dispersing Agent

4.1 A solution of sodium hexametaphosphate (sometimes called sodium metaphosphate) shall be used in distilled or demineralized water, at the rate of 40 g of sodium hexametaphosphate/litre of solution (Note 7).

NOTE 7—Solutions of this salt, if acidic, slowly revert or hydrolyze back to the orthophosphate form with a resultant decrease in dispersive action. Solutions should be prepared frequently (at least once a month) or adjusted to pH of 8 or 9 by means of sodium carbonate. Bottles containing solutions should have the date of preparation marked on them.

4.2 All water used shall be either distilled or demineralized water. The water for a hydrometer test shall be brought to the temperature that is expected to prevail during the hydrometer test. For example, if the sedimentation cylinder is to be placed in the water bath, the distilled or demineralized water to be used shall be brought to the temperature of the controlled water bath; or, if the sedimentation cylinder is used in a room with controlled temperature, the water for the test shall be at the temperature of the room. The basic temperature for the hydrometer test is 68°F (20°C). Small variations of temperature do not introduce differences that are of practical significance and do not prevent the use of corrections derived as prescribed.

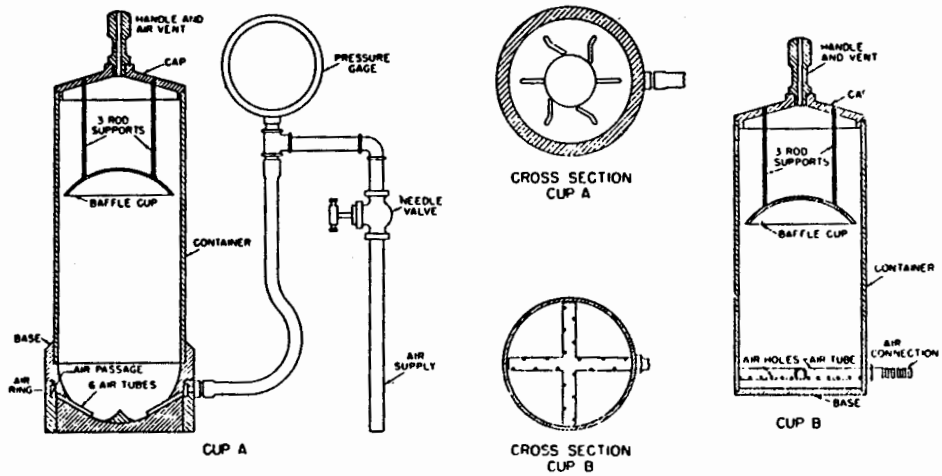



FIG. 3 Air-Jet Dispersion Cups of Apparatus B

## 5. Test Sample

5.1 Prepare the test sample for mechanical analysis as outlined in Practice D 421. During the preparation procedure the sample is divided into two portions. One portion contains only particles retained on the No. 10 (2.00-mm) sieve while the other portion contains only particles passing the No. 10 sieve. The mass of air-dried soil selected for purpose of tests, as prescribed in Practice D 421, shall be sufficient to yield quantities for mechanical analysis as follows:

5.1.1 The size of the portion retained on the No. 10 sieve shall depend on the maximum size of particle, according to the following schedule:

| Nominal Diameter of Largest Particles, in. (mm) | Approximate Minimum Mass of Portion, g |
|---|---|
| ⅜ (9.5) | 500 |
| ¾ (19.0) | 1000 |
| 1 (25.4) | 2000 |
| 1½ (38.1) | 3000 |
| 2 (50.8) | 4000 |
| 3 (76.2) | 5000 |

5.1.2 The size of the portion passing the No. 10 sieve shall be approximately 115 g for sandy soils and approximately 65 g for silt and clay soils.

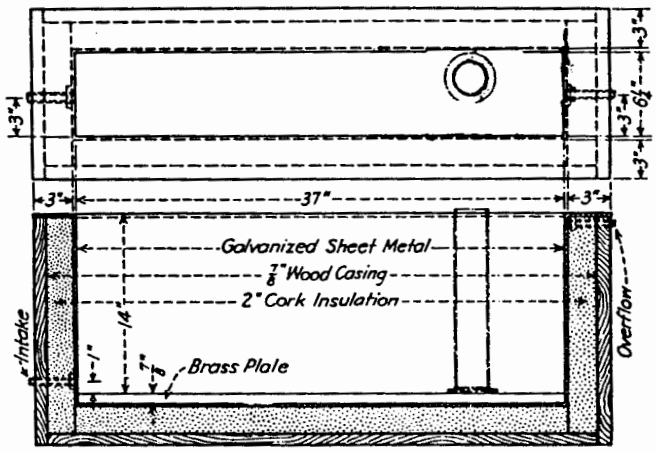
5.2 Provision is made in Section 5 of Practice D 421 for weighing of the air-dry soil selected for purpose of tests, the separation of the soil on the No. 10 sieve by dry-sieving and washing, and the weighing of the washed and dried fraction retained on the No. 10 sieve. From these two masses the percentages retained and passing the No. 10 sieve can be calculated in accordance with 12.1.

NOTE 8—A check on the mass values and the thoroughness of pulverization of the clods may be secured by weighing the portion passing the No. 10 sieve and adding this value to the mass of the washed and oven-dried portion retained on the No. 10 sieve.

### SIEVE ANALYSIS OF PORTION RETAINED ON NO. 10 (2.00-mm) SIEVE

## 6. Procedure

6.1 Separate the portion retained on the No. 10 (2.00-mm) sieve into a series of fractions using the 3-in. (75-mm), 2-in. (50-mm), 1½-in. (37.5-mm), 1-in. (25.0-mm), ¾-in. (19.0-mm), ⅜-in. (9.5-mm), No. 4 (4.75-mm), and No. 10 sieves, or as many as may be needed depending on the sample, or upon the specifications for the material under test.




Metric Equivalents

| in. | ⅞ | 1 | 3 | 6¼ | 14 | 37 |
|---|---|---|---|---|---|---|
| mm | 22.2 | 25.4 | 76.2 | 158.2 | 356 | 940 |

FIG. 4 Insulated Water Bath

6.2 Conduct the sieving operation by means of a lateral and vertical motion of the sieve, accompanied by a jarring action in order to keep the sample moving continuously over the surface of the sieve. In no case turn or manipulate fragments in the sample through the sieve by hand. Continue sieving until not more than 1 mass % of the residue on a sieve passes that sieve during 1 min of sieving. When mechanical sieving is used, test the thoroughness of sieving by using the hand method of sieving as described above.

6.3 Determine the mass of each fraction on a balance conforming to the requirements of 3.1. At the end of weighing, the sum of the masses retained on all the sieves used should equal closely the original mass of the quantity sieved.

HYDROMETER AND SIEVE ANALYSIS OF PORTION PASSING THE NO. 10 (2.00-mm) SIEVE

## 7. Determination of Composite Correction for Hydrometer Reading

7.1 Equations for percentages of soil remaining in suspension, as given in 14.3, are based on the use of distilled or demineralized water. A dispersing agent is used in the water, however, and the specific gravity of the resulting liquid is appreciably greater than that of distilled or demineralized water.

7.1.1 Both soil hydrometers are calibrated at 68°F (20°C), and variations in temperature from this standard temperature produce inaccuracies in the actual hydrometer readings. The amount of the inaccuracy increases as the variation from the standard temperature increases.

7.1.2 Hydrometers are graduated by the manufacturer to be read at the bottom of the meniscus formed by the liquid on the stem. Since it is not possible to secure readings of soil suspensions at the bottom of the meniscus, readings must be taken at the top and a correction applied.

7.1.3 The net amount of the corrections for the three items enumerated is designated as the composite correction, and may be determined experimentally.

7.2 For convenience, a graph or table of composite corrections for a series of 1° temperature differences for the range of expected test temperatures may be prepared and used as needed. Measurement of the composite corrections may be made at two temperatures spanning the range of expected test temperatures, and corrections for the intermediate temperatures calculated assuming a straight-line relationship between the two observed values.

7.3 Prepare 1000 mL of liquid composed of distilled or demineralized water and dispersing agent in the same proportion as will prevail in the sedimentation (hydrometer) test. Place the liquid in a sedimentation cyclinder and the cylinder in the constant-temperature water bath, set for one of the two temperatures to be used. When the temperature of the liquid becomes constant, insert the hydrometer, and, after a short interval to permit the hydrometer to come to the temperature of the liquid, read the hydrometer at the top of the meniscus formed on the stem. For hydrometer 151H the composite correction is the difference between this reading and one; for hydrometer 152H it is the difference between the reading and zero. Bring the liquid and the hydrometer to the other temperature to be used, and secure the composite correction as before.

## 8. Hygroscopic Moisture

8.1 When the sample is weighed for the hydrometer test, weigh out an auxiliary portion of from 10 to 15 g in a small metal or glass container, dry the sample to a constant mass in an oven at 230 ± 9°F (110 ± 5°C), and weigh again. Record the masses.

## 9. Dispersion of Soil Sample

9.1 When the soil is mostly of the clay and silt sizes, weigh out a sample of air-dry soil of approximately 50 g. When the soil is mostly sand the sample should be approximately 100 g.

9.2 Place the sample in the 250-mL beaker and cover with 125 mL of sodium hexametaphosphate solution (40 g/L). Stir until the soil is thoroughly wetted. Allow to soak for at least 16 h.

9.3 At the end of the soaking period, disperse the sample further, using either stirring apparatus A or B. If stirring apparatus A is used, transfer the soil - water slurry from the beaker into the special dispersion cup shown in Fig. 2, washing any residue from the beaker into the cup with distilled or demineralized water (Note 9). Add distilled or demineralized water, if necessary, so that the cup is more than half full. Stir for a period of 1 min.

NOTE 9—A large size syringe is a convenient device for handling the water in the washing operation. Other devices include the wash-water bottle and a hose with nozzle connected to a pressurized distilled water tank.

9.4 If stirring apparatus B (Fig. 3) is used, remove the cover cap and connect the cup to a compressed air supply by means of a rubber hose. A air gage must be on the line between the cup and the control valve. Open the control valve so that the gage indicates 1 psi (7 kPa) pressure (Note 10). Transfer the soil - water slurry from the beaker to the air-jet dispersion cup by washing with distilled or demineralized water. Add distilled or demineralized water, if necessary, so that the total volume in the cup is 250 mL, but no more.

NOTE 10—The initial air pressure of 1 psi is required to prevent the soil - water mixture from entering the air-jet chamber when the mixture is transferred to the dispersion cup.

9.5 Place the cover cap on the cup and open the air control valve until the gage pressure is 20 psi (140 kPa). Disperse the soil according to the following schedule:

| Plasticity Index | Dispersion Period, min |
|---|---|
| Under 5 | 5 |
| 6 to 20 | 10 |
| Over 20 | 15 |

Soils containing large percentages of mica need be dispersed for only 1 min. After the dispersion period, reduce the gage pressure to 1 psi preparatory to transfer of soil - water slurry to the sedimentation cylinder.

## 10. Hydrometer Test

10.1 Immediately after dispersion, transfer the soil - water slurry to the glass sedimentation cylinder, and add distilled or demineralized water until the total volume is 1000 mL.

10.2 Using the palm of the hand over the open end of the cylinder (or a rubber stopper in the open end), turn the cylinder upside down and back for a period of 1 min to complete the agitation of the slurry (Note 11). At the end of 1 min set the cylinder in a convenient location and take hydrometer readings at the following intervals of time (measured from the beginning of sedimentation), or as many as may be needed, depending on the sample or the specification for the material under test: 2, 5, 15, 30, 60, 250, and 1440 min. If the controlled water bath is used, the sedimentation cylinder should be placed in the bath between the 2- and 5-min readings.

NOTE 11—The number of turns during this minute should be approximately 60, counting the turn upside down and back as two turns.

Any soil remaining in the bottom of the cylinder during the first few turns should be loosened by vigorous shaking of the cylinder while it is in the inverted position.

10.3 When it is desired to take a hydrometer reading, carefully insert the hydrometer about 20 to 25 s before the reading is due to approximately the depth it will have when the reading is taken. As soon as the reading is taken, carefully remove the hydrometer and place it with a spinning motion in a graduate of clean distilled or demineralized water.

NOTE 12—It is important to remove the hydrometer immediately after each reading. Readings shall be taken at the top of the meniscus formed by the suspension around the stem, since it is not possible to secure readings at the bottom of the meniscus.

10.4 After each reading, take the temperature of the suspension by inserting the thermometer into the suspension.

## 11. Sieve Analysis

11.1 After taking the final hydrometer reading, transfer the suspension to a No. 200 (75-μm) sieve and wash with tap water until the wash water is clear. Transfer the material on the No. 200 sieve to a suitable container, dry in an oven at 230 ± 9°F (110 ± 5°C) and make a sieve analysis of the portion retained, using as many sieves as desired, or required for the material, or upon the specification of the material under test.

## CALCULATIONS AND REPORT

## 12. Sieve Analysis Values for the Portion Coarser than the No. 10 (2.00-mm) Sieve

12.1 Calculate the percentage passing the No. 10 sieve by dividing the mass passing the No. 10 sieve by the mass of soil originally split on the No. 10 sieve, and multiplying the result by 100. To obtain the mass passing the No. 10 sieve, subtract the mass retained on the No. 10 sieve from the original mass.

12.2 To secure the total mass of soil passing the No. 4 (4.75-mm) sieve, add to the mass of the material passing the No. 10 sieve the mass of the fraction passing the No. 4 sieve and retained on the No. 10 sieve. To secure the total mass of soil passing the ⅜-in. (9.5-mm) sieve, add to the total mass of soil passing the No. 4 sieve, the mass of the fraction passing the ⅜-in. sieve and retained on the No. 4 sieve. For the remaining sieves, continue the calculations in the same manner.

12.3 To determine the total percentage passing for each sieve, divide the total mass passing (see 12.2) by the total mass of sample and multiply the result by 100.

## 13. Hygroscopic Moisture Correction Factor

13.1 The hydroscopic moisture correction factor is the ratio between the mass of the oven-dried sample and the air-dry mass before drying. It is a number less than one, except when there is no hygroscopic moisture.

## 14. Percentages of Soil in Suspension

14.1 Calculate the oven-dry mass of soil used in the hydrometer analysis by multiplying the air-dry mass by the hygroscopic moisture correction factor.

14.2 Calculate the mass of a total sample represented by the mass of soil used in the hydrometer test, by dividing the oven-dry mass used by the percentage passing the No. 10 (2.00-mm) sieve, and multiplying the result by 100. This value is the weight $W$ in the equation for percentage remaining in suspension.

**TABLE 1 Values of Correction Factor, $a$, for Different Specific Gravities of Soil Particles[A]**

| Specific Gravity | Correction Factor[A] |
|---|---|
| 2.95 | 0.94 |
| 2.90 | 0.95 |
| 2.85 | 0.96 |
| 2.80 | 0.97 |
| 2.75 | 0.98 |
| 2.70 | 0.99 |
| 2.65 | 1.00 |
| 2.60 | 1.01 |
| 2.55 | 1.02 |
| 2.50 | 1.03 |
| 2.45 | 1.05 |

[A] For use in equation for percentage of soil remaining in suspension when using Hydrometer 152H.

14.3 The percentage of soil remaining in suspension at the level at which the hydrometer is measuring the density of the suspension may be calculated as follows (Note 13): For hydrometer 151H:

$$P = [(100\,000/W) \times G/(G - G_1)](R - G_1)$$

NOTE 13—The bracketed portion of the equation for hydrometer 151H is constant for a series of readings and may be calculated first and then multiplied by the portion in the parentheses.

For hydrometer 152H:

$$P = (Ra/W) \times 100$$

where:

$a$ = correction faction to be applied to the reading of hydrometer 152H. (Values shown on the scale are computed using a specific gravity of 2.65. Correction factors are given in Table 1),

$P$ = percentage of soil remaining in suspension at the level at which the hydrometer measures the density of the suspension,

$R$ = hydrometer reading with composite correction applied (Section 7),

$W$ = oven-dry mass of soil in a total test sample represented by mass of soil dispersed (see 14.2), g,

$G$ = specific gravity of the soil particles, and

$G_1$ = specific gravity of the liquid in which soil particles are suspended. Use numerical value of one in both instances in the equation. In the first instance any possible variation produces no significant effect, and in the second instance, the composite correction for $R$ is based on a value of one for $G_1$.

## 15. Diameter of Soil Particles

15.1 The diameter of a particle corresponding to the percentage indicated by a given hydrometer reading shall be calculated according to Stokes' law (Note 14), on the basis that a particle of this diameter was at the surface of the suspension at the beginning of sedimentation and had settled to the level at which the hydrometer is measuring the density of the suspension. According to Stokes' law:

$$D = \sqrt{[30n/980(G - G_1)] \times L/T}$$

where:

$D$ = diameter of particle, mm,

$n$ = coefficient of viscosity of the suspending medium (in this case water) in poises (varies with changes in temperature of the suspending medium),

$L$ = distance from the surface of the suspension to the level at which the density of the suspension is being measured, cm. (For a given hydrometer and sedimentation cylinder, values vary according to the hydrometer readings. This distance is known as effective depth (Table 2)),

$T$ = interval of time from beginning of sedimentation to the taking of the reading, min,

$G$ = specific gravity of soil particles, and

$G_l$ = specific gravity (relative density) of suspending medium (value may be used as 1.000 for all practical purposes).

NOTE 14—Since Stokes' law considers the terminal velocity of a single sphere falling in an infinity of liquid, the sizes calculated represent the diameter of spheres that would fall at the same rate as the soil particles.

15.2 For convenience in calculations the above equation may be written as follows:

$$D = K\sqrt{L/T}$$

where:

$K$ = constant depending on the temperature of the suspension and the specific gravity of the soil particles. Values of $K$ for a range of temperatures and specific gravities are given in Table 3. The value of $K$ does not change for a series of readings constituting a test, while values of $L$ and $T$ do vary.

15.3 Values of $D$ may be computed with sufficient accuracy, using an ordinary 10-in. slide rule.

NOTE 15—The value of $L$ is divided by $T$ using the $A$- and $B$-scales, the square root being indicated on the $D$-scale. Without ascertaining the value of the square root it may be multiplied by $K$, using either the $C$- or $CI$-scale.

## 16. Sieve Analysis Values for Portion Finer than No. 10 (2.00-mm) Sieve

16.1 Calculation of percentages passing the various sieves used in sieving the portion of the sample from the hydrometer test involves several steps. The first step is to calculate the mass of the fraction that would have been retained on the No. 10 sieve had it not been removed. This mass is equal to the total percentage retained on the No. 10 sieve (100 minus total percentage passing) times the mass of the total sample represented by the mass of soil used (as calculated in 14.2), and the result divided by 100.

16.2 Calculate next the total mass passing the No. 200 sieve. Add together the fractional masses retained on all the sieves, including the No. 10 sieve, and subtract this sum from the mass of the total sample (as calculated in 14.2).

16.3 Calculate next the total masses passing each of the other sieves, in a manner similar to that given in 12.2.

16.4 Calculate last the total percentages passing by dividing the total mass passing (as calculated in 16.3) by the total mass of sample (as calculated in 14.2), and multiply the result by 100.

## 17. Graph

17.1 When the hydrometer analysis is performed, a graph of the test results shall be made, plotting the diameters of the particles on a logarithmic scale as the abscissa and the percentages smaller than the corresponding diameters to an

**TABLE 2 Values of Effective Depth Based on Hydrometer and Sedimentation Cylinder of Specified Sizes[A]**

| Hydrometer 151H | | Hydrometer 152H | | | |
|---|---|---|---|---|---|
| Actual Hydrometer Reading | Effective Depth, $L$, cm | Actual Hydrometer Reading | Effective Depth, $L$, cm | Actual Hydrometer Reading | Effective Depth, $L$, cm |
| 1.000 | 16.3 | 0 | 16.3 | 31 | 11.2 |
| 1.001 | 16.0 | 1 | 16.1 | 32 | 11.1 |
| 1.002 | 15.8 | 2 | 16.0 | 33 | 10.9 |
| 1.003 | 15.5 | 3 | 15.8 | 34 | 10.7 |
| 1.004 | 15.2 | 4 | 15.6 | 35 | 10.6 |
| 1.005 | 15.0 | 5 | 15.5 | | |
| 1.006 | 14.7 | 6 | 15.3 | 36 | 10.4 |
| 1.007 | 14.4 | 7 | 15.2 | 37 | 10.2 |
| 1.008 | 14.2 | 8 | 15.0 | 38 | 10.1 |
| 1.009 | 13.9 | 9 | 14.8 | 39 | 9.9 |
| 1.010 | 13.7 | 10 | 14.7 | 40 | 9.7 |
| 1.011 | 13.4 | 11 | 14.5 | 41 | 9,6 |
| 1.012 | 13.1 | 12 | 14.3 | 42 | 9.4 |
| 1.013 | 12.9 | 13 | 14.2 | 43 | 9.2 |
| 1.014 | 12.6 | 14 | 14.0 | 44 | 9.1 |
| 1.015 | 12.3 | 15 | 13.8 | 45 | 8.9 |
| 1.016 | 12.1 | 16 | 13.7 | 46 | 8.8 |
| 1.017 | 11.8 | 17 | 13.5 | 47 | 8.6 |
| 1.018 | 11.5 | 18 | 13.3 | 48 | 8.4 |
| 1.019 | 11.3 | 19 | 13.2 | 49 | 8.3 |
| 1.020 | 11.0 | 20 | 13.0 | 50 | 8.1 |
| 1.021 | 10.7 | 21 | 12.9 | 51 | 7.9 |
| 1.022 | 10.5 | 22 | 12.7 | 52 | 7.8 |
| 1.023 | 10.2 | 23 | 12.5 | 53 | 7.6 |
| 1.024 | 10.0 | 24 | 12.4 | 54 | 7.4 |
| 1.025 | 9.7 | 25 | 12.2 | 55 | 7.3 |
| 1.026 | 9.4 | 26 | 12.0 | 56 | 7.1 |
| 1.027 | 9.2 | 27 | 11.9 | 57 | 7.0 |
| 1.028 | 8.9 | 28 | 11.7 | 58 | 6.8 |
| 1.029 | 8.6 | 29 | 11.5 | 59 | 6.6 |
| 1.030 | 8.4 | 30 | 11.4 | 60 | 6.5 |
| 1.031 | 8.1 | | | | |
| 1.032 | 7.8 | | | | |
| 1.033 | 7.6 | | | | |
| 1.034 | 7.3 | | | | |
| 1.035 | 7.0 | | | | |
| 1.036 | 6.8 | | | | |
| 1.037 | 6.5 | | | | |
| 1.038 | 6.2 | | | | |

[A] Values of effective depth are calculated from the equation:

$$L = L_1 + \tfrac{1}{2}\,[L_2 - (V_B/A)]$$

where:

$L$ = effective depth, cm,

$L_1$ = distance along the stem of the hydrometer from the top of the bulb to the mark for a hydrometer reading, cm,

$L_2$ = overall length of the hydrometer bulb, cm,

$V_B$ = volume of hydrometer bulb, $cm^3$, and

$A$ = cross-sectional area of sedimentation cylinder, $cm^2$

Values used in calculating the values in Table 2 are as follows:

For both hydrometers, 151H and 152H:

$L_2$ = 14.0 cm

$V_B$ = 67.0 $cm^3$

$A$ = 27.8 $cm^2$

For hydrometer 151H:

$L_1$ = 10.5 cm for a reading of 1.000

= 2.3 cm for a reading of 1.031

For hydrometer 152H:

$L_1$ = 10.5 cm for a reading of 0 g/litre

= 2.3 cm for a reading of 50 g/litre

TABLE 3 Values of K for Use in Equation for Computing Diameter of Particle in Hydrometer Analysis

| Temperature, °C | Specific Gravity of Soil Particles | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2.45 | 2.50 | 2.55 | 2.60 | 2.65 | 2.70 | 2.75 | 2.80 | 2.85 |
| 16 | 0.01510 | 0.01505 | 0.01481 | 0.01457 | 0.01435 | 0.01414 | 0.01394 | 0.01374 | 0.01356 |
| 17 | 0.01511 | 0.01486 | 0.01462 | 0.01439 | 0.01417 | 0.01396 | 0.01376 | 0.01356 | 0.01338 |
| 18 | 0.01492 | 0.01467 | 0.01443 | 0.01421 | 0.01399 | 0.01378 | 0.01359 | 0.01339 | 0.01321 |
| 19 | 0.01474 | 0.01449 | 0.01425 | 0.01403 | 0.01382 | 0.01361 | 0.01342 | 0.1323 | 0.01305 |
| 20 | 0.01456 | 0.01431 | 0.01408 | 0.01386 | 0.01365 | 0.01344 | 0.01325 | 0.01307 | 0.01289 |
| 21 | 0.01438 | 0.01414 | 0.01391 | 0.01369 | 0.01348 | 0.01328 | 0.01309 | 0.01291 | 0.01273 |
| 22 | 0.01421 | 0.01397 | 0.01374 | 0.01353 | 0.01332 | 0.01312 | 0.01294 | 0.01276 | 0.01258 |
| 23 | 0.01404 | 0.01381 | 0.01358 | 0.01337 | 0.01317 | 0.01297 | 0.01279 | 0.01261 | 0.01243 |
| 24 | 0.01388 | 0.01365 | 0.01342 | 0.01321 | 0.01301 | 0.01282 | 0.01264 | 0.01246 | 0.01229 |
| 25 | 0.01372 | 0.01349 | 0.01327 | 0.01306 | 0.01286 | 0.01267 | 0.01249 | 0.01232 | 0.01215 |
| 26 | 0.01357 | 0.01334 | 0.01312 | 0.01291 | 0.01272 | 0.01253 | 0.01235 | 0.01218 | 0.01201 |
| 27 | 0.01342 | 0.01319 | 0.01297 | 0.01277 | 0.01258 | 0.01239 | 0.01221 | 0.01204 | 0.01188 |
| 28 | 0.01327 | 0.01304 | 0.01283 | 0.01264 | 0.01244 | 0.01255 | 0.01208 | 0.01191 | 0.01175 |
| 29 | 0.01312 | 0.01290 | 0.01269 | 0.01249 | 0.01230 | 0.01212 | 0.01195 | 0.01178 | 0.01162 |
| 30 | 0.01298 | 0.01276 | 0.01256 | 0.01236 | 0.01217 | 0.01199 | 0.01182 | 0.01165 | 0.01149 |

arithmetic scale as the ordinate. When the hydrometer analysis is not made on a portion of the soil, the preparation of the graph is optional, since values may be secured directly from tabulated data.

## 18. Report

18.1 The report shall include the following:

18.1.1 Maximum size of particles,

18.1.2 Percentage passing (or retained on) each sieve, which may be tabulated or presented by plotting on a graph (Note 16),

18.1.3 Description of sand and gravel particles:

18.1.3.1 Shape—rounded or angular,

18.1.3.2 Hardness—hard and durable, soft, or weathered and friable,

18.1.4 Specific gravity, if unusually high or low,

18.1.5 Any difficulty in dispersing the fraction passing the No. 10 (2.00-mm) sieve, indicating any change in type and amount of dispersing agent, and

18.1.6 The dispersion device used and the length of the dispersion period.

NOTE 16—This tabulation of graph represents the gradation of the sample tested. If particles larger than those contained in the sample were removed before testing, the report shall so state giving the amount and maximum size.

18.2 For materials tested for compliance with definite specifications, the fractions called for in such specifications shall be reported. The fractions smaller than the No. 10 sieve shall be read from the graph.

18.3 For materials for which compliance with definite specifications is not indicated and when the soil is composed almost entirely of particles passing the No. 4 (4.75-mm) sieve, the results read from the graph may be reported as follows:

(*1*) Gravel, passing 3-in. and retained on No. 4 sieve ..... %
(*2*) Sand, passing No. 4 sieve and retained on No. 200 sieve ..... %
(*a*) Coarse sand, passing No. 4 sieve and retained on No. 10 sieve ..... %
(*b*) Medium sand, passing No. 10 sieve and retained on No. 40 sieve ..... %
(*c*) Fine sand, passing No. 40 sieve and retained on No. 200 sieve ..... %
(*3*) Silt size, 0.074 to 0.005 mm ..... %
(*4*) Clay size, smaller than 0.005 mm ..... %
Colloids, smaller than 0.001 mm ..... %

18.4 For materials for which compliance with definite specifications is not indicated and when the soil contains material retained on the No. 4 sieve sufficient to require a sieve analysis on that portion, the results may be reported as follows (Note 17):

SIEVE ANALYSIS

| Sieve Size | Percentage Passing |
|---|---|
| 3-in. | ..... |
| 2-in. | ..... |
| 1½-in. | ..... |
| 1-in. | ..... |
| ¾-in. | ..... |
| ⅜-in. | ..... |
| No. 4 (4.75-mm) | ..... |
| No. 10 (2.00-mm) | ..... |
| No. 40 (425-μm) | ..... |
| No. 200 (75-μm) | ..... |
| HYDROMETER ANALYSIS | |
| 0.074 mm | ..... |
| 0.005 mm | ..... |
| 0.001 mm | ..... |

NOTE 17—No. 8 (2.36-mm) and No. 50 (300-μm) sieves may be substituted for No. 10 and No. 40 sieves.

## 19. Keywords

19.1 grain-size; hydrometer analysis; hygroscopic moisture; particle-size; sieve analysis

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# SITE SAFETY AND HEALTH PLAN

**FOR**

**PRELIMINARY ASSESSMENTS/SITE INVESTIGATIONS**
**AT WASTE SITES**
**SS-06, SD-15, AOC-BBMS, AND AOC-RR**
**HOLLOMAN AIR FORCE BASE, NEW MEXICO**

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U.S. Army Corps of Engineers
Omaha District
Omaha, Nebraska

February 1995

## SITE SAFETY AND HEALTH PLAN APPROVAL

This Site Safety and Health Plan (SSHP) was developed to outline health and safety guidelines and procedures for the Preliminary Assessment/Site Investigation (PA/SI) activities under Delivery Order (DO) No. 1, Work Authorization Directives (WAD) Nos. 3, 5, and 9 at Holloman Air Force Base (AFB), New Mexico. The signatures below indicate concurrence with the procedures specified in the plan and a commitment to the philosophy of quality to all project personnel.

William L. Hughes, Lead Geologist, Groundwater Technology Government Services, Inc.

Signature _____ Date _____

Sara C. Brothers, Project Manager, Groundwater Technology Government Services, Inc.

Signature _____ Date _____

Stephen Venuti, Certified Industrial Hygienist, Groundwater Technology Government Services, Inc.

Signature _____ Date _____

Diane Morrell, Certified Industrial Hygienist, Foster Wheeler Environmental Services, Inc.

Signature _____ Date _____

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## LIST OF ACRONYMS

| | |
|---|---|
| ACGIH | American Conference of Governmental Industrial Hygienists |
| AFB | Air Force Base |
| CFR | Code of Federal Regulations |
| CIH | Certified Industrial Hygienist |
| CPR | Cardio-pulmonary Resuscitation |
| CSP | Certified Safety Professional |
| CET | Certified Environmental Trainer |
| CIH | Certified Industrial Hygienist |
| COHN | Certified Occupational Health Nurse |
| CY | Cubic Yards |
| DOT | Department of Transportation |
| EPA | Environmental Protection Agency |
| FID | Flame Ionization Detector |
| EMS | Emergency Medial Services |
| HEPA | High Efficiency Particulate Air-Purifying |
| HSM | Health Safety Manager |
| IDLH | Immediately Dangerous to Life or Health |
| JSA | Job Safety Analysis |
| LEL | Lower Explosive Limit |
| MD | Medical Doctor |
| MSDS | Material Safety Data Sheet |
| NBR | Nitrile Butyl Rubber |
| NIOSH | National Institute for Occupational Safety and Health |
| NMED | New Mexico Environmental Department |
| OSHA | Occupational Safety and Health Administration |
| PA/SI | Preliminary Assessment/Site Investigation |
| PEL | Permissible Exposure Limit |
| PID | Photoionization Detector |
| PIR | Preliminary Incident Report |
| PM | Project Manager |

## LIST OF ACRONYMS (CONTINUED)

| | |
|---|---|
| POC | Point of Contact |
| ppb | parts per billion |
| PPE | Personal Protection Equipment |
| ppm | parts per million |
| SHSO | Site Health and Safety Officer |
| SSHP | Site Health and Safety Plan |
| SOSP | Standard Operating Safety Procedures |
| SWMU | Solid Waste Management Unit |
| TAL | Target Analyte List |
| TBA | To Be Announced |
| TM | Task Manager |
| TLV | Threshold Limit Value |
| USACE | United States Army Corps of Engineers |
| WAD | Work Authorization Directive |

# 1.0 INTRODUCTION

## 1.1 Site Safety and Health Plan Purpose

Groundwater Technology Government Services, Inc. (Groundwater Technology) has been retained by Foster Wheeler Environmental Services, Inc. (Foster Wheeler) (MOA DENS-94-1159JM) to perform environmental services for the United States Army Corps of Engineers (USACE), Omaha District, Total Environmental Restoration Contract (TERC), Contract No. DACW45-94-D0003, DO No. 1, WAD Nos. 3, 5, and 9.

The purpose of this SSHP is to provide Groundwater Technology field personnel, subcontractors and other visitors with an understanding of the potential chemical, physical and related hazards that exist or may arise while the tasks of this project are being performed.

### *1.1.1 Overview of Project Scope, Hazards and Levels-of-Protection*

| | |
|---|---|
| SCOPE: | Use of Geo-Probe drilling rig for the collection of soil gas survey points, soil samples, and hydropunch groundwater samples. |
| HAZARD SUMMARY:<br>• Chemical<br>• Physical<br>• Biological<br>• Other (Radiological, etc.) | Low (petroleum hydrocarbons and metals)/Moderate (Skin contact; sulfuric acid in soils)<br>Moderate<br>Not anticipated<br>Not anticipated |
| LEVEL(s)-OF-PROTECTION: | Level D/Level C Upgrade Contingency |
| CLIENT OR OWNER: | United States Army Corps of Engineers, Omaha District |
| SITE NAME: | SS-06, SD-15, AOC-BBMS, and AOC-RR - Holloman AFB |
| SITE ADDRESS: | Holloman AFB, New Mexico |
| PROJECT NUMBER: | 830012201 |
| PROJECT MANAGER: | Sara C. Brothers |
| DATE(S) OF SITE WORK: | March 1995 through April 1995<br>(0730-1630, Monday through Friday) |
| SITE SIZE: | Four sites within approximately 4 square miles. |
| SITE TOPOGRAPHY: | Relatively flat lying |
| SITE WEATHER: | Mostly sunny, temperature in high 40s to low 80s (spring). |
| SITE DESCRIPTION/HISTORY: | Holloman AFB is located in south-central New Mexico, approximately 5 miles southwest of the city of Alamagordo. Groundwater Technology has been contracted to conduct a PA/SI at four sites. |

## 1.2 Document Hierarchy/Regulatory Basis

This SSHP is prepared in accordance with OSHA 29 CFR 1910.120 and the USACE Safety and Health Requirements Manual EM 385-1-1, and is designed to be consistent with Groundwater Technology's Corporate Health & Safety Program and Foster Wheeler's Site Specific/Corporate Health and Safety Program. This SSHP describes the procedures to be followed in order to reduce employee exposure to potential health hazards which may be present at the project site. The emergency response procedures necessary to respond to such hazards are also described within this SSHP.

## 1.3 Scope of Work

WAD Nos. 3, 5, and 9 of DO No. 1 consists of PA/SI work at two sites (AOC-BBMS and AOC-RR) and site investigation (SI) work at two sites (SS-06 and SD-15) at Holloman AFB, New Mexico.

## 1.4 Site Location, History and Description

A summary of the WADs and a description of each of the sites is presented in this section. Maps showing the soil boring, monitoring wells, and soil gas surveys are presented in Appendix D. A more detailed description of the sites is presented in the work plan.

### *1.4.1 Site SS-06 Fuel Line Spill Site No. 2*

In 1979, approximately 8,000 gallons of JP-4 were spilled onto the ground at this site. The spill area was located 500 feet from the base boundary and 500 feet from the nearest drainage ditch. The site is also situated approximately 200 feet south of a petroleum, oils and lubricants (POL) storage area. Clean-up operations commenced immediately and the majority of the fuel was recovered.

The SI will consist of a soil gas survey, installation of up to 12 soil borings using a Geo-Probe drilling rig and the collection of 12 soil samples and 6 groundwater samples.

### *1.4.2 Site SD-15-Refrigeration/Heat Shop Washrack (SWMU-82)*

This site consists of approximately 50 square feet and is located in the Civil Engineering Complex. From 1971 to 1981, sulfuric acid was utilized to de-scale cooling system equipment. The rinsewater was discharged to a septic tank drain field. The washrack is located 2,200 feet from the base boundary and less than 25 feet to the near surface drainage ditch.

The SI will consist of the installation of 6 soil borings using a Geo-Probe drilling rig and collection of 6 groundwater samples. Groundwater samples will be analyzed at the site using a mobile analytical laboratory. If the groundwater samples contain chemical of concern concentrations greater than site regulatory action levels, up to 10 soil borings will be installed for the collection of soil samples and 5 groundwater samples. In addition, four monitoring wells may be installed for the collection of groundwater samples.

### *1.4.3 Site AOC-BBMS/Generator Run-up Area*

The Bare Base Mobility Squadron (BBMS)/Generator Run-up Area is located in the southwestern portion of the Base. The generator run-up area is situated east of Building 933 and southwest of Building 902. In 1984, approximately 2,000 to 3,000 gallons of JP-4 was released when a valve was inadvertently left open. Only 400 gallons of JP-4 was recovered. The purpose of the PA is to collect information about the conditions at the site so that the potential threat to human health and the environment may be assessed and so that the proposed site investigation activities may be fully outlined.

The SI will consist of a soil gas survey, installation of 12 soil borings using a Geo-Probe drilling rig and the collection of soil samples and 6 groundwater samples. If the groundwater samples contain chemicals of concern concentrations greater than site regulatory action levels, up to 10 borings will be installed using a Geo-Probe drill rig for the

collection of soil and 5 groundwater samples. In addition, four monitoring wells may be installed for the collection of groundwater samples.

### *1.4.4 Site AOC-RR*

The site is located approximately 50 feet west of Installation Restoration Program (IRP) Site SD-08 near the eastern boundary of the base in the main base area. The site consists of Building 80 which historically was used as a shop for locomotive repair. Within Building 80 is a former repair pit that was 52 feet long which was used to access the bottom of locomotives. Historical drawings of the pit indicate that an open bottom french drain was used to drain fluids that collected at the bottom. The pit was abandoned by placing engineered fill and capping with concrete. No information was provided to Groundwater Technology regarding the liquid wastes generated during the repair of the locomotives.

The SI will consist of soil gas survey, installation of 16 soil borings using a Geo-Probe drilling rig for the collection of soil samples and 10 groundwater samples. If the groundwater samples contain chemicals of concern of concentrations greater than site regulatory action levels, up to 10 soil borings will be installed for the collection of soil samples and 5 groundwater samples. Eight monitoring wells may also be installed for the collection of groundwater samples.

# 2.0 ORGANIZATION/KEY PERSONNEL and RESPONSIBILITIES

## 2.1 Project Team

- On-site Personnel:

| Name | Project Title/Assigned Role | Phone Numbers |
|---|---|---|
| TBA | Site Manager *{required}* | work:<br>home: |
| TBA | Task Supervisor(s) *{optional}* | work:<br>home: |
| TBA | Site Safety and Health Supervisor *{required}* | work:<br>home: |
| TBA | Competent Person *{requirement depends upon site}* | work:<br>home: |
| TBA | First Aid Personnel *{required}* | work:<br>home: |

- Other Project Personnel:

| Name | Project Title/Assigned Role | Phone Numbers |
|---|---|---|
| Sara Brothers | Project Manager | work: (505)242-3113<br>home: (505)345-3252 |
| Nathan Grant | Health and Safety Representative | work: (602)966-0808<br>home: (602)350-9213 |
| Stephen Venuti | Groundwater Technology Health and Safety Manager | work: (617) 769 7600<br>ext. 358<br>home: (617) 665 8603 |

### *2.1.1 Roles and Responsibilities*

The primary objective of this SSHP is the well-being of all field personnel and the community surrounding this site. In order to accomplish this, project staff and approved subcontractors shall acknowledge and adhere to the policies and procedures established herein. The control of site hazards is dependent upon the degree to which management enforces compliance and employees comply with the specified health and safety requirements.

Therefore, personnel at all levels of the organization must recognize their individual responsibility to comply. All activities covered by this SSHP must be conducted in compliance with this SSHP and with applicable federal, state and local health and safety regulations, including 29 CFR 1910.120 and EM 385-1-1. Personnel covered by this SSHP who cannot or will not comply must be excluded from site activities.

Accordingly, all personnel assigned to work in controlled work zones as defined in Section 4.1 of SSHP shall be made aware of the contents of this SSHP and sign the Agreement and Acknowledgement Statement (Appendix A-1) to certify that they are aware and understand the contents, and agree to abide by its provisions. Any changes in the scope of work of this project and/or site conditions must be amended in writing on the SSHP Amendment Sheet (Appendix A-2) and approved by the Groundwater Technology Health and Safety Manager/Certified Industrial Hygienist (CIH).

Any person not actively participating in the work at the site is regarded as a "visitor" and must follow Groundwater Technology's visitor/trainees guidelines. (Appendix A-3).

- **Project Manager:** Responsible for managing the project (i.e. coordination, scheduling, notifications, correspondence, and reporting). The project manager will ensure that the SSHP is followed and that the project is completed and as contracted.

- **Site Managers and Task Supervisors:** Responsibility for compliance with company Health and Safety programs, policies, procedures and applicable laws and regulations is shared by all Groundwater Technology management and supervisory personnel. This includes the need for effective oversight and supervision of project staff necessary to control the health and safety aspects of daily operations.

- **Site Health and Safety Officer/Supervisor (SHSO):** SHSO are appointed on a per-project basis by the Project Manager and/or other management representatives. The SHSO is defined by OSHA 1910.120 as "...the individual located on a hazardous waste site who is responsible to the employer and has the authority and knowledge necessary to implement the site safety and health plan and verify compliance with applicable safety and health requirements." The SHSO is responsible to both project management and the designated local/regional health and safety representative with regard to the completion of these assigned duties.

- **Competent Person:** A "Competent Person", as defined by OSHA 1926.20(b) - Accident Prevention Responsibilities, is the individual "who is capable of identifying existing and predictable hazards in surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them." The competent person may have other duties such as the SHSO. A competent person must be designated on a site-by-site basis based on the site conditions, scope-of-work, and the individual's ability to recognize site-specific hazards and take appropriate corrective actions.

- **First Aid Personnel:** Individual(s) designated by Groundwater Technology having current (Red Cross or equivalent) training and certification in basic first aid and cardiopulmonary resuscitation (CPR). This person must also have received training and information regarding Groundwater Technology's bloodborne pathogen control program including the required use of "universal precautions" and the availability of HBV vaccinations.

- **Staff:** Ultimate control of health safety is in the hands of each individual employee. Therefore, each employee must become familiar with and comply with all health and safety requirements associated with their position and daily operations. Employees also have the responsibility to notify the appropriate management and/or health and safety representative of unsafe conditions and accidents/injuries immediately. When employees are issued respirators or any other personal

protective equipment (PPE), they are responsible for ensuring that said items are used properly, cleaned as required and maintained in good working order.

- **Subcontractors:** This SSHP is intended to incorporate subcontractor-specific tasks. All Groundwater Technology subcontractors are required to review and indicate by signature that they will abide by the SSHP. Individual tasks will be reviewed with subcontract personnel during daily "tail-gate" safety meetings. If necessary the SHSO will prepare a field addendum to address task specific deficiencies or changes.

The activities described in this SSHP may be subject to audit by the Groundwater Technology or Foster Wheeler Health and Safety Manager. The appropriate schedule for any such audit will be determined at a later date.

In addition to the possible need for a formal audit, daily safety and health inspections shall be conducted and recorded as part of the daily site log by the SHSO to determine if operations are being performed in accordance with the SSHP, applicable OSHA regulations and contract requirements.

**Groundwater Technology personnel have the authority to stop work performed by our subcontractors at this site if work is not being performed in accordance with the requirements of this SSHP.**

Complete a Preliminary Incident Report (Appendix A-4) if this occurs.

# 3.0 HAZARD ANALYSIS

## 3.1 Hazard Identification

Groundwater Technology follows along a traditional approach to worker health and safety by using job safety analysis (JSA) as a technique to identify hazards associated with certain job tasks. This technique is prepared in a fashion to meet requirements described job hazard analysis per the USACE Safety and Health Requirements Manual EM-385-1-1 (October 1992).

Appendix C-1 contains JSA sheets for potential hazards expected to be encountered while engaging in site specific tasks for this project. The SHSO will inspect the site to ensure that all of the tasks conducted at the site are performed according to the JSAs. Additional JSA sheets can be added in the future as an amendment to this document to address any unexpected or unforeseeable hazards not yet identified in the USACE Manual EM-385-1-1, the Groundwater Technology Health and Safety Policy and Procedure Manual, or the described JSAs. The minimum required PPE is Level D, however, upgrades may be necessary based on air monitoring (Table 6-1). The maximum anticipated chemical of concern concentrations in groundwater are presented in Table 3-1. The SSHP will also be periodically reviewed by the Project Manager, SHSO and/or the CIH to determine if changes in the SSHP are needed. If any of these changes are due to change in the scope of work of this project and/or site conditions, the SSHP will be amended in writing on the SSHP Amendment Sheet (Appendix A-2) and approved by the CIH.

## 3.2 Hazard Assessments

The following hazard assessment applies only to the activities within the specified scope of this SSHP.

## 3.3 Chemical Hazards

**TABLE 3-1**
**CHEMICALS OF CONCERN IN GROUNDWATER**

| Site | Chemical of Concern | Maximum Concentration |
|---|---|---|
| SS-06 | JP-4<br>BTEX | NA<br>NA |
| SD-15 | Sulfuric Acid<br>Metals | NA<br>NA |
| AOC-BBMS | TPH<br>JP-4<br>BTEX | NA<br>NA<br>NA |
| AOC-RR | BTEX<br>Solvents (chlorinated & non-chlorinated)<br>Metals | NA<br>NA<br>NA |

NA = Analytical Data Not Available

**TABLE 3-2**
**CONTAMINANT PROFILES**

| Chemical | Exposure Route | Symptoms of Overexposure |
|---|---|---|
| Total Volatile Organics (solvents/ JP-4/BTEX) | Inhalation, Ingestion | Staggering gait, slurred speech, mental confusion, shortness of breath, coughing, bloody sputum, chest pain, vomiting, abdominal pain, diarrhea |
| Sulfuric Acid | Skin contact, ingestion | Severe irritation, burns |
| Metals (from descaling) | Skin contact, ingestion, inhalation | Skin and respiratory irritation, allergic symptoms, sensitization, acute, systemic and chronic disorders impacting a variety of target organs (depending upon the particular metal compound) |

### *3.3.1 Total Volatile Organics (solvents/JP-4/BTEX)*

A variety of sources, including chlorinated and non-chlorinated solvents, petroleum products such as JP-4 and/or other **benzene, toluene, ethylbenzene** and **xylene** (BTEX) containing compounds, may contribute to the total volatile organic compounds detected on the site.

Exposure to the vapors of many chlorinated organic compounds such as perchloroethylene (PCE) and trichloroethylene (TCE) above their respective permissible exposure limits (PELs) will result in similar symptoms. The actual PELs as set by the Occupational Safety and Health Administration (OSHA), vary depending on the specific compound.

Over exposure to the vapor of these compounds can cause irritation of the eyes, nose and throat. The liquid if splashed in the eyes, may cause burning irritation and damage. Repeated or prolonged skin contact with the liquid may cause dermatitis. Acute overexposure to chlorinated hydrocarbons depresses the central nervous system exhibiting such symptoms as, drowsiness, dizziness, headache, blurred vision, incoordination, mental confusion, flushed skin, tremors, nausea, vomiting, fatigue and cardiac arrhythmia. Alcohol may make symptoms of overexposure worse. If alcohol has been consumed, the overexposed worker may become flushed. Some of these compounds are considered to be potential human carcinogens.

Exposure to the vapors of BTEX above each compound's respective permissible exposure limit (PEL), as defined by OSHA, may produce irritation of the mucous membranes of the upper respiratory tract, nose and mouth. Overexposure may also result in the depression of the central nervous system. Symptoms of such exposure include drowsiness, headache, fatigue and drunken-like behavior. Benzene has been determined to be carcinogenic, targeting blood-forming organs and bone marrow.

The vapor pressures of these compounds are high enough to generate significant quantities of airborne vapor. On sites where high concentrations of these compounds are present, this can result in a potential inhalation hazard to the field team during subsurface

investigations. However, if the site is open and the anticipated quantities of BTEX contamination are small (i.e. part per million (ppm) concentrations in the soil or groundwater), overexposure potential will also be small.

### *3.3.2 Metal Compounds:*

- Overexposure to metal compounds, including those resulting from descaling operations, has been associated with a variety of local and systemic health hazards, both acute and chronic in nature, with chronic effects being most significant. Direct contact with the dusts of some metal compounds can result in contact or allergic dermatitis. Repeated contact with arsenic compounds may result in hyperpigmentation. Cases of skin cancer due to the trivalent inorganic arsenic compounds have been documented. The moist mucous membranes, particularly the conjunctivae, are most sensitive to the irritating effects of arsenic. Copper particles embedded in the eye result in a pronounced foreign body reaction with a characteristic discoloration of eye tissue.

  Inhalation of copper and zinc dusts above their established PELs may result in flu-like symptoms known as "metal fume fever." Prolonged and repeated inhalation of the dusts of inorganic arsenic compounds above the established PEL may result in weakness, loss of appetite, a sense of heaviness in the stomach and vomiting. Respiratory problems such as cough, hoarseness and chest pain usually precede the gastrointestinal problems. Chronic overexposure to the dusts of inorganic arsenic may result in lung cancer.

- Tetraethyl and Tetramethyl Lead compounds are used as anti-knock ingredients in gasoline and other petroleum products. The inhalation of tetraethyl lead dusts may result in irritation of the respiratory tract. This dust, when in contact with moist skin or eye membranes, may cause itching, burning and transient redness.

The direct absorption of a sufficient quantity of tetraethyl lead, whether briefly at a high rate, or for prolonged periods at a low rate, may cause acute intoxication of the central nervous system. Mild degrees of intoxication may cause headache, anxiety, insomnia, nervous excitation and minor gastrointestinal disturbances.

### *3.3.3 Sulfuric Acid*

The degree of sulfuric acid contamination of the soils in the vicinity of the SD-15 washrack descaling operation is unknown. Potential adverse symptoms of exposure increase with increasing contaminant levels. Dilute quantities of the acid may act as an irritant to skin, eyes and mucous membranes. It may cause irreparable corneal damage and blindness as well as scarring of the eyelids and face. These symptoms may occur rapidly with concentrated quantities. Methods of contact avoidance and proper protective clothing must be utilized.

### *3.3.4 Chemicals Subject to OSHA Hazard Communication*

All chemicals brought on site such as solvents, reagents, decontamination solutions, or any other hazardous chemical must be accompanied by the required labels, Material Safety Data Sheets (MSDS), and employee training documentation (OSHA 1910.1200). For additional information refer to the **Groundwater Technology Hazard Communication Program.**

## 3.4 Physical Hazards

A "Competent Person" must perform frequent and regular inspection of the site, materials and equipment in accordance with 1926.20 to identify site hazards. All personnel on site should be provided with the information and training necessary to avoid accidental injury. This includes assuring that the site is maintained in a such a way that slip, trip and fall hazards are recognized and eliminated or controlled. Basic personal protective equipment (steel-toed boots, hardhats and safety eyewear) must be available and its use enforced.

### *3.4.1 Mechanical Equipment/Construction Hazards*

The use of drill rigs, Geo-Probes, trucks and other mechanical equipment represent potentially serious construction hazards. Whenever such equipment is used, personnel in the vicinity should be limited to those who must be there to complete their assigned duties. All personnel must avoid standing within the turning radius of the equipment or below any suspended load. Job sites must be kept as clean, orderly and sanitary as possible. When water is used, care must be taken to avoid creating muddy or slippery conditions. If slippery conditions are unavoidable, barriers and warning signs must be used to warn of these dangers.

Personnel must never turn backs to operating machinery. No loose clothing, jewelry, hair or other personal items should be worn around rotating equipment or other equipment that could catch or ensnare these items. Personnel should stand far enough away from operating machinery to prevent accidental contact which may result from mechanical or human error.

### *3.4.2 Electrical*

OSHA regulations require that employees who may be exposed to electrical equipment be trained to recognize the associated hazards and the appropriate control methods. All **extension cords** used for portable tools or other equipment must be designed for hard or extra usage and be (three wire) grounded.

All 120-volt, single-phase 15- and 20-ampere receptacle outlets on construction sites and other locations where moisture/water contact may occur must be equipped with **ground-fault circuit interrupters (GFCI)** units. GFCI units must be attached directly to or as close as possible to the receptacle. GFCI located away from the receptacle will not protect any wiring between the receptacle and the GFCI unit. Only the wiring plugged into the GFCI and outward will be protected by the GFCI.

All **(temporary lighting)** lamps for general illumination must be protected from accidental breakage. Metal case sockets must be grounded. Portable lighting in wet or conductive locations should be 12 volts or less.

### *3.4.3 Fire and Explosion*

The possibility of flammable materials being encountered during field activities must be recognized and the appropriate steps necessary to minimize fire and explosion must be observed. This includes situations where **excessive organic vapors or free product** are encountered. When this occurs, monitoring with a combustible gas indicator (CGI), is required.

Excessive organic vapors, for the purposes of initiating the use of a CGI, are defined as sustained readings (i.e., continuous for at least five minutes) at or above 100 units or as an instantaneous reading at or above 1,000 units on the photoionization detector (PID) or flame ionization detector (FID) in close proximity (within 1 foot or less) of the borehole, test pit, sampling location or other area of potential exposure.

Control methods may include forced ventilation and/or filling the borehole with enough water to inhibit the release of methane and other gases which would otherwise escape through the top of the borehole.

- If forced (mechanical) ventilation is to be used, all such equipment must be approved for Class I, Division I hazardous atmospheres. The blower must be positioned to blow across the top of the borehole so that gases and vapors may be diluted as they exit the borehole. Do not attempt to suck out the gases or vapors. Blowers, all other mechanical equipment, and tools which could release sparks or static electricity must be bonded and grounded.

- Regardless of the gas/vapor control method used, the atmosphere surrounding the borehole must be frequently monitored using direct reading instruments approved for Class I, Division I hazardous atmospheres. Monitoring should be conducted

within 1 to 2 feet of the top of the borehole. Do not insert sampling devices into the borehole. Never approach the auger or drill shaft while it is in operation.

- If combustible gas levels equal or exceed 10 percent of the lower explosive limit (LEL), when monitored as described above, operations should be immediately shut down and the area evacuated until appropriate control measures have been implemented and levels have been resampled and verified safe for reentry.

- Regardless of actual instrument readings, if all sources of ignition can not be controlled, operations should be immediately shut down and the area evacuated until ignition sources have been eliminated. Ignition sources include, but are not limited to: smoking, static electricity, lighting, open flames, spontaneously ignitable substances, frictional heat or sparks, hot surfaces, radiant heat, electrical sparks, stray currents, cutting and welding, and ovens, furnaces and heating equipment.

  In situations where hexane, methanol or other flammable solvents are needed for field activities, the following precautions must be observed: **Keep flammable and combustible materials away from heat, sparks and open flames. Do not smoke around flammable or combustible materials. Keep all flammable and combustible liquids in approved and properly labelled safety containers.**

  At least one 10-pound ABC fire extinguisher must be located within 100 feet of each work area.

### *3.4.4 Heat and Cold Stress*

Overexposure to temperature extremes can represent significant risks to personnel if simple precautions are not observed. Typical control measures designed to prevent **heat stress** include dressing properly, drinking plenty of the right fluids, and establishing an appropriate work/break regimen. Typical control measures designed to prevent **cold stress** also include dressing properly, and establishing an appropriate work/break regimen. The project manager must assure that the appropriate measures are observed.

### 3.4.5 Moving Vehicles, Traffic Safety

All vehicular traffic routes which could impact worker safety must be identified and communicated. Whenever necessary, barriers or other methods must be established to prevent injury from moving vehicles. This is particularly important when field activities are conducted in parking lots, driveways, ramps or roadways. OSHA 1926.201 specifies that when signs, signals or barricades do not provide adequate protection from highway or street traffic, flagmen must be utilized. **Flagmen must wear red or orange garments. Garments worn at night must be reflective.**

### 3.4.6 Noise

Noise exposure can be affected by many factors such as the number and types of noise sources (continuous vs. intermittent or impact), and the proximity to noise-intensifying structures such walls or building which cause noise to bounce back or echo. The most important factor affecting total noise exposure is distance from the source. The closer one is to the source, the louder the noise. Drill rigs, backhoes or other mechanical equipment can be sources of significant noise exposure. In order to reduce the exposure to this noise, personnel working in areas of excessive noise must use appropriate hearing protectors (ear plugs or ear muffs).

In general, wherever actual data from sound level meters or noise dosimeters is unavailable and it is necessary to raise one's voice above a normal conversational level to communicate with others within 3 to 5 feet away, hearing protection should be worn.

### *3.4.7 Overhead Utilities and Hazards*

Overhead hazards can include low hanging structures which can cause injury due to bumping into them. Other overhead hazards include **falling objects, suspended loads, swinging loads and rotating equipment**. Hardhats must be worn by personnel in areas where these types of physical hazards may be encountered. Barriers or other methods must also be used to exclude personnel from these areas were appropriate. Electrical wires are

another significant overhead hazard. According to OSHA (29 CFR 1926.550), **the minimum clearance which must be maintained from overhead electrical wires is 10 feet** from an electrical source rated $\leq$ 50 kV. Sources rated > 50 kV require a minimum clearance of 10 feet plus 0.4 inches per kV above 50 kV. OSHA's minimum clearance requirements are roughly equivalent to those specified by the Army Corp of Engineers (EM 385-1-1, Table 11-3) as summarized in Table 3-3.

**TABLE 3-3**
**MINIMUM CLEARANCE REQUIREMENTS FROM OVERHEAD ELECTRICAL WIRES**

| Nominal Voltage (kV) | Minimum Clearance (ft) |
|---|---|
| 0-50 | 10 |
| 51-100 | 12 |
| 101-200 | 15 |
| 201-300 | 20 |
| 301-500 | 25 |
| 501-750 | 35 |
| 751-1000 | 45 |

### *3.4.8 Pedestrian Traffic*

The uncontrolled presence of pedestrians on a drilling or excavation site can be hazardous to both pedestrians and site workers. Prior to the initiation of site activities, the site should be surveyed to determine if, when and where pedestrians may gain access. This includes walkways, parking lots, gates and doorways. Barriers or caution tape should be used to

exclude all pedestrian traffic. **Exclusion of pedestrian traffic is intended to prevent injury to the pedestrians and eliminate distractions which could cause injury to site workers.**

### *3.4.9 Underground Utilities and Hazards*

The identification of underground storage tanks (USTs), pipes, utilities and other underground hazards is critically important prior to all drilling, excavating and other intrusive activities. In accordance with OSHA 29 CFR 1926.650, **the estimated location of utility installations, such as sewer, telephone, electric, water lines and other underground installations that may reasonably be expected to be encountered** during excavation work, **must be determined** prior to opening an excavation. The same requirements apply to drilling operations and the use of soil gas probes. Where public utilities may exist, the utility agencies or operators must be contacted directly or through a utility-sponsored service such as **Digsafe**. Where other underground hazards may exist, reasonable attempts must be made to identify their locations as well. **Failure to identify underground hazards can lead to fire, explosion, flooding, electrocution or other life threatening accidents.**

## 3.5 Biological Hazards

Project personnel should be provided with the information and training necessary to avoid accidental injury or illness which can result from exposure to biological hazards. This includes assuring that the site is carefully assessed so that the hazards associated with poisonous plants, insects or other sources of biological contamination are recognized and eliminated or controlled.

### *3.5.1 Poisonous Plants*

Although poisonous plants are not anticipated to be encountered at the site, personnel should be aware of the presence of poisonous plants in areas adjacent to the site. **Poison ivy** is a climbing plant with alternate green to red leaves (arranged in threes) and white berries. **Poison oak** is similar to poison ivy and sumac but its leaves are oak-like in form.

The leaves of these poisonous plants produce an irritating oil which causes an intensely itching skin rash and characteristic blister-like lesions.

### *3.5.2 Insects*

Stinging insects, primarily **spiders, scorpions, bees** and **wasps**, are prevalent in the area of the sites during the warmer months.

### *3.5.3 Rattlesnakes*

Poisonous snakes (Rattlesnakes) could be encountered during site activities. Employees are advised to be alert to this danger. Snake bites can be painful and lead to serious illness if not treated immediately. If bitten, employees must seek medical attention immediately. A snake bite kit should be included as part of the first aid kit. The best thing to do, however is to avoid contact. Wear sturdy leather boots. Avoid walking in areas where snakes may hide. Use extreme caution when moving or lifting objects which could be used by snakes as cover. Never reach under or behind such objects or into other areas where snakes may hide.

# 4.0 SITE CONTROL

## 4.1 Controlled Work Zones

Groundwater Technology observes the site control methods suggested in the "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities," NIOSH/OSHA/USCG/EPA, November, 1985. Accordingly, the area surrounding each of the active work areas is to be divided into three zones: the exclusion or "Hot" zone, the contamination reduction zone (CRZ), and the support zone.

### *4.1.1 Exclusion Zone*

Due to the scattered locations of the activities covered within the scope of this SSHP, the actual zones are expected to change frequently in accordance with daily activities. Therefore, all exclusion zones are expected to be temporary or dynamic. Site personnel will be advised of the locations of temporary work zones as part of the routine site safety meetings.

Each exclusion zone will consist of the active work areas where site investigations are taking place. A 15-foot radius will be established as the typical perimeter of the zone, however, this may be increased as necessary in order to protect unprotected personnel from contact with vapors, physical or other site related hazards that may arise from these operations. The perimeter of the zone will be marked with traffic cones and/or brightly colored hazard tape. Personnel entering these areas must wear the prescribed level of protective equipment.

### *4.1.2 Contamination Reduction Zone*

Each CRZ will be a clearly-marked corridor between the exclusion and support zones. The actual length and/or location of the corridor will also be temporary or dynamic in accordance with the locations of the exclusion zones. The CRZ is where personnel will begin the sequential decontamination process when exiting the exclusion zone. To prevent

cross contamination and for accountability purposes, all personnel must enter and leave the exclusion zone through the CRZ. A separate heavy equipment decontamination zone will be required.

### *4.1.3 Support Zone*

The support zone will be an area outside the exclusion zone and CRZ where support trailers and equipment may be staged and support activities may be conducted. Eating, drinking and smoking will be allowed only in this area. Sanitary facilities, potable water and water and soap for hand washing along with containers for solid waste for use by Groundwater Technology subcontractor personnel should be located within this area.

### *4.1.4 Uncontrolled Areas*

Portions of the site which are not designated as active exclusion, contamination reduction or support zones are considered to be uncontrolled areas within the context of this site health and safety plan and therefore not subject to the requirements of OSHA 1910.120.

## 4.2 Other Site Control Measures/Work Limitations

The following measures are designed to augment the specific health and safety guidelines provided in this plan.

- The "buddy system" will be used at by all field personnel. No one is to work alone in controlled/active work zones. The standby team member must be intimately familiar with the procedures for initiating an emergency response.

- Avoidance of contamination is of the utmost importance. Whenever possible, avoid contact with contaminated (or potentially contaminated) surfaces or materials. Walk around (not through) puddles and discolored surfaces. Do not kneel on the ground or set equipment on the ground. Protect air monitoring equipment from water by bagging.

- Hands and face must be thoroughly washed upon leaving the work area and before eating, drinking or any other activities.

- Eating, drinking, chewing gum or tobacco, smoking or any practice that increases the probability of hand-to-mouth transfer and ingestion of materials is prohibited except in the support zone after proper decontamination.
- Beards or other facial hair that interfere with respirator fit are prohibited for anyone who is required to wear a respirator.
- The use of alcohol or drugs is prohibited during the conduct of field operations.
- All equipment must be decontaminated or discarded, as designated by the SHSO, before leaving the site.

## 4.3 Site Preparation

Time and effort will be spent preparing the site/location prior to scheduled activities. Such preparation includes eliminating physical hazards (debris, weeds, ignition sources, etc.), identifying underground (steam, communications, electrical etc.) and overhead utilities, and construction/illumination.

Prior to drilling and/or other intrusive subsurface activities, a utility clearance (such as Digsafe, One Call, etc.) authorization number must be obtained. **On-base activities will require a digging permit from the Civil Engineering Department.**

In addition, site/area maps are to be compiled and security measures established. Emergency services will be notified of planned activities and a communications network will be set up.

## 4.4 Site Entry/Security

Site entry procedures are dictated by requirements for entry onto United States military installations and currently only authorized personnel are allowed access to the sites at Holloman AFB. Authorized personnel must meet all training and medical surveillance

requirements stated in this SSHP and review and sign the agreement and acknowledgement sheet of the SSHP prior to being allowed access to the site.

Personnel authorized to perform work on this site include:

1. Sara Brothers, Project Manager
2. Stephen Venuti, C.I.H., Health and Safety Manager
3. TBA, SHSO
4. Dave Crowley, C.S.P., C.E.T.
5. TBA, On-Site Workers
6. Foster Wheeler Personnel
7. Regulatory Agency Personnel
8. USACE Personnel
9. Holloman AFB Personnel

# 5.0 DECONTAMINATION

Proper decontamination is required of all personnel and equipment before leaving the site. All materials and equipment used for decontamination must be disposed of properly. Clothing, tools, buckets, brushes, and all other equipment that is contaminated must be secured in drums or other containers and labeled. Clothing not completely decontaminated on site should be secured in plastic bags before being removed from the site.

All water used in decontamination procedures shall be stored in 55-gallon drums or other designated container until approval by the POC for disposal is received. Disposable sampling materials and PPE will be placed in plastic bags and temporarily stored at a designated location. These materials shall be disposed of in accordance with the Holloman AFB Waste Management Plan.

## 5.1 Personnel Decontamination

Personnel decontamination will be accomplished by following a systematic procedure of cleaning and removal of PPE. Contaminated PPE such as boots and face shields will be rinsed free of gross contamination, scrubbed clean in a detergent solution and then rinsed clean. When personnel decontamination is necessary, a three-basin wash system will be set up within the active contamination reduction zone.

Disposable PPE, such as Tyvek coveralls, gloves, outer boots, etc. will be disposed of as general refuse. Respirators will be cleaned after each use with respirator wipe pads and will be stored in plastic bags after cleaning. General refuse will be placed in plastic bags and then into an on-site dumpster.

### *5.1.1 Decontamination Sequence*

(Note: Steps required will depend on the level of protection worn.)

1. Remove and wipe clean hard hat

2a. Rinse boots and gloves of gross contamination

2b. Scrub boots and gloves clean

2c. Rinse boots and gloves

3. Remove outer boots

4. Remove outer gloves

5. Remove tyvek coveralls

6. Remove respirator, wipe clean and store

7. Remove inner gloves

Boots that have been decontaminated can be worn into the support zone.

## 5.2 Equipment Decontamination

Appropriate measures should be taken to prevent unnecessary or avoidable equipment contamination. Sampling devices routinely become contaminated. However, monitoring instruments can and should be handled in a manner which avoids direct/physical contact with solid or liquid contamination which could leave residual deposits on the instrument. Once contaminated, instruments are difficult to clean without damaging them. Any delicate instrument which cannot be easily decontaminated should be protected while it is being used. It should be placed in a clear plastic bag, and the bag taped and secured around the instrument. Openings are made in the bag for sample intake and exhaust.

If solvents are used for decontamination of equipment all safety precautions specified on the manufacturer's warning label and MSDS must be observed. Solvents or rinsate

generated during the decontamination process will be drummed, labeled, and disposed of with other substances from the site. **Never use organic solvent to clean skin!**

Wooden tools are difficult to decontaminate because they absorb chemicals. They should be kept on site and handled only by protected workers. At the end of the field activities, wooden tools should be discarded.

Drilling rigs, Geo-Probes, truck, backhoes, and other mechanical equipment are difficult to decontaminate. The method generally used is to wash them with water under high pressure or to scrub accessible parts with detergent/water solution under pressure.

In some cases, shovels, scoops and augers may require steam cleaning. Particular care must be given to those components in direct contact with contaminants.

Personnel performing decontamination methods capable of generating airborne contaminants (dusts, mists, aerosols, etc.) must do so in Level C PPE. Otherwise, Level D or Modified Level D PPE should be worn.

**TABLE 5-1**
**DECONTAMINATION PROCEDURES**

| Item | Examples | Procedure |
|---|---|---|
| Field Personnel | Hands, face and any exposed skin | • Practice prevention; minimize exposure to contaminated materials through the proper use of PPE.<br>• Wash with detergent and water; rinse with water. |
| Field Equipment | Bailers, interface probes, hand tools, and miscellaneous sampling equipment | • Decontaminate with a solution of detergent and water; rinse with water prior to leaving the site.<br>• Protect from exposure by covering with disposable covers such as plastic to minimize required decontamination activities. |
| Disposable PPE | Tyvek® suits, inner latex gloves, respirator cartridges | • Dispose of according to the requirements of the client and state and federal agencies. |
| Nondisposable PPE | Respirators | • Wipe out respirator with disinfecting pad prior to donning.<br>• Decontaminate on site at the close of each day with a solution of an approved sanitizing powder and water. |
| | Boots and gloves | • Decontaminate outside with a solution of detergent and water; rinse with water prior to leaving the site.<br>• Protect from exposure by covering with disposable covers such as plastic to minimize required decontamination activities. |

# 6.0 MEDICAL SURVEILLANCE

## 6.1 General

Personnel covered by this SSHP must be active participants in Groundwater Technology Medical Monitoring Program or in a similar program which complies with OSHA 29 CFR 1910.120(f), ANSI Z88.2 and the USACE Safety and Health Requirements Manual EM 385-1-1, Appendix K. Each individual must have completed an annual surveillance examination and/or an initial baseline examination within the last year prior to performing any work on this site covered by this SSHP.

## 6.2 Medical/Technical Advisors

| | |
|---|---|
| Stephen Venuti, C.I.H., Health and Safety Manager<br>Groundwater Technology Government Services, Inc.,<br>Norwood, MA | (617) 769-7600<br>ext. 358 |
| David Crowley, C.S.P., C.E.T., C.H.M.M.<br>Groundwater Technology, Inc., Norwood, MA | (617) 769-7602 |
| Katy Perkoski, R.N., C.O.H.N.<br>Groundwater Technology, Inc., Norwood, MA | (617) 769-7600 |
| Ben Hoffman, M.D.<br>Consulting Medical Director | (603) 778-9426 |

The specific duties of the Medical/Technical Advisors include:

- providing technical input into the design of the site health and safety plan;
- advising worker exposure potential along with appropriate hazard reduction methods; and
- recommending a suitable medical monitoring program for the site workers.

# 7.0 AIR MONITORING

Air monitoring action levels have been developed to indicate the chemical concentrations in the breathing zone that require an upgrade in level of PPE. General air monitoring guidelines are presented in Table 7-1. All workers on-site have been properly fitted with PPE (i.e. respirators) and have been trained in their use (i.e. donning and doffing). Air monitoring measurements will be taken in the breathing zone of the worker most likely to have the highest exposure.

Transient peaks will not automatically trigger action. Action will be taken when levels are consistently exceeded in a 5-minute period. The action levels apply to all tasks performed on this site.

**TABLE 7-1**

**GENERAL AIR MONITORING GUIDELINES**

Conduct periodic monitoring when: (1) it is possible that an Immediate Danger to Life and Death (IDLH) condition or a flammable atmosphere has developed or (2) there is an indication that exposures may have risen over permissible exposure limits or published exposure levels since the last monitoring. Look for a possible rise in exposures associated with these situations:

- **Change in Site Area** - work begins on a different section of the site
- **Change in Contaminants** - handling contaminants other than those first identified
- **Perceptible chemical odors or symptoms of exposure**
- **Change in On-Site Activity** - one operation ends and another begins
- **Handling Leaking Drums or Containers**
- **Working with Obvious Liquid Contamination** (e.g, a spill or lagoon)

Conduct air monitoring when the possibility of volatilization exists (such as with a new monitoring well or a well containing known product).

Conduct air monitoring on a well at a site known to have little contamination (documented by experience or laboratory data) **only** if an odor emanates from the well.

Air monitoring falls into two categories: direct reading/environmental monitoring and personal exposure monitoring.

## 7.1 Environmental Monitoring

The required environmental monitoring will be conducted using the direct reading instruments as indicated in the following chart. Data provided by these instruments will be used to determine the appropriate control actions and personal protective equipment requirements.

Equipment calibration must be performed in accordance with the manufacturers instructions. Field checks using the appropriate reference standards must be made on site at the minimum frequency of twice per shift (pre- and post-sampling). A daily log of all instrument readings, as well as all field reference checks and calibration information, must be maintained.

All air monitoring data must be recorded on the Vapor Monitoring Sheet (Appendix B-3).

## Table 7-2 -- Vapor Monitoring Action Levels

| Chemical | | | Exposure Limits | | Instrument | | | Required Action | Sample/ Monitoring Frequency |
|---|---|---|---|---|---|---|---|---|---|
| Identification | Vapor Pressure VP (mmHg) | Ionization Potential IP (eV) | OSHA PEL (ppm) | ACGIH TLV (ppm) | Type | Relative Response | Reading | | |
| Total VOCs as: | | | | | PID (10.2 lamp/benzene std.) | | Any reading above background.<br>≥ 15ppm<br>≥ 100ppm | • Sample for Benzene<br>• Upgrade to Level C<br>• Leave area. Re-assess control options and project scope | Sample with PID throughout active operations (soil gas survey, drilling, Geo-Probe) as detailed in Table 7-1. |
| Ethyl Benzene | 10 (79°F) | 8.76 | 100 | 100 | | 1:1 | | | |
| Toluene | 20 (65°F) | 8.82 | 50 [skin] | 50 [skin] | | 1:1 | | | |
| Xylene | 9 | 8.56 | 100 | 100 | | 1:1.1 | | | |
| Trichloroethylene | 58 | 9.45 | 50 | 50 | | unknown | | | |
| Perchloroethylene | 14 | 9.32 | 25 | 25 | | unknown | | | |
| Benzene | 75mm | 9.24 Ev | 1 [TWA]<br>5 [STEL] | 10 | Color indicator tube (Draeger/Sensidyne) | ± 25% | ≥ 0.5ppm<br>≥ 15ppm | • Upgrade to Level C<br>• Leave area. Re-assess control options and project scope | Initiation of new task, new area or new task in same area. |
| Combustible Gas (contingency only) | NA | NA | NA | NA | CGI (pentane std) | NA | <10% LEL<br>10 to 25% LEL<br>>25% LEL | • Continue to monitor with caution. Eliminate all ignition sources.<br>• Shutdown operations, evacuate area, begin vapor control measures. Resample prior to reentry.<br>• Explosion hazard; withdraw from area. | In the event of > 100 units (5 minutes sustained) as measured with PID or instantaneous reading ≥ 1,000 units as measured with PID. |

Notes:

VOC = volatile organic compound; VP (mmhg) = vapor pressure in millimeters at Mercury at 68°F; IP (Ev) = ionization potential in electron volts; OSHA PEL = Occupational Safety and Health Administration Permissible Exposure Limit; ACGIH TLV = American Conference of Governmental Industrial Hygienists Threshold Limit Value; ppm = parts per million; TWA = 8-Hour Time-Weighted Average; STEL = Short-Term Exposure Limit; CGI =Combustible Gas Indicator
CGI = Combustible Gas Indicator

### *7.1.1 Total Volatile Organics (solvents/JP-4/BTEX)*

A PID, equipped with a 10.2 eV lamp, calibrated with isobutylene and referenced to benzene-in-air (or a FID calibrated with and referenced to methane in air), will be used to monitor the breathing zone of workers to assess the potential presence of organic vapors. Benzene, ethylbenzene, toluene, xylene, perchloroethylene, and trichloroethylene each have **ionization potentials (IP)** below ten and will produce **relative responses (RR)** of approximate 1:1 using the PID as described above.

The SHSO must ensure that PID readings are conducted daily at the initiation of all activities within the scope of this project. Monitoring will continue throughout all activities at a frequency of at lease once every 15 minutes or at some other frequency as determined by the SHSO.

Because of the low exposure limit of benzene (1 ppm), it is not easily detected by the PID (the exposure limit of benzene would be indicated by a barely noticeable meter deflection of 1 unit on a PID calibrated to benzene). Therefore, PID readings will be supplemented with specific color indicator tubes (Draeger, Sensidyne or equivalent) to detect the presence of benzene in the breathing zone of workers during investigative activities.

The SHSO will ensure that indicator tube readings are conducted whenever PID readings above background are sustained. Color indicator tube samples will be collected at least once immediately after the action is required by PID readings and repeated at a frequency to be determined by the SHSO.

Should the color indicator tube readings indicate breathing zone benzene levels of 0.5 ppm or greater, respiratory protection will be donned. If the color indicator tubes indicate that benzene is not present, the action level for donning respirators is 15 ppm on PID. Should tubes indicate concentrations of benzene are present in worker breathing zones above 25 ppm, work will be stopped so that the scope can be re-evaluated and this SSHP modified accordingly.

### *7.1.2 Dust Monitoring*

It is not anticipated that field activities will produce significant quantities of airborne dust at the sites under this scope of work. It can be assumed that dirt in the areas contaminated with sulfuric acid and/or metals, if airborne, would represent an exposure hazard. Therefore, methods that prevent the release of visible airborne dust must be utilized. Dust monitoring, other than visual observation, will not be conducted during field activities.

### *7.1.3 Confined Space Entry*

No confined space/limited egress tasks are to be performed within the scope of this SSHP.

### *7.1.4 Combustible Gas Indicator (CGI)*

Allowing for the possibility that flammable materials may be encountered on site, steps necessary to minimize fire and explosion must be observed. If excessive organic vapors or free product are encountered, monitoring with a CGI calibrated using methane as a reference standard will be required. As a contingency, appropriate response actions are described in Table 7-2.

## 7.2 Personal Exposure Monitoring

According to OSHA 1910.120, personal exposure monitoring for the purpose of determining individual time-weighted average exposures is required during certain site cleanup or other remedial activities. Determinations regarding individual exposure potentials will be based on the work area monitoring described above. Separate personal air sampling will not be conducted. If color indicator tubes indicate a level of benzene above the Level C action level, representative sampling in accordance with NIOSH/OSHA sampling protocol may be required for affected employees.

# 8.0 PERSONAL PROTECTIVE EQUIPMENT (PPE)

PPE will be donned as described below for the activities covered by this SSHP. Based on available analytical data and the nature of the site (i.e., open) and the specified scope of activities, it is assumed that most activities will require Level D or Modified Level D. This plan also contains contingencies for upgrading to Level C.

Only PPE that meet the following ANSI standards may be worn:

- Eye protection - ANSI Z87.1-1989
- Head protection - ANSI Z89.1-1986
- Foot protection - ANSI Z41-1991

Prior to use, all equipment must be inspected to ensure proper working condition. Contact with contaminated surfaces, or surfaces suspected of being contaminated should be avoided. This includes walking through, kneeling or placing equipment in puddles, mud, discolored surfaces, or on drums and other containers. Eating, smoking, drinking and/or the application of cosmetics is restricted to the support zone and is prohibited in the immediate work area. When utilizing protective garments such as tyvek suits, gloves and booties, all seams between protective items will be sealed with duct tape. Limitations during temperature extremes, heat stress and medical considerations will be monitored by the SHSO for determination of work/rest regiment.

## 8.1 General Site Work

General site work (outside the active exclusion zones and/or CRZs will require Level D protective equipment. This equipment is defined as:

- Work uniform/clothes (consisting of shirt and trousers)
- Steel-toed boots
- Approved safety glasses or goggles
- Hard hat
- Fluorescent vest, when vehicular traffic is on or adjacent to the site

- Ear plugs and muffs (if required)
- Nitrile gloves for water sampling handling

## 8.2 Hydropunch, Geo-Probe, Sampling and Soil Gas Survey

Modified Level D personal protective clothing will be worn during all intrusive and sampling activities where skin contact with contaminants is reasonably anticipated. This equipment is defined as:

- Work uniform/clothes (consisting of shirt and trousers or coveralls)
- Steel-toed boots
- Approved safety glasses or goggles
- Hard hat
- Fluorescent vest, when vehicular traffic is on or adjacent to the site
- Ear plugs and muffs (if required)
- Nitrile gloves for water sampling handling
- Tyvek® suits, NBR outer and nitrile inner gloves if skin contact with contaminants is possible (Tyvek® suit is an option to be utilized at the discretion of the SHSO on his/her visual assessment of the conditions within the immediate work area).

## 8.3 Upgrade Contingency

If the Action Levels specify the need, the following Level C PPE will be required:

- NIOSH-approved full-face respirator with organic vapor/acid gas and/or HEPA cartridges
- Work uniform/clothes (consisting of shirt and trousers or coveralls)
- Steel-toed boots
- Hard hat
- Tyvek® suits, NBR outer and nitrile inner gloves, if skin contact with contaminants is possible (Tyvek® suit is an option to be utilized at the discretion of the SHSO on his/her visual assessment of the conditions within the immediate work area).

## 8.4 Decontamination

Personnel performing decontamination methods capable of generating airborne contaminants (dusts, mists, aerosols, etc.) must do so in Level C PPE. Otherwise, Level D or Modified Level D PPE should be worn.

# 9.0 RESPIRATORY PROTECTION PROGRAM

If required (based on air monitoring results), Level C respiratory protection will be worn, consisting of full-face air purifying respirator with combination dust and organic vapor cartridges. Furthermore, should dusty conditions (i.e., visible air borne dust) be observed (particularly in the areas of sulfuric acid, metals and/or pesticide contamination), Level C respiratory protection will be donned.

All personnel who will be required to don air purifying respirators must have been qualitatively or quantitatively fit-tested for the particular brand and size respirator he/she will be wearing on site within the last year.

Normal eyeglasses cannot be worn under full-face respirators because the temple bars interfere with the face seal. For workers requiring corrective face piece lenses, special spectacles designed for use with respirators must be available. Contact lenses should not be worn on site. However, ANSI Z88.2-1992 American National Standard for Respiratory Protection, paragraph 7.5.3.3 states that: "Contact lenses may be worn with respirators, provided the individual has previously demonstrated that he or she has had successful experience wearing contact lenses. The contact lens wearer shall practice wearing the respirator while wearing the contact lenses."

In the event that air monitoring results indicate the need to go to Level B protection (full-face, positive pressure or demand-mode supplied air breathing apparatus or equivalent), the scope and associated cost of this study may need to be re-evaluated.

# 10.0 TRAINING AND COMMUNICATION

## 10.1 General Training Requirements

Personnel covered by this SSHP must be active participants in Groundwater Technology Training Program or in a similar program which complies with OSHA 29 CFR 1910.120(e), OSHA 29 CFR 1926.20, and the USACE Safety and Health Requirements Manual EM 385-1-1 (Section 28.D).

Individuals who plan to work in the active/designated exclusion zones and/or CRZs where the potential for exposure to safety or health hazards exists must have completed an annual 8-hour refresher training course and/or initial 40-hour training course within the last year prior to performing any such work.

Also, at least one Groundwater Technology representative must be on site during all activities to act as the site manager and SHSO. This individual must have documentation of at least three days of supervised field experience as well as completion of the specified 8-hour training course for managers and supervisors.

## 10.2 On-Site Communications

Verbal communication at the sites may be impeded by on-site background noise or on-going activities, or the use of personnel protective equipment. Two-way radios will be used on-site (unless prohibited by Security) when communication is necessary between working zones or geographic features which may limit other forms of communication. Radio frequencies will be approved by the Air Force. Hand signals may be used between personnel and will be reviewed during daily safety/pre-shift meetings. The use of the "buddy system" will ensure that any information is communicated between all workers on-site. Visual contact must be maintained between pairs when respiratory protection is used.

External communications between on-site and off-site personnel will be conducted through the use of cellular telephone or pay phones located on/near the facility. Exact locations of

the telephones and numbers will be obtained before site activities begin and will be communicated to all site personnel.

## 10.3 Notification of Activities

Prior to starting work at the site, the base fire department and base and Alamogordo hospitals will be contacted by the SHSO regarding the scope of work, potential hazards at the site and to confirm that the emergency services are capable of handling an emergency situation.

## 10.4 Safety Orientation/Tailgate Meetings

A tailgate safety meeting will be given to the workers by the SHSO daily to review the chemical, physical and toxicological properties of the contaminants that may be present at the site. Proper and safe work practices will be reviewed. Contingency plans for potential emergency situations and location(s) of available safety equipment will be addressed at this meeting. The SHSO shall inspect the site to ensure that the SSHP is being properly implemented. The SSHP will be periodically reviewed to ensure that all physical and chemical hazards encountered during field activities are recognized and addressed by the SSHP.

# 11.0 SUBCONTRACTOR REQUIREMENTS

Subcontractors to Groundwater Technology will be required to provide to the Groundwater Technology Project (Site) Manager specific written documentation that each individual assigned to this project has completed the medical monitoring and training requirements specified above. This information must be provided prior to their performing any work on site.

## 12.0 FIRST AID PLAN

The following general guidelines will apply if the need for emergency first aid services arises:

1. Survey the situation. Do not endanger your own life. DO NOT ENTER A CONFINED SPACE TO RESCUE SOMEONE WHO HAS BEEN OVERCOME UNLESS PROPERLY EQUIPPED AND A STANDBY PERSON IS PRESENT.

2. Call the fire department IMMEDIATELY. Explain the physical injury, chemical exposure, fire, or release.

3. Decontaminate the victim without delaying life-saving procedures.

4. If the victim's condition appears to be noncritical, but seems to be more severe than minor cuts, he/she should be transported to the nearest hospital by trained Emergency Medical Services (EMS) personnel: Let the doctor assume the responsibility for determining the severity of the injury. If the condition is obviously serious, EMS must transport the victim.

5. When transporting an injured person to a hospital, bring this SSHP to assist medical personnel with diagnosis and treatment. In all cases of chemical overexposure, follow standard procedures as outlined for poison management, first aid, and, if applicable, cardiopulmonary resuscitation.

6. Notify the Project Manager and the SSHO. Complete the Preliminary Incident Report (Appendix A-4) within 24 hours.

| TABLE 12-1 – EMERGENCY FIRST AID PROCEDURES | | | |
|---|---|---|---|
| **To Stop Bleeding** | | **Cardiopulmonary Resuscitation (CPR)** | |
| 1. | Give medical statement, that you are trained in first aid/CPR. | 1. | Give medical statement, that you are trained in first aid/CPR. |
| 2. | Assure airway, breathing, circulation | 2. | Arousal: Check for consciousness. |
| 3. | Use **DIRECT PRESSURE** over the wound with clean dressing or your hand (use nonpermeable gloves). Direct pressure will control most bleeding. | 3. | Open airway with chin-lift. |
| 4. | Bleeding from an artery or several injury sites may require **DIRECT PRESSURE** on a **PRESSURE POINT.** Use pressure points for 30-60 seconds to help control severe bleeding. | 4. | Look, listen, and feel for breathing. |
| 5. | Continue primary care and seek medical aid as needed. | 5. | If breathing is absent, give 2 slow, full rescue breaths. |
| | | 6. | Check the pulse for 5 to 10 seconds. |
| | | 7. | If pulse is present, continue rescue breathing: **1 breath every 5 seconds** |

# 13.0 GENERAL SAFETY RULES

Precautions must be taken to prevent injuries and exposures to the following potential hazards.

**TABLE 13-1**
**POTENTIAL HAZARDS AND CONTROL**

| Potential Hazard | Control |
|---|---|
| Exposure to Chemicals of Concern<br><br>(See Appendices B-1: MSDS Definitions and B-2: MSDSs) | 1. Stand up-wind of contaminants whenever possible.<br>2. Minimize contact and contact time with petroleum products.<br>3. Avoid walking through discolored areas, puddles, leaning on drums, or contacting anything that is likely to be contaminated.<br>4. Do not eat, drink, smoke and/or apply cosmetics in the hot or warm zones.<br>5. Wear gloves when in contact with contaminated surfaces.<br>6. Safety glasses must be worn at a minimum.<br>7. Splash goggles must be worn when working with liquids.<br>8. Refer to Section 7 for specific monitoring requirements and action levels.<br>9. >100 ppm organic vapors in breathing zone. **STOP WORK IMMEDIATELY-CONTACT SHSO AND HSM OR CIH.**<br>10. If unknown materials are encountered, call the SHSO. |
| Exposure to Surface/Subsurface Airborne Dust | 1. Stand upwind whenever intrusive activities occur and generate visible signs of airborne dust.<br>2. Monitor air for airborne dust (surface or subsurface)<br>3. Utilize wet methods (spraying ground, wet drilling etc.) when visible signs of airborne dust is generated. |
| Inclement Weather | 1. Stop outdoor work during electrical storms and other extreme weather conditions such as extreme heat or cold temperatures.<br>2. Take cover indoors or in vehicle.<br>3. Listen to local forecasts for warnings about specific weather hazards such as tornados, hurricanes and flash floods. |
| Noise | 1. Wear hearing protection when equipment such as a drill rig, jackhammer, cut saw, air compressor, blower or other heavy equipment is operating on the site.<br>2. Wear hearing protection whenever you need to raise your voice above normal conversational speech due to a loud noise source; this much noise indicates the need for protection. |

**TABLE 13-1**
**POTENTIAL HAZARDS AND CONTROL**

| Potential Hazard | Control |
|---|---|
| Electric Shock | 1. Maintain appropriate distance from overhead utilities; **20-foot minimum clearance from power lines required; 10-foot minimum clearance from shielded power lines.**<br>2. Use ground-fault circuit interrupters as required.<br>3. Perform lockout/tagout procedures (Appendix C-1).<br>4. Use three-pronged plugs and extension cords.<br>5. Contact your local underground utility-locating service.<br>6. Follow code requirements for electrical installations in hazardous locations. |
| Physical Injury | 1. Wear hard hats and safety glasses when on site.<br>2. Maintain visual contact with the equipment operator and wear orange safety vest when heavy equipment is used on site.<br>3. Prevent slips, trips and falls; keep work area uncluttered. |
| Back Injury | 1. Use a mechanical lifting device or a lifting aid where appropriate.<br>2. If you must lift, plan the lift before doing it. |
| Insects | 1. Tuck pants into socks.<br>2. Wear long sleeves and use insect repellent. |
| Poisonous Plants (such as poison ivy, oak or sumac) | 1. Do not enter areas infested with poisonous plants.<br>2. Immediately wash any areas that come into contact with poisonous plants. |
| Drilling | 1. Inspect cables, ropes and hooks for wear.<br>2. Beware of slipping during damp or wet conditions.<br>3. Try to perform the work or rectify the problem from the ground. |
| Fire Control | 1. Smoke only in designated areas.<br>2. Keep flammable liquids in closed containers.<br>3. Keep site clean; avoid accumulating combustible debris such as paper.<br>4. Isolate flammable and combustible materials from ignition sources. |
| First aid kit, emergency eye wash station, fire extinguisher and absorbent pads will be located on-site in the truck. | |

# 14.0 VISITOR REQUIREMENTS

Visitors to the site will be required to participate in a site safety orientation briefing. In accordance with the contract requirements, four sets of protective equipment (excluding respirators, prescription glasses and safety shoes), i.e., Modified Level D as specified in this plan will be continuously maintained on site for government representatives.

# 15.0 EMERGENCY ACTION PLAN

## 15.1 General Requirements

OSHA defines emergency response as any "response effort by employees from outside the immediate release area or by other designated responders (i.e., mutual-aid groups, local fire departments, etc.) to an occurrence which results, or is likely to result in an uncontrolled release of a hazardous substance." Personnel covered by this SSHP are not expect to participate in an emergency response where there are potential safety or health hazards (i.e., fire, explosion, or chemical exposure).

Response actions will be limited to evacuation and medical/first aid as described in Table 15-1.

**TABLE 15-1**
**CONTINGENCY PLANS FOR SITE EMERGENCIES**

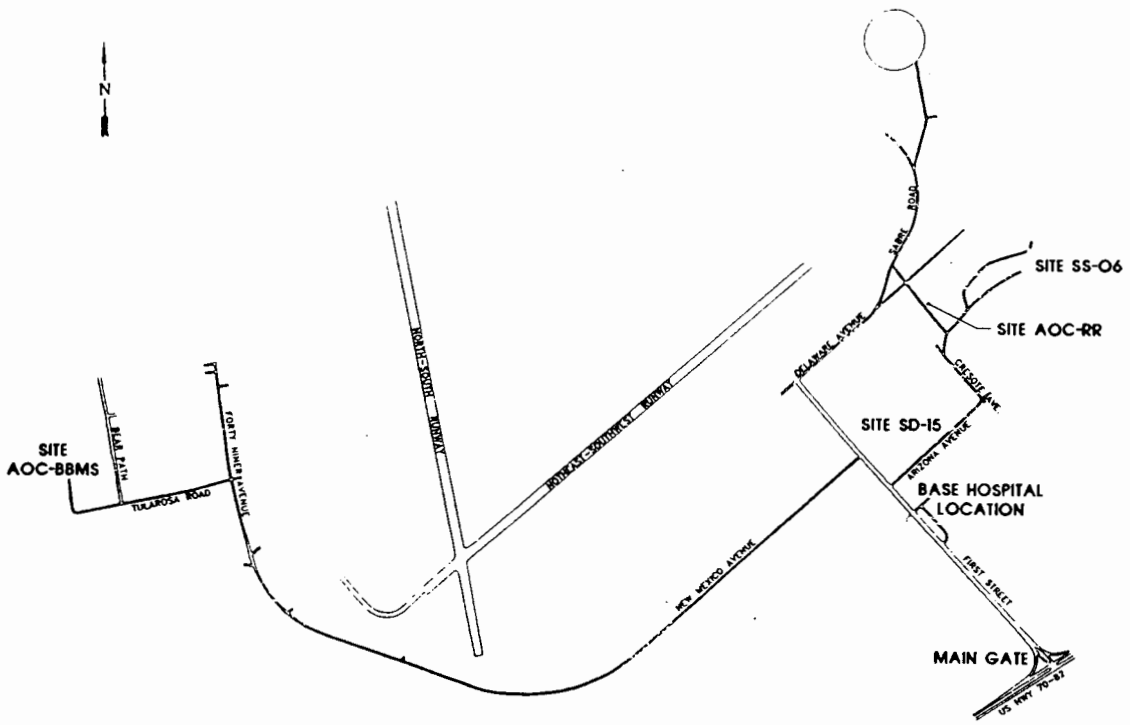
| Situation | | Action | |
|---|---|---|---|
| 1 | **Evacuation** | 1. | Immediately notify all on-site personnel of an emergency requiring evacuation to a designated rally point upwind of the site. |
| | | 2. | Leave the dangerous area. |
| | | 3. | Notify Emergency Services, as appropriate. |
| | | 4. | Account for all personnel. |
| | | 5. | Contact the PM and the SHSO as soon as possible. |
| | | 6. | Maintain site security and control measures for community safety until emergency responders arrive. |

**TABLE 15-1**
**CONTINGENCY PLANS FOR SITE EMERGENCIES**

| Situation | | Action |
|---|---|---|
| 2 | **Contaminant Exposure** | 1. Evaluate the situation before taking action. Do not enter a confined space to rescue someone who has been overcome unless properly equipped and a standby person is present.<br><br>2. Remove person from contaminated environment.<br><br>3. If decontamination can be done, wash, rinse and/or cutoff protective clothing and equipment, especially for heat stress related illness.<br><br>4. If decontamination cannot be done due to severity of injury/illness, wrap victim in blankets, plastic or rubber to reduce contamination of other personnel. Alert EMS personnel to potential contamination and instruct them about specific decontamination procedures. Transport to hospital with SSHP to assist medical personnel in diagnosis and treatment. |
| 3 | **Medical Emergency** | 1. Survey the Situation:<br>**Do not enter an area that may jeopardize your safety.**<br>■ Establish the patient's level of consciousness.<br>■ Call for help.<br>■ Contact Emergency Medical Services and inform them of patient's condition.<br>■ Provide EMS and hospital personnel with information on the chemical(s) that may exist.<br><br>2. Primary Assessment (patient unconscious)<br>■ Arousal<br>■ Airway<br>■ Breathing<br>■ Circulation<br><br>**Only trained personnel should perform CPR or First Aid.**<br><br>3. Secondary Assessment (patient conscious)<br>■ Check for bleeding: Control with direct pressure.<br>■ Do not move patient (unless location is not secure).<br>■ Monitor vital signs.<br>■ Provide First Aid and CPR to the level of your training.<br>■ Contact the PM and SHSO as soon as possible.<br>■ Document the incident on Preliminary Incident Report form. |

| TABLE 15-1<br>CONTINGENCY PLANS FOR SITE EMERGENCIES | | |
|---|---|---|
| **Situation** | | **Action** |
| **4** | **Fire Emergency** | 1. **Evacuate the area.**<br>2. Notify the Fire Services (1117).<br>3. Extinguish small fires with an all-purpose extinguisher.<br>4. Contact the PM and SHSO.<br>5. Document the incident using the Preliminary Incident Report Form. |
| **5** | **Adverse Weather Conditions** | Refer to Section 16 of this SSHP. |
| **6** | **Spill/Release** | Refer to Section 17 of this SSHP. In the event of an accidental spill or release of a hazardous substance, the Project Manager must contact the client or generator. The generator is under obligation to report to the proper government agencies. If the spill extends into waterways, the Coast Guard and the National Response Center (1-800-424-8802) must be notified immediately by the client with his permission. |
| **Notifications: Complete a Preliminary Incident Report.** | | |

# HOSPITAL LOCATION MAP




## Hospital Directions:

From SS-06 and AOC-RR: Go south on unnamed road that turns into Creosote Avenue. Turn right onto Arizona Avenue. Turn left onto First Street. Hospital is on left side of the road.

FROM SD-15: Turn right on Arizona Avenue. Turn left on First Street. Hospital is on the left side of the road.

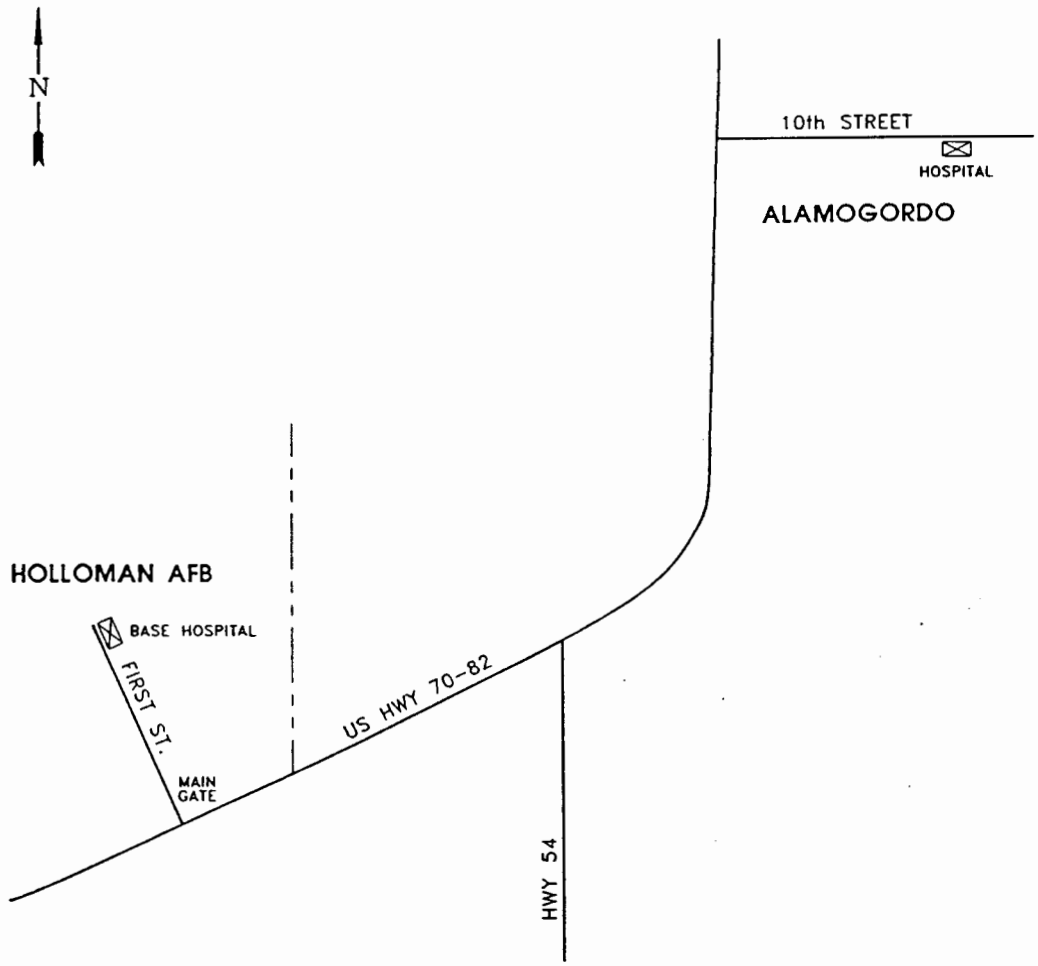
From AOC-BBMS: Turn right on Bear Path. Turn left onto Tularosa Blvd. Turn right onto Forty Niner Avenue. Forty Niner Avenue turns into New Mexico Avenue. Turn right on First Street. Hospital is on left side of the road.

## Hospital Information:

| | |
|---|---|
| **Name** | 833rd Medical Group Hospital |
| **Address** | Santa Fe Street |
| **City, State** | Holloman AFB, NM |
| **Phone** | (505) 479-7171 |

**Use in life threatening situations.**

# HOSPITAL LOCATION MAP




## Hospital Directions:

From Main Gate. Turn left onto US 70-82. Turn left onto 10th Street. Hospital on left side of road.

## Hospital Information:

| | |
|---|---|
| **Name** | Gerald Champion Memorial Hospital |
| **Address** | 1209 East 9th Street |
| **City, State** | Alamogordo, NM |
| **Phone** | (505) 439-2100 |

**Use in non-life threatening situations.**

## 15.3 Incident Reporting Procedures

In addition to current Groundwater Technology Accident/Incident Reporting Policies and Procedures, accident prevention plans need to be addressed on a site-specific basis. The following outlines such needs:

- Administrative responsibilities including identification and accountability for accident prevention.
- Work plans to control/coordinate all phases of the work, including subcontractors.
- Initial site specific training/indoctrination.
- Plans for traffic control, noise control, temporary building/structure layouts (including electrical diagrams), fire protection, emergency services access, job site inspections and routine maintenance/cleanup, and any local ordinance compliance issues.
- Accident Investigation procedures pursuant to USACE EM 385-1-1, Section 2.

In the event of an accident or incident, a Preliminary Incident Report (Appendix A-4) must be completed within 24 hours. This is a Groundwater Technology internal reporting document. Depending upon the nature of the incident, additional agencies or individuals that may need to be notified include the EPA, NMED, OSHA, Base, POC. Unless otherwise mandated by law, **no outside agency may be contacted without explicit approval by the Air Force.** The table below provides a summary of incident reporting guidelines.

**TABLE 15-2**

**INCIDENT REPORTING GUIDE**

| Incident Class | | |
|---|---|---|
| Class I: A minor incident that is dealt with at the local level. | Class II: A serious incident that requires notification to Corporate within 24 hours | Class III: A highly significant incident requiring immediate notification and assistance from Business Unit and Corporate |
| **Examples of Incidents** | | |
| • First Aid injury<br>• Minor damage to property (less than $200)<br>• Non-reportable quantity spill<br>• Near miss incident<br>• Unsafe condition or action<br><br>Note: If there is a question as to Class I or II, follow Class II notification actions. | • Personal injury (more than first aid to employee, sub-contractor or public)<br>• Vehicle accident involving injury or damage to vehicle or property<br>• Damage to property greater than $200 but less than $10,000<br>• Near miss incident that could have been very serious<br>• Fire/Explosion<br>• Non-emergency notification of regulatory agency is required<br>• Served with subpoena (DO NOT ACCEPT, have delivered to CT Corporation System, Registered Agent) | • Hospitalization (of one or more persons)<br>• Unprotected chemical exposure<br>• Death<br>• Damage to property greater than $10,000<br>• Regulatory agency response to incident site<br>• Multiple injury of employees, sub-contractors or public<br>• Emergency notification of regulatory agency<br>• Site visit from regulatory agency<br>• Contact or appearance of news or public media |

| TABLE 15-2<br>INCIDENT REPORTING GUIDE | | |
|---|---|---|
| **Incident Class** | | |
| Class I: A minor incident that is dealt with at the local level. | Class II: A serious incident that requires notification to Corporate within 24 hours | Class III: A highly significant incident requiring immediate notification and assistance from Business Unit and Corporate |
| **Notification Actions** | | |
| 1. On-scene person notifies Manager immediately by phone<br>2. Provide PIR form to Manager within 24 hours<br>3. Manager investigates and follows up | 1. On-scene person notifies Manager immediately by phone<br>2. Manager investigates<br>3. Manager notifies the Business Unit Manager, H&S Manager and Corporate Director H&S with PIR form within 24 hours of the incident<br>4. Manager provides a detailed final investigation report within 30 days to Business Unit Manager, H&S Manager and Corporate Director H&S | 1. On-scene person notifies Manager immediately by phone<br>2. Manager immediately notifies Business Unit Manager, H&S Manager, and Corporate Director H&S (1-800-876-0647, Mailbox #11911) by phone. PIR form is provided by fax immediately to (1-617-769-9861) addressed to Corporate Director H&S<br>3. Incident management team conferences by phone and formulates an action plan |

any incident (other than minor first aid treatment) resulting in injury, illness or property damage requires an accident investigation and report. The investigation should be initiated as soon as emergency conditions are under control. The purpose of this investigation is not to attribute blame but to determine the pertinent facts so that repeat or similar occurrences can be avoided.

The investigation should begin while details are still fresh in the mind of anyone involved. The person administering first aid may be able to start the fact gathering process if the injured are able to speak. Pertinent facts must be determined. Questions beginning with who, what, when, where, and how are usually most effective to discover ways to improve job performance in terms of efficiency and quality of work, as well as safety and health concerns.

## 16.0 HURRICANE AND DESTRUCTIVE WEATHER RESPONSE PLAN

Work will not be permitted during severe weather conditions or if there is an imminent threat of severe weather conditions which threaten the health and safety of on-site workers. Additionally site workers are advised to:

1. Stop work during electrical storms and other extreme weather conditions such as extreme heat or cold temperatures.

2. Take cover indoors or in vehicle.

3. Listen to local forecasts for warnings about specific weather hazards such as tornados, flash floods or electrical storms.

4. Take frequent work breaks during extreme heat or cold conditions.

## 17.0 SPILL PREVENTION AND CONTROL

Prevent problems by documenting the location of underground lines (e.g. product, sewer, telephone) before starting site work. If you rupture a line or tank or another leak occurs, document the spill or release in writing. Include dates, times, actions taken, agreements reached and names of people involved. In the event of a spill or release, follow this plan.

1. Wear appropriate PPE; stay upwind of the spill/release.

2. Turn off equipment and other sources of ignition.

3. Conduct defensive measures to stop the flow or basic containment of the spill (i.e., turn off pumps and shut valves to stop the flow/leak, plug the leak or collect drippings in a bucket, when possible, and place sorbent pads to collect product, if possible.)

4. Call Fire Department immediately if fire emergency develops.

5. Inform Groundwater Technology PM about the situation.

6. Determine if the client wants Groundwater Technology to repair the damage or if the client will use an emergency repair contractor.

7. Based on agreements, contact emergency spill contractor for cleaning up the impacted material.

8. Advise the client of spill discharge notification requirements and determine who will complete and submit forms. Do not submit or report to agencies without the client's consent. Document each interaction with the client and regulators and note, in writing: name, title, authorizations, refusals, decisions, and commitments to actions.

9. Do not transport or approve transportation of contaminated material until proper manifests have been completed and approved. Be aware that soils/product may meet criteria for hazardous waste.

10. Do not sign manifests as generator of waste; contact the regional compliance manager to discuss waste transportation.

**All unplanned releases (spills) shall be reported to Holloman AFB and the USACE TM.** Unless otherwise mandated by law, **no outside agency may be contacted without explicit approval by the Air Force.**

Note: Complete a Preliminary Incident Report.

# JOB SAFETY ANALYSIS
# VEHICLE OPERATIONS

| JOB STEPS - Vehicle Operations | |
|---|---|
| **JOB HAZARDS** | **CONTROL/SAFEGUARDS** |
| 1. Employee run over or hit by moving vehicle | 1. a. back up signals on equipment;<br>b. traffic safety vest for all field personnel;<br>c. foot traffic restricted in areas of operation;<br>d. establish standard hand signals for laborers assisting in vehicle operations.<br>e. turn off engine when leaving the vehicle. |
| 2. Physical hazards;<br>a. hit in head<br>b. foreign body in eye<br>c. foot injury | 2. a. hard hat;<br>b. safety glasses<br>c. steel toe boots |
| 3. Overhead utilities/overhead obstacles | 3. Nominal Voltage — Minimum Clearance<br>0-50 kV — 10 ft<br>51-100 kV — 12 ft<br>101-200 kV — 15 ft<br>201-300 kV — 20 ft<br>301-500 kV — 25 ft<br>501-750 kV — 35 ft<br>751-1000 kV — 45 ft |

# JOB SAFETY ANALYSIS
# SOIL GAS SURVEY

| JOB STEPS - Soil gas survey using Geo-Probe Drill Rig | |
|---|---|
| **JOB HAZARDS** | **CONTROL/SAFEGUARDS** |
| 1. Noise levels exceeding the OSHA personal exposure limit (PEL). | 1. Utilize earmuffs and/or ear plugs to effectively reduce noise levels. |
| 2. Vapors from suspect contaminants. | 2. a. Review hazard information/MSDS for the contaminants suspected to be on-site;<br>b. Perform required air monitoring;<br>c. Redirect exhaust fumes; if action levels are approached;<br>d. Reposition to upwind location.<br>e. Shut down Geo-Probe Unit if action levels are exceeded; and<br>f. No smoking in work zone. |
| 3. Underground pipelines and utility lines can be ruptured or damaged during active drilling operations. | 3. a. Have a dig-safe search conducted;<br>b. Obtain as built plans or blueprints to identify underground utilities/obstacles; and<br>c. Hand dig to 5' depth in questionable areas or suspect utilities. |
| 4. Moving parts such as the sampling rod on the unit may catch clothing. | 4. a. Secure loose clothing;<br>b. Do not wear reflective vest;<br>c. Check "kill switch" daily; and<br>d. Keep hands free from moving parts. |
| 5. High pressure hydraulic lines and air lines used on Geo-Probe Unit are hazardous when they are in need of repair or improperly assembled. | 5. All high pressure lines should have preventative maintenance check regularly in accordance with manufacturer's recommendations. |

# APPENDIX A

# ADMINISTRATIVE INFORMATION

## APPENDIX A-1: AGREEMENT AND ACKNOWLEDGEMENT SHEET

Groundwater Technology personnel have the authority to stop field activities at this site if any activity is not performed in accordance with the requirements of the Site Safety Plan. All Groundwater Technology project personnel, subcontractor personnel and visitors are required to sign the Agreement and Acknowledgement Sheet **prior** to conducting field activities at this site.

**APPENDIX A-1**
**GROUNDWATER TECHNOLOGY, INC.**
**AGREEMENT AND ACKNOWLEDGEMENT SHEET**

1. **I have been made aware of and fully understand the SHSP and my responsibilities.**
2. **I agree to abide by the provisions of the SHSP.**

| | |
|---|---|
| Name | Signature |
| Company | Date |
| | |
| Name | Signature |
| Company | Date |
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| Name | Signature |
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| Company | Date |

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| Company | Date |

## APPENDIX A-1: AGREEMENT AND ACKNOWLEDGEMENT SHEET

Groundwater Technology personnel have the authority to stop field activities at this site if any activity is not performed in accordance with the requirements of the Site Safety Plan. All Groundwater Technology project personnel, subcontractor personnel and visitors are required to sign the Agreement and Acknowledgement Sheet **prior** to conducting field activities at this site.

**APPENDIX A-1**
**GROUNDWATER TECHNOLOGY, INC.**
**AGREEMENT AND ACKNOWLEDGEMENT SHEET**

1. **I have been made aware of and fully understand the SHSP and my responsibilities.**
2. **I agree to abide by the provisions of the SHSP.**

| | |
|---|---|
| Name | Signature |
| Company | Date |
| | |
| Name | Signature |
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| Name | Signature |
| Company | Date |

## APPENDIX A-2: AMENDMENT SHEET

---

**Project Name:** _____

**Project Number:** _____

**Project Manager:** _____

**Location:** _____

**Changes in field activities or hazards:**

**Prepared by:** _____ _____
**Health and Safety Manager** **Date**

**Approved by:** _____ _____
**Certified Industrial Hygienist** **Date**

# APPENDIX A-3: VISITOR/TRAINEE GUIDELINES

Groundwater Technology, Inc. is committed to providing a safe environment on all work sites for visitors, trainees, employees and/or passersby. In order to accomplish this, the following guidelines must be followed.

## 1. VISITORS

Any person not actively participating in the work at the site is regarded as a "visitor" and must follow Groundwater Technology's visitor/trainee guidelines. Visitors must be accompanied by a representative while on site.

Sites must be marked with signs, placards, and/or barricades to designate hazardous boundaries. Visitors will not be allowed on any site that is not adequately marked.

## 2. TRAINEES

Trainees are employees of Groundwater Technology who have not yet completed Groundwater Technology's required safety training program. New hires and in-house company transfers will be considered trainees until safety training requirements are met.

Trainees will be informed of restrictions by their supervisor and must abide by them before visiting active sites.

Trainees will be permitted to visit Groundwater Technology sites as observers as long as the following conditions are met:

- Trainees are supervised at all times while observing on site.
- Trainees do not perform work functions of any type while on site.
- Trainees do not handle any equipment, tools and/or supplies while on site.
- Trainees do not enter any hazardous or hot zone or confined space areas while on site.

Supervisors will be responsible for informing trainees of the above conditions and for ensuring that the conditions are met. Supervisors will also ensure that trainees will not be asked to violate the conditions listed above.

A Trainee/Observer Agreement Form must be signed by both the trainee and the supervisor and placed on file in the Regional Human Resources department.

**Infractions of the above agreement will be viewed as extremely serious and will be subject to discipline up to and including termination for either the trainee and/or supervisor.**

## TRAINEE/OBSERVER AGREEMENT FORM

---

Groundwater Technology is committed to providing a safe working environment for all employees. In addition, Groundwater Technology will comply with OSHA requirements for employee safety training prior to working on any hazardous site.

*The following section is to be filled out by trainee.*

Agreement between:

_____ _____ and Groundwater Technology.
Name (print/type) SS#

Because we have your safety in mind, you will be considered a trainee until all training criteria are met. This means you must complete all training requirements prior to performing work activities on site. As a requirement of the training program, you will be asked to visit Groundwater Technology sites as an observer. You must be supervised on all of these site visits.

As an on-site observer trainee, your signature below indicates your agreement to these restrictions.

**You may not:**

1. Perform work functions of any type.
2. Handle any equipment/tools and/or supplies of any type.
3. Enter any hazardous or hot zone areas.

I agree to adhere to the above conditions in all instances while on site as a trainee/observer.

_____ _____
Signature Date

- - - -

## APPENDIX A-4: PRELIMINARY INCIDENT REPORT

Person Completing Report _____ Phone _____ Today's Date ____

Incident Date _____ Time: ____ am / pm Location _ Dept. #

Type of Incident:

- ☐ Personal Injury/Illness
- ☐ Unsafe Condition/Action
- ☐ Property Damage
- ☐ Permit/Code Compliance
- ☐ Fire/Explosion
- ☐ Equipment Damage
- ☐ Spill/Release
- ☐ Newspaper/Radio/ Television
- ☐ Chemical Exposure
- ☐ Customer Incident
- ☐ Near Miss
- ☐ Motor Vehicle
  Call Associates Leasing at 1-800-255-2607 if GTI vehicle involved

☐ Other _____

**Personal Injury** ☐ Yes ☐ No (If no, go to next section)

☐ First Aid Only ☐ Hospitalization ☐ Medical Treatment ☐ Possible Injury, Not Confirmed

Person Injured: ☐ GTI Employee ☐ Subcontractor ☐ Customer/Public/Other

Injured Name _____ Telephone _____

Office/Addres _____

Nature of Injury, Illness or Exposure _____

_____

_____

Describe nature of incident, how it occurred, who was involved, witnesses and possible causal factors:

_____

_____

_____

Describe actions taken and persons notified:

_____

_____

_____

Manager Responsible for Follow-up _____ Telephone _____

**Provide this report to the responsible manager within 24 hours. Notify Corporate at (800) 876-0647, Mailbox 11911, of all Class II and III incidents and fax to (617) 769-9861 within 24 hours.**

Distributed To: _____, _____,

_____, _____

Rev. 12/94

# APPENDIX B

# CHEMICAL PROFILES

## MATERIAL SAFETY DATA SHEETS (MSDS)

| **Project/Task Name:** | **Project/Task Numbers:** |
|---|---|
| **Form Completed By:** (print name) | (signature) (date) |

In accordance with the OSHA Hazard Communication Standards (1910.1200 and 1926.59) a MSDS must be readily accessible on-site for each hazardous chemical. This applies to all "chemicals" brought on-site such as bentonite clay, calibration gases, cleaning agents, epoxy, PVC pipe cleaner and cement, sample preservatives, and welding rods. **This requirement does not apply to hazardous wastes.** Material Safety Data Sheets for the chemicals listed below are to be included as a part of this appendix to the SSHP or maintained in a separate file or binder on-site. This form/list is to be updated whenever new chemicals are introduced.

| **Product or Chemical Name** (list): | **Manufacturer or Distributor** (list): | **Date** (listed): |
|---|---|---|
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## MSDS DEFINITIONS

**article.** A manufactured item exempt from the OSHA Hazard Communication Standard: (i) Which is formed to a specific shape or design during manufacture; (ii) which has end use function(s) dependent in whole or in part upon its shape or design during end use; and (iii) which does not release, or otherwise result in exposure to, a hazardous chemical, under normal conditions of use.

**chemical.** Any element, chemical compound or mixture of elements, and/or compounds.

**chemical manufacturer.** An employer with a workplace where chemical(s) are produced for use or distribution.

**chemical name.** The scientific designation of a chemical in accordance with the nomenclature system developed by the International Union of Pure and Applied Chemistry (IUPAC) or the Chemical Abstracts Service (CAS) rules of nomenclature, or a name which will clearly identify the chemical for the purpose of conducting a hazard evaluation.

**combustible liquid.** A liquid having a flashpoint at or above 100°F (37.8°C), but below 200°F (93.3°C).

**common name.** Any designation or identification such as code name, code number, trade name, brand name, or generic name used to identify a chemical other than by its chemical name.

**compressed gas.** (i) A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70°F (21.1°C); or (ii) A gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130°F (54.4°C) regardless of the pressure at 70°F (21.1°C); or (iii) A liquid having a vapor pressure exceeding 40 psi at 100°F (37.8°C) as determined by ASTM D-323-72.

**container.** Any bag, barrel, bottle, box, can, cylinder, drum, reaction vessel, storage tank, or the like that contains a hazardous chemical. For Hazard Communication purposes, pipes, or piping systems, and engines, fuel tanks, or other operating systems in a vehicle, are not considered to be containers.

**distributor.** A business, other than a chemical manufacturer or importer, which supplies hazardous chemicals to other distributors or to employers.

**employee.** A worker who may be exposed to hazardous chemicals under normal operating conditions or in foreseeable emergencies. Workers such as office workers or bank tellers who encounter hazardous chemicals only in non-routine, isolated instances are not covered by the Hazard Communication Standard.

**explosive.** A chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

**exposed.** Exposed means that an employee is subjected to a hazardous chemical in the course of employment through any route of entry (inhalation, ingestion, skin contact, or absorption, etc.), and includes potential (e.g., accidental or possible) exposure.

**flammable liquid.** Any liquid having a flashpoint below 100°F (37.8°C).

**flashpoint.** The minimum or lowest temperature at which a liquid gives off a vapor in sufficient concentration just above the liquid surface to ignite.

**foreseeable emergency.** Any potential occurrence such as, but not limited to, equipment failure, rupture of containers, or failure control equipment which could result in an uncontrolled release of a hazardous chemical into the workplace.

**hazardous chemical.** Any chemical which is a physical hazard or a health hazard, as defined by the Hazard Communication Standard, except for: (i) any hazardous waste (as defined by the U.S. EPA); (ii) tobacco or tobacco products; (iii) wood or wood products; (iv) articles; (v) food, drugs, cosmetics, or alcoholic beverages in a retail establishment which are packaged for sale to consumers.

**hazard warning.** Means any words, pictures, symbols, or combination thereof appearing on a label or other appropriate form of warning which convey the hazard(s) of the chemical(s) in the container(s).

**health hazard.** Chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic system, and agents which damage the lungs, skin, eyes, or mucous membranes.

**immediately dangerous to life or health (IDLH).** Any atmospheric condition that poses an immediate threat to life, or which is likely to result in acute or immediate severe health effects. This includes oxygen deficiency conditions.

**immediate use.** Means that the hazardous chemical will be under the control of and used only by the person who transfers it from labeled container and only within the work shift in which it is transferred.

**label.** Any written, printed, or graphic material displayed on or affixed to containers of hazardous chemicals.

**lower explosive limit (LEL).** The minimum concentration of vapor in air below which propagation of a flame will not occur in the presence of an ignition source.

**Material Safety Data Sheet (MSDS).** See Appendix A.

**odor threshold.** A property displayed by a particular compound, low detection indicates a physiological sensation due to molecular contact with the olfactory nervous system (Based on 50 percent of the population).

**Permissible Exposure Limit (PEL).** Legally enforceable inhalation exposure limit usually expressed as a time-weighted average concentrations similar to (and in many cases derived from) the Threshold Limit Values.

**physical hazard.** A chemical which is either combustible, compressed gas, explosive, flammable, organic peroxide, oxidizer, pyrophoric, unstable (reactive) or water reactive.

**produce.** Manufacture, process, formulate, or repackage.

**Recommended Exposure Limit (REL).** An inhalation exposure limit defined by NIOSH similar to the Threshold Limit Values.

**Threshold Limit Value - Time Weighted Average (TLV-TWA).** The time-weighted average concentration for a normal 8-hour work day and a 40-hour work week, to which nearly all workers may be repeatedly exposed without adverse effect.

**upper explosive limit (LEL).** The maximum concentration of vapor in air above which propagation of a flame will not occur in the presence of an ignition source.

**use.** Package, handle, react, or transfer.

**vapor pressure (V.P.).** The pressure characteristic at any given temperature of a vapor in equilibrium with its liquid or solid form, often expressed in millimeters of mercury (mm Hg).

**work area.** A room or defined space in a workplace where hazardous chemicals are produced or used, and where employees are present.

**workplace.** An establishment, job site, or project, at one geographical location containing one or more work areas.

## APPENDIX B-1: MSDS DEFINITIONS

| | |
|---|---|
| **(TLV-TWA)** | ***Threshold Limit Value - Time Weighted Average***. The time-weighted average concentration for a normal 8-hour work day and a 40-hour work week, to which nearly all workers may be repeatedly exposed without adverse effect. |
| **(PEL)** | ***Permissible exposure limit***. Time-weighted average concentrations similar to (and in many cases derived from) the Threshold Limit Values. The PEL is a legal standard that is not to be exceeded unless noted otherwise. |
| **(REL)** | ***Recommended Exposure Limit*** as defined by NIOSH similar to the Threshold Limit Values. |
| **(IDLH)** | ***Immediately dangerous to life or health*** - Any atmospheric condition that poses an immediate threat to life, or which is likely to result in acute or immediate severe health effects. Oxygen deficiency is **IDLH**. |
| **(LEL)** | ***Lower Explosive Limit*** - The minimum concentration of vapor in air below which propagation of a flame will not occur in the presence of an ignition source. |
| **(UEL)** | ***Upper Explosive Limit*** - The maximum concentration of vapor in air above which propagation of a flame will not occur in the presence of an ignition source. |
| **Flash Point (F.P.)** | The lowest temperature at which the vapor of a combustible liquid can be made to ignite momentarily in air. |
| **Vapor Pressure (V.P.)** | The pressure characteristic at any given temperature of a vapor in equilibrium with its liquid or solid form, often expressed in millimeters of mercury (mm Hg). |
| **Odor Threshold** | A property displayed by a particular compound. Low detection indicates a physiological sensation due to molecular contact with the olfactory nervous system (based on 50% of the population). |
| **Ionization Potential (I.P.)** | The amount of ionization characteristic a particular chemical compound displays. |

## APPENDIX B-2: MATERIAL SAFETY DATA SHEETS (MSDS)

The following MSDS are for some of the hazardous materials that will be encountered at this site. Contact your local Health and Safety Representative if you need additional information on these materials.

Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8854

*Material Safety Data Sheets Collection:*

Sheet No. 316
Benzene

Issued: 11/78 Revision: E, 8/90

## Section 1. Material Identification 32

**Benzene ($C_6H_6$) Description:** Derived by fractional distillation of coal tar, hydrodealkylation of toluene or pyrolysis of gasoline, catalytic reforming of petroleum, and transalkylation of toluene by disproportionation reaction. Used as a fuel; a chemical reagent; a solvent for a large number of materials such as paints, plastics, rubber, inks, oils, and fats; in manufacturing phenol, ethylbenzene (for styrene monomer), nitrobenzene (for aniline), dodecylbenzene (for detergents), cyclohexane (for nylon), chlorobenzene, diphenyl, benzene hexachloride, maleic anhydride, benzene-sulfonic acid, artificial leather, linoleum, oil cloth, varnishes, and lacquers; for printing and lithography; in dry cleaning; in adhesives and coatings; for extraction and rectification; as a degreasing agent; in the tire industry; and in shoe factories. Benzene has been banned as an ingredient in products intended for household use and is no longer used in pesticides.

**Other Designations:** CAS No. 0071-43-2, benzol, carbon oil, coal naphtha, cyclohexatriene, mineral naphtha, nitration benzene, phene, phenyl hydride, pyrobenzol.

**Manufacturer:** Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*[73] for a suppliers list.

R 1
I 4
S 2*
K 4
*Skin absorption

NFPA
3 2 0 -

HMIS
H 3
F 3
R 0
PPG†
† Sec. 8

**Cautions:** Benzene is a confirmed *human carcinogen* by the IARC. *Chronic low-level exposure may cause cancer (leukemia) and bone marrow damage, with injury to blood-forming tissue.* It is also a dangerous fire hazard when exposed to heat or flame.

## Section 2. Ingredients and Occupational Exposure Limits

Benzene, ca 100%*

**1989 OSHA PELs**
(29 CFR 1910.1000, Table Z-1-A)
8-hr TWA: 1 ppm, 3 mg/m³
15-min STEL: 5 ppm, 15 mg/m³

(29 CFR 1910.1000, Table Z-2)
8-hr TWA: 10 ppm
Acceptable Ceiling Concentration: 25 ppm
Acceptable Maximum Peak: 50 ppm (10 min)†

**1989-90 ACGIH**
TLV-TWA: 10 ppm, 32 mg/m³

**1988 NIOSH RELs**
TWA: 0.1 ppm, 0.3 mg/m³
Ceiling: 1 ppm, 3 mg/m³

**1985-86 Toxicity Data‡**
Man, oral, $LD_{Lo}$: 50 mg/kg; no toxic effect noted
Man, inhalation, $TC_{Lo}$: 150 ppm inhaled intermittently over 1 yr in a number of discrete, separate doses affects the blood (other changes) and nutritional and gross metabolism (body temperature increase)
Rabbit, eye: 2 mg administered over 24 hr produces severe irritation

* OSHA 29 CFR 1910.1000, Subpart Z, states that the final benzene standard in 29 CFR 1910.1028 applies to all occupational exposures to benzene except in some subsegments of industry where exposures are consistently under the action level (i.e., distribution and sale of fuels, sealed containers and pipelines, coke production, oil and gas drilling and production, natural gas processing, and the percentage exclusion for liquid mixtures); for the excepted subsegments, the benzene limits in Table Z-2 apply.
† Acceptable maximum peak above the acceptable ceiling concentration for an 8-hr shift.
‡ See NIOSH, *RTECS* (CY1400000), for additional irritative, mutative, reproductive, tumorigenic, and toxicity data.

## Section 3. Physical Data

**Boiling Point:** 176 °F (80 °C)
**Melting Point:** 42 °F (5.5 °C)
**Vapor Pressure:** 100 mm Hg at 79 °F (26.1 °C)
**Vapor Density (Air = 1):** 2.7
**Evaporation Rate (Ether = 1):** 2.8

**Molecular Weight:** 78.11
**Specific Gravity (15 °C/4 °C):** 0.8787
**Water Solubility:** Slightly (0.180 g/100 g of $H_2O$ at 25 °C)
**% Volatile by Volume:** 100
**Viscosity:** 0.6468 mPa at 20 °C

**Appearance and Odor:** A colorless liquid with a characteristic sweet, aromatic odor. The odor recognition threshold (100% of panel) is approximately 5 ppm (unfatigued) in air. Odor *is not* an adequate warning of hazard.

## Section 4. Fire and Explosion Data

| Flash Point: 12 °F (-11.1 °C), CC | Autoignition Temperature: 928 °F (498 °C) | LEL: 1.3% v/v | UEL: 7.1% v/v |
|---|---|---|---|

**Extinguishing Media:** Use dry chemical, foam, or carbon dioxide to extinguish benzene fires. Water may be ineffective as an extinguishing agent since it can scatter and spread the fire. Use water spray to cool fire-exposed containers, flush spills away from exposures, disperse benzene vapor, and protect personnel attempting to stop an unignited benzene leak.

**Unusual Fire or Explosion Hazards:** Benzene is a Class 1B flammable liquid. A concentration exceeding 3250 ppm is considered a potential fire explosion hazard. Benzene vapor is heavier than air and can collect in low lying areas or travel to an ignition source and flash back. Explosive and flammable benzene vapor-air mixtures can easily form at room temperature. Eliminate all ignition sources where benzene is used, handled, or stored.

**Special Fire-fighting Procedures:** Isolate hazard area and deny entry. Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and full protective equipment. Structural firefighter's protective clothing provides limited protection. Stay out of low areas. Be aware of runoff from fire control methods. Do not release to sewers or waterways. Runoff to sewer can create pollution, fire, and explosion hazard.

## Section 5. Reactivity Data

**Stability/Polymerization:** Benzene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

**Chemical Incompatibilities:** Benzene explodes on contact with diborane, permanganic acid, bromine pentafluoride, peroxodisulfuric acid, and peroxomonosulfuric acid. It ignites on contact with dioxygen difluoride, dioxygenyl tetrafluoroborate, iodine heptafluoride, and sodium peroxide + water. Benzene forms sensitive, explosive mixture with iodine pentafluoride, ozone, liquid oxygen, silver perchlorate, nitryl perchlorate, nitric acid, and arsenic pentafluoride + potassium methoxide (explodes above 30 °C). A vigorous or incandescent reaction occurs with bromine trifluoride, uranium hexafluoride, and hydrogen + Raney nickel [above 410 °F (210 °C)]. Benzene is incompatible with oxidizing materials.

**Conditions to Avoid:** Avoid heat and ignition sources.

**Hazardous Products of Decomposition:** Thermal oxidative decomposition of benzene can produce toxic gases and vapors such as carbon monoxide.

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## Section 6. Health Hazard Data

**Carcinogenicity:** The ACGIH, OSHA, and IARC list benzene as, respectively, a supected human carcinogen, a cancer hazard, and, based on sufficient human and animal evidence, a human carcinogen (Group 1).
**Summary of Risks:** Prolonged skin contact or excessive inhalation of benzene vapor may cause headache, weakness, appetite loss, and fatigue. The most important health hazards are cancer (leukemia) and bone marrow damage with injury to blood-forming tissue from chronic low-level exposure. Higher level exposures may irritate the respiratory tract and cause central nervous system (CNS) depression.
**Medical Conditions Aggravated by Long-Term Exposure:** Exposure may worsen ailments of the heart, lungs, liver, kidneys, blood, and CNS.
**Target Organs:** Blood, central nervous system, bone marrow, eyes, upper respiratory tract, and skin.
**Primary Entry Routes:** Inhalation, skin contact.
**Acute Effects:** Symptoms of acute overexposure include irritation of the eyes, nose, and respiratory tract, breathlessness, euphoria, nausea, drowsiness, headache, dizziness, and intoxication. Severe exposure may lead to convulsions and unconsciousness. Skin contact may cause a drying rash (dermatitis).
**Chronic Effects:** Long-term chronic exposure may result in many blood disorders ranging from aplastic anemia (an inability to form blood cells) to leukemia.
**FIRST AID**
**Eyes:** Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.
**Skin:** *Quickly* remove contaminated clothing. Immediately rinse with flooding amounts of water for at least 15 min. For reddened or blistered skin, consult a physician. Wash affected area with soap and water.
**Inhalation:** Remove exposed person to fresh air. Emergency personnel should protect against inhalation exposure. Provide CPR to support breathing or circulation as necessary. Keep awake and transport to a medical facility.
**Ingestion:** Never give anything by mouth to an unconscious or convulsing person. If ingested, *do not induce vomiting* since aspiration may be fatal. Call a physician immediately.
**After first aid, get appropriate in-plant, paramedic, or community medical support.**
**Physician's Note:** Evaluate chronic exposure with a CBC, peripheral smear, and reticulocyte count for signs of myelotoxicity. Follow up any early indicators of leukemia with a bone marrow biopsy. Urinary phenol conjugates may be used for biological monitoring of recent exposure. Acute management is primarily supportive for CNS depression.

## Section 7. Spill, Leak, and Disposal Procedures

**Spill/Leak:** *Design and practice a benzene spill control and countermeasure plan (SCCP).* Notify safety personnel, evacuate all unnecessary personnel, eliminate all heat and ignition sources, and provide adequate ventilation. Cleanup personnel should protect against vapor inhalation, eye contact, and skin absorption. Absorb as much benzene as possible with an inert, noncombustible material. For large spills, dike far ahead of spill and contain liquid. Use nonsparking tools to place waste liquid or absorbent into closable containers for disposal. Keep waste out of confined spaces such as sewers, watersheds, and waterways because of explosion danger. Follow applicable OSHA regulations (29 CFR 1910.120).
**Disposal:** Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.
**EPA Designations**
Listed as a RCRA Hazardous Waste (40 CFR 261.33), Hazardous Waste No. U019
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 1000 lb (454 kg) [* per Clean Water Act, Sec. 307 (a), 311 (b)(4), 112; and per RCRA, Sec. 3001]
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as SARA Toxic Chemical (40 CFR 372.65)
**OSHA Designations**
Listed as an Air Contaminant (29 CFR 1910.1000, Tables Z-1-A and Z-2)

## Section 8. Special Protection Data

**Goggles:** Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).
**Respirator:** Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*
**Other:** Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact.
**Ventilation:** Provide general and local explosion-proof ventilation systems to maintain airborne concentrations at least below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[105]
**Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
**Contaminated Equipment:** Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.
**Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

## Section 9. Special Precautions and Comments

**Storage Requirements:** Store in tightly closed containers in a cool, dry, well-ventilated area away from all heat and ignition sources and incompatible materials. *Caution! Benzene vapor may form explosive mixtures in air.* To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations in production and storage areas. When opening or closing benzene containers, use nonsparking tools. Keep fire extinguishers readily available.
**Engineering Controls:** Because OSHA specifically regulates benzene (29 CFR 1910.1028), educate workers about its potential hazards and dangers. Minimize all possible exposures to carcinogens. If possible, substitute less toxic solvents for benzene; use this material with extreme caution and only if absolutely essential. Avoid vapor inhalation and skin and eye contact. Use only with adequate ventilation and appropriate personal protective gear. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Designate regulated areas of benzene use (see legend in the box below) and label benzene containers with "DANGER, CONTAINS BENZENE, CANCER HAZARD."
**Other Precautions:** Provide preplacement and periodic medical examinations with emphasis on a history of blood disease or previous exposure.

**Transportation Data (49 CFR 172.101, .102)**

| | |
|---|---|
| **DOT Shipping Name:** Benzene (*benzol*) | **IMO Shipping Name:** Benzene |
| **DOT Hazard Class:** Flammable liquid | **IMO Hazard Class:** 3.2 |
| **ID No.:** UN1114 | **ID No.:** UN1114 |
| **DOT Label:** Flammable liquid | **IMO Label:** Flammable liquid |
| **DOT Packaging Exceptions:** 173.118 | **IMDG Packaging Group:** II |
| **DOT Packaging Requirements:** 173.119 | |

DANGER
BENZENE
CANCER HAZARD
FLAMMABLE–NO SMOKING
AUTHORIZED PERSONNEL ONLY
RESPIRATOR REQUIRED

*MSDS Collection* References: 1, 2, 12, 26, 73, 84-94, 100, 101, 103, 109, 124, 126, 127, 132, 134, 136, 138, 139, 143
**Prepared by:** MJ Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** MJ Upfal, MD, MPH; **Edited by:** JR Stuart, MS



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(518) 377-8854

*Material Safety Data Sheets Collection:*

Sheet No. 317
Toluene

Issued: 8/79 Revision: E, 9/92 Errata: 2/94

## Section 1. Material Identification



**Toluene ($C_6H_5CH_3$) Description:** Derived from petroleum i.e., dehydrogenation of cycloparaffin fractions followed by the aromatization of saturated aromatic hydrocarbons or by fractional distillation of coal-tar light oil and purified by rectification. Used widely as a solvent (replacing benzene in many cases) for oils, resins, adhesives, natural rubber, coal tar, asphalt, pitch, acetyl celluloses, cellulose paints and varnishes; a diluent for photogravure inks, raw material for organic synthesis (benzoyl & benzilidene chlorides, saccharine, TNT, toluene diisocyanate, and many dyestuffs), in aviation and high octane automobile gasoline, as a nonclinical thermometer liquid and suspension solution for navigational instruments.

**Other Designations:** CAS No. 108-88-3, Methacide, methylbenzene, methylbenzol, phenylmethane, toluol, Tolu-sol.

**Manufacturer:** Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*[73] for a suppliers list.

**Cautions:** Toluene is an eye, skin, and respiratory tract irritant becoming narcotic at high centrations. Liver and kidney damage has occurred. Pregnant women chronically exposed to toluene have shown teratogenic effects. Toluene is highly flammable.

R 1
I 3
S 2*
K 3
* Skin absorption

NFPA: 3 / 2 / 0 / -

HMIS
H 2- Chronic effects
F 3
R 0
PPE-Sec. 8

## Section 2. Ingredients and Occupational Exposure Limits

Toluene, < 100%; may contain a small amount of benzene (~ 1%), xylene, and nonaromatic hydrocarbons.

**1991 OSHA PELs**
8-hr TWA: 100 ppm (375 mg/m$^3$)
15-min STEL: 150 ppm (560 mg/m$^3$)

**1990 IDLH Level**
2000 ppm

**1990 NIOSH RELs**
TWA: 100 ppm (375 mg/m$^3$)
STEL: 150 ppm (560 mg/m$^3$)

**1992-93 ACGIH TLV (Skin)**
TWA: 50 ppm (188 mg/m$^3$)

**1990 DFG (Germany) MAK***
TWA: 100 ppm (380 mg/m$^3$)
Half-life: 2 hr to end of shift
Category II: Substances with systemic effects
Peak Exposure Limit: 500 ppm, 30 min average value, 2/shift

**1985-86 Toxicity Data†**
Man, inhalation, $TC_{Lo}$: 100 ppm caused hallucinations, and changes in motor activity and changes in psychophysiological tests.
Human, oral, $LD_{Lo}$: 50 mg/kg; toxic effects not yet reviewed
Human, eye: 300 ppm caused irritation.
Rat, oral, $LD_{50}$: 5000 mg/kg
Rat, liver: 30 µmol/L caused DNA damage.

* Available information suggests damage to the developing fetus is probable.
†See NIOSH, *RTECS* (XS5250000), for additional irritation, mutation, reproductive, and toxicity data.

## Section 3. Physical Data

**Boiling Point:** 232 °F (110.6 °C)
**Melting Point:** -139 °F (-95 °C)
**Molecular Weight:** 92.15
**Density:** 0.866 at 68 °F (20/4 °C)
**Surface Tension:** 29 dyne/cm at 68 °F (20 °C)
**Viscosity:** 0.59 cP at 68 °F (20 °C)
**Refraction Index:** 1.4967 at 20 °C/D

**Water Solubility:** Very slightly soluble, 0.6 mg/L at 68 °F (20 °C)
**Other Solubilities:** Soluble in acetone, alcohol, ether, benzene, chloroform, glacial acetic acid, petroleum ether, and carbon disulfide.
**Vapor Pressure:** 22 mm Hg at 68 °F (20 °C); 36.7 mm Hg at 86 °F (30 °C)
**Saturated Vapor Density (Air = 0.075 lb/ft$^3$ or 1.2 kg/m$^3$):** 0.0797 lb/ft$^3$ or 1.2755 kg/m$^3$
**Odor Threshold (range of all referenced values):** 0.021 to 69 ppm

**Appearance and Odor:** Colorless liquid with a sickly sweet odor.

## Section 4. Fire and Explosion Data

| Flash Point: 40 °F (4.4 °C) CC | Autoignition Temperature: 896 °F (480 °C) | LEL: 1.27% v/v | UEL: 7.0% v/v |
|---|---|---|---|

**Extinguishing Media:** Toluene is a Class 1B flammable liquid. To fight fire, use dry chemical carbon dioxide, or 'alcohol-resistant' foam. Water spray may be ineffective as toluene floats on water and may actually spread fire. **Unusual Fire or Explosion Hazards:** Concentrated vapors are heavier than air and may travel to an ignition source and flash back. Container may explode in heat of fire. Toluenes' burning rate = 5.7 mm/min and its flame speed = 37 cm/sec. Vapor poses an explosion hazard indoors, outdoors, and in sewers. May accumulate static electricity. **Special Fire-fighting Procedures:** Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Structural firefighter's protective clothing provides only limited protection. Apply cooling water to sides of tanks until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use monitor nozzles or unmanned hose holders; if impossible, withdraw from fire and let burn. Withdraw immediately if you hear a rising sound from venting safety device or notice any tank discoloration due to fire because a BLEVE (boiling liquid expanding vapor explosion) may be imminent. Do not release runoff from fire control methods to sewers or waterways.

## Section 5. Reactivity Data

**Stability/Polymerization:** Toluene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization can't occur. **Chemical Incompatibilities:** Strong oxidizers, concentrated nitric acid, nitric acid + sulfuric acid, dinitrogen tetroxide, silver perchlorate, bromine trifluoride, tetranitromethane, and 1,3-dichloro-5,5-dimethyl-2,4-imidazolididione. **Conditions to Avoid:** Contact with heat, ignition sources, or incompatibles. **Hazardous Products of Decomposition:** Thermal oxidative decomposition of toluene can produce carbon dioxide, and acrid, irritating smoke.

## Section 6. Health Hazard Data

**Carcinogenicity:** The IARC,[164] NTP,[169] and OSHA[164] do not list toluene as a carcinogen. **Summary of Risks:** Toluene is irritating to the eyes, nose, and respiratory tract. Inhalation of high concentrations produces a narcotic effect sometimes leading to coma as well as liver and kidney damage. 93% of inhaled toluene is retained in the body of which 80% is metabolized to benzoic acid, then to hippuric acid and excreted in urine. The remainder is metabolized to *o*-cresol and excreted or exhaled unchanged. Toluene metabolism is inhibited by alcohol ingestion and is synergistic with benzene, asphalt fumes, or chlorinated hydrocarbons (i.e. perchloroethylene). Toluene is readily absorbed through the skin at 14 to 23 mg/cm$^2$/hr. Toluene is absorbed quicker during exercise than at rest and appears to be retained longer in obese versus thin victims; presumably due to its lipid solubility. There is inconsistent data on toluene's ability to damage bone marrow; chronic poisoning has resulted in anemia and leucopenia with biopsy showing bone marrow hypo-plasia. These reports are few and some authorities argue that the effects may have been due to benzene contaminants. Chronic inhalation during pregnancy has been associated with teratogenic effects on the fetus including microcephaly, CNS dysfunction, attentional deficits, developmental delay + language impairment, growth retardation, and physical defects including a small midface, short palpebral fissures, with deep-set eyes, low-set ears, flat nasal bridge with a small nose, micrognathia, and blunt fingertips. There is some evidence that toluene causes an autoimmune illness in which the body produces antibodies that cause inflammation of its own kidney.

*Continue on next page*

## Section 6. Health Hazard Data

**Medical Conditions Aggravated by Long-Term Exposure:** Alcoholism and CNS, kidney, skin, or liver disease. **Target Organs:** CNS, liver, kidney, skin. **Primary Entry Routes:** Inhalation, skin contact/absorption. **Acute Effects:** Vapor inhalation causes respiratory tract irritation, fatigue, [illegible]ess, confusion, dizziness, headache, dilated pupils, watering eyes, nervousness, insomnia, parasthesis, and vertigo progressing to narcotic coma. [illegible]ay result from cardiac arrest due to ventricular fibrillation with catecholamines loss. Liquid splashed in the eye causes conjunctival irritation, [illegible] corneal damage and possible burns. Prolonged skin contact leads to drying and fissured dermatitis. Ingestion causes GI tract irritation and [illegible]oms associated with inhalation. **Chronic Effects:** Symptoms include mucous membrane irritation, headache, vertigo, nausea, appetite loss and alcohol intolerance. Repeated heavy exposure may result in encephalopathies (cerebellar ataxia and cognitive dysfunction), liver enlargement, and kidney dystrophy (wasting away). Symptoms usually appear at workdays end, worsen at weeks end and decrease or disappear over the weekend. **FIRST AID Eyes:** *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult an ophthalmologist immediately. **Skin:** *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. **Inhalation:** Remove exposed person to fresh air and support breathing as needed. **Ingestion:** Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center and unless otherwise advised, have that *conscious and alert* person drink 1 to 2 glasses of water to dilute. *Do not* induce vomiting because of danger of aspiration into the lungs. Gastric lavage may be indicated if large amounts are swallowed; potential toxicity needs to be weighed against aspiration risk when deciding for or against gastric lavage. **Note to Physicians:** Monitor cardiac function. If indicated, use epinephrine and other catecholamines carefully, because of the possibility of a lowered myocardial threshold to the arrhythmogenic effects of such substances. Obtain CBC, electrolytes, and urinalysis. Monitor arterial blood gases. If toluene has > 0.02% (200 ppm) benzene, evaluate for potential benzene toxicity. BEI: hippuric acid in urine, sample at shift end (2.5 g/g creatinine); Toluene in venous blood, sample at shift end (1.0 mg/L).

## Section 7. Spill, Leak, and Disposal Procedures

**Spill/Leak:** Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Cleanup personnel protect against inhalation and skin/eye contact. Use water spray to cool and disperse vapors but it may not prevent ignition in closed spaces. Cellosolve, hycar absorbent materials, and fluorocarbon water can also be used for vapor suppression/containment. Take up small spill with earth, sand, vermiculite, or other absorbent, noncombustible material. Dike far ahead of large spills for later reclamation or disposal. For water spills, (10 ppm or greater) apply activated carbon at 10X the spilled amount and remove trapped material with suction hoses or use mechanical dredges/lifts to remove immobilized masses of pollutants and precipitates. Toluene can undergo fluidized bed incineration at 842 to 1796 °F (450 to 980 °C), rotary kiln incineration at 1508 to 2912 °F (820 to 1600 °C), or liquid injection incineration at 1202 to 2912 °F (650 to 1600 °C). Follow applicable OSHA regulations (29 CFR 1910.120). **Ecotoxicity Values:** Blue gill, $LC_{50}$ = 17 mg/L/24 hr; shrimp (*Crangonfracis coron*), $LC_{50}$ = 4.3 ppm/96 hr; fathead minnow (*Pimephales promelas*), $LC_{50}$ = 36.2 mg/L/96 hr. **Environmental Degradation:** If released to land, toluene evaporates and undergoes microbial degradation. In water, toluene volatilizes and biodegrades with a half-life of days to several weeks. In air, toluene degrades by reaction with photochemically produced hydroxyl radicals. **Disposal:** Treat contaminated water by gravity separation of solids, followed by skimming of surface. Pass through dual media filtration and carbon absorption units (carbon ratio 1 kg to 10 kg soluble material). Return waste water from backwash to gravity separator. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

**EPA Designations**
Listed as a RCRA Hazardous Waste (40 CFR 261.33): No. U220
S[illegible]A Extremely Hazardous Substance (40 CFR 355), TPQ: Not listed
[illegible] as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 1000 lb (454 kg)
[illegible]r RCRA, Sec. 3001; CWA, Sec. 311 (b)(4); CWA, Sec. 307 (a)]
Listed as a SARA Toxic Chemical (40 CFR 372.65): Not listed

**OSHA Designations**
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

## Section 8. Special Protection Data

**Goggles:** Wear protective eyeglasses with shatter-resistant glass and side-shields or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy. **Respirator:** Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For < 1000 ppm, use any chemical cartridge respirator with appropriate organic vapor cartridges, any supplied-air respirator (SAR), or SCBA. For < 2000 ppm, use any SAR operated in continuous-flow mode, any SAR or SCBA with a full facepiece, or any air-purifying respirator with a full facepiece having a chin-style, front or back mounted organic vapor canister. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas. **Other:** Wear chemically protective gloves, boots, aprons, and gauntlets to prevent skin contact. Polyvinyl alcohol with a breakthrough time of > 8 hr, Teflon and Viton are recommended as suitable materials for PPE. **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.[103] **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Separate contaminated work clothes from street clothes and launder before reuse. Remove toluene from your shoes and clean PPE. **Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

## Section 9. Special Precautions and Comments

**Storage Requirements:** Prevent physical damage to containers. Store in a cool, dry, well-ventilated area away from ignition sources and incompatibles. Outside or detached storage is preferred. If stored inside, use a standard flammable liquids warehouse, room, or cabinet. To prevent static sparks, electrically ground and bond all equipment used with toluene. Do not use open lights in toluene areas. Install Class 1, Group D electrical equipment. Check that toluene is free of or contains < 1% benzene before use. **Engineering Controls:** To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain concentrations at the lowest practical level. **Administrative Controls:** Adopt controls for confined spaces (29 CFR 1910.146) if entering areas of unknown toluene levels (holes, wells, storage tanks). Consider preplacement and periodic medical exams of exposed workers that emphasize the CNS, liver, kidney, and skin. Include hemocytometric and thrombocyte count in cases where benzene is a contaminant of toluene. Monitor air at regular intervals to ensure effective ventilation.

**Transportation Data (49 CFR 172.101)**

[illegible]ipping Name: Toluene
[illegible]azard Class: 3
[illegible]o.: UN1294
OT Packing Group: II
OT Label: Flammable Liquid
Special Provisions (172.102): T1

**Packaging Authorizations**
a) Exceptions: 150
b) Non-bulk Packaging: 202
c) Bulk Packaging: 242

**Quantity Limitations**
a) Passenger Aircraft or Railcar: 5L
b) Cargo Aircraft Only: 60L

**Vessel Stowage Requirements**
Vessel Stowage: B
Other: --

*MSDS Collection* References: 26, 73, 100, 101, 103, 124, 126, 127, 132, 140, 148, 153, 159, 163, 164, 167, 169, 171, 174, 175, 176, 180.
Prepared by: M Gannon, BA; Industrial Hygiene Review: PA Roy, CIH, MPH; Medical Review: AC Darlington, MD, MPH

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*Material Safety Data Sheets Collection:*

Sheet No. 385
Ethylbenzene

Issued: 8/78 Revision: B, 9/92

## Section 1. Material Identification



**Ethylbenzene ($C_6H_5C_2H_5$) Description:** Derived by heating benzene and ethylene in presence of aluminum chloride with subsequent distillation, by fractionation directly from the mixed xylene stream in petroleum refining, or dehydrogenation of naphthenes. Used as a solvent, an antiknock agent in gasoline; and as an intermediate in production of synthetic rubber, styrene, cellulose acetate, diethylbenzene, acetophenone, ethyl anthraquinone, propyl oxide, and α-methylbenzol alcohol.
**Other Designations:** CAS No. 100-41-4, ethylbenzol, EB, phenylethane, NCI-C56393.
**Manufacturer:** Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*[73] for a suppliers list.

R 1
I 3
S 2*
K 4
* Skin absorption

NFPA
3 / 2 / 0 / -

HMIS
H 2†
F 3
R 0
PPE - Sec. 8
† Chronic effects

**Cautions:** Ethylbenzene is a skin and mucous membrane irritant considered the most irritating of the benzene series. Inhalation causes acute and chronic central nervous system (CNS) effects. It is highly flammable and forms explosive mixtures with air.

## Section 2. Ingredients and Occupational Exposure Limits

Ethylbenzene, ca >99.0%. Impurities include ~ 0.1% *meta* & *para* xylene, ~ 0.1% cumene, and ~ 0.1% toluene.

**1991 OSHA PELs**
8-hr TWA: 100 ppm (435 mg/m$^3$)
15-min STEL: 125 ppm (545 mg/m$^3$)
Action Level: 50 ppm (217 mg/m$^3$)

**1990 IDLH Level**
2000 ppm

**1990 NIOSH REL**
TWA: 100 ppm (435 mg/m$^3$)
STEL: 125 ppm (545 mg/m$^3$)

**1992-93 ACGIH TLVs**
TWA: 100 ppm (434 mg/m$^3$)
STEL: 125 ppm (545 mg/m$^3$)

**1990 DFG (Germany) MAK**
TWA: 100 ppm (440 mg/m$^3$)
Category 1: local irritants
Peak Exposure Limit: 200 ppm, 5 min momentary value, max of 8/shift
Danger of cutaneous absorption

**1985-86 Toxicity Data***
Human, inhalation, $TC_{Lo}$: 100 ppm/8 hr caused eye effects, sleep, and respiratory changes.
Human, lymphocyte: 1 mmol/L induced sister chromatid exchange.
Rat, oral, $LD_{50}$: 3500 mg/kg; toxic effects not yet reviewed
Rat (female), inhalation, $TC_{Lo}$: 1000 ppm/7 hr/day, 5 days/wk, for 3 wk prior to mating and daily for 19 days of gestation produced pups with high incidence of extra ribs.[179]

* See NIOSH, *RTECS* (DA0700000), for additional irritation, mutation, reproductive, and toxicity data.

## Section 3. Physical Data

**Boiling Point:** 277 °F (136 °C)
**Melting Point:** -139 °F (-95 °C)
**Surface Tension:** 31.5 dyne/cm
**Ionization Potential:** 8.76 eV
**Viscosity:** 0.64 cP at 77 °F (25 °C)
**Refraction Index:** 1.4959 at 68 °F (20 °C)
**Relative Evaporation Rate (ether = 1):** 0.0106
**Bulk Density:** 7.21 lb/Gal at 77 °F (25 °C)
**Critical Temperature:** 651 °F (343.9 °C)
**Critical Pressure:** 35.6 atm

**Molecular Weight:** 106.16
**Density:** 0.863 at 77 °F (25 °C)
**Water Solubility:** Slightly, 14 mg/100 mL at 59 °F (15 °C)
**Other Solubilities:** Miscible in alcohol, ether; soluble in carbon tetrachloride, benzene, sulfur dioxide, and many organic solvents; insoluble in ammonia
**Odor Threshold:** 2.3 ppm
**Vapor Pressure:** 7.1 mm Hg at 68 °F (20 °C); 10 mmHg at 78.62 °F (25.9 °C); 100 mm Hg 165.38 °F (74.1 °C)
**Saturated Vapor Density (Air = 0.075 lb/ft$^3$ or 1.2 kg/m$^3$):** 0.0768 lb/ft$^3$ or 1.2298 kg/m$^3$

**Appearance and Odor:** Colorless, flammable liquid with a pungent odor.

## Section 4. Fire and Explosion Data

| Flash Point: 64 °F (18 °C) CC | Autoignition Temperature: 810 °F (432 °C) | LEL: 1.0% v/v | UEL: 6.7% v/v |
|---|---|---|---|

**Extinguishing Media:** Class 1B Flammable liquid. For small fires, use dry chemical, carbon dioxide, or 'alcohol-resistant' foam. For large fires, use fog or 'alcohol-resistant' foam. Use water only if other agents are unavailable; EB floats on water and may travel to an ignition source and spread fire. **Unusual Fire or Explosion Hazards:** Burning rate = 5.8 mm/min. Vapors may travel to an ignition source and flash back. Container may explode in heat of fire. EB poses a vapor explosion hazard indoors, outdoors, and in sewers. **Special Fire-fighting Procedures:** Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Cool container sides with water until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use monitor nozzles or unmanned hose holders; if impossible, withdraw from area and let fire burn. Withdraw immediately if you hear rising sound from venting safety device or notice any tank discoloration due to fire. Do not release runoff from fire control methods to sewers or waterways.

## Section 5. Reactivity Data

**Stability/Polymerization:** Ethylbenzene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.
**Chemical Incompatibilities:** Reacts vigorously with oxidizers.
**Conditions to Avoid:** Exposure to heat and oxidizers.
**Hazardous Products of Decomposition:** Thermal oxidative decomposition of EB can produce acrid smoke and irritating fumes.

## Section 6. Health Hazard Data

**Carcinogenicity:** The IARC,[164] NTP,[169] and OSHA[164] do not list EB as a carcinogen. **Summary of Risks:** Occupational exposure to EB alone is rare since it is usually present together with other solvents. EB is irritating to the eyes, skin, and respiratory tract. Vapor inhalation produces varying degrees of CNS effects depending on concentration. The liquid is absorbed through the skin but vapors are not. 56 to 64% of inhaled ethylbenzene is retained and metabolized. Urinary metabolites following exposure to 23 to 85 ppm for 8 hr are mandelic acid (64%), phenylglyoxylic acid (25%), and methylphenylcarbinol/1-phenyl ethanol (5%). Concurrent exposure to xylene and ethylbenzene causes slower excretion of EB metabolites. Based on the rat $LD_{50}$, one manufacturer gives 3 to 4 oz. as the lethal dose for a 100 lb person.

*Continue on next page*

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## Section 6. Health Hazard Data

**Medical Conditions Aggravated by Long-Term Exposure:** Skin and CNS diseases and impaired pulmonary function (especially obstructive lung disease). **Target Organs:** Eyes, respiratory system, skin, CNS, blood. **Primary Entry Routes:** Inhalation, skin and eye contact. **Acute Effects:** Vapor inhalation of 200 ppm caused transient eye irritation; 1000 ppm caused eye irritation with profuse watering (tolerance developed rapidly); 2000 ppm caused severe and immediate eye irritation and watering, nasal irritation, chest constriction, and vertigo; 5000 ppm was intolerable and caused eye and nose irritation. Inhalation of high concentrations may cause narcosis, cramps, and death due to respiratory paralysis. Skin exposed to pure ethylbenzene for 10 to 15 min absorbed 22 to 33 mg/cm$^2$/hr. Immersion of hand in solutions of 112 & 156 mg/L for 1 hr absorbed 118 & 215.7 µg/cm$^2$/hr, respectively. **Chronic Effects:** Repeated skin contact may cause dryness, scaling, and fissuring. Workers chronically exposed to > 100 ppm complained of fatigue, sleepiness, headache, and mild irritation of the eyes and respiratory tract. Repeated vapor inhalation may result in blood disorders, particularly leukopenia (abnormally low level of white blood cells) and lymphocytosis.

**FIRST AID**

**Eyes:** *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately. **Skin:** *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician. **Inhalation:** Remove exposed person to fresh air and support breathing as needed. **Ingestion:** Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center and unless otherwise advised, have that *conscious and alert* person drink 1 to 2 glasses of water to dilute. *Do not* induce vomiting! Aspiration of even a small amount of EB in vomitus can cause severe damage since its low viscosity and surface tension will cause it to spread over a large area of the lung tissue.

**After first aid, get appropriate in-plant, paramedic, or community medical support.**

**Note to Physicians:** BEI = mandelic acid in urine (1.5 g/g of creatinine), sample at end of shift at workweeks end. Since this test is not specific, test for EB in expired air for confirmation.

## Section 7. Spill, Leak, and Disposal Procedures

**Spill/Leak:** Notify safety personnel. Isolate and ventilate area, deny entry and stay upwind. Shut off all ignition sources. Cleanup personnel should protect against vapor inhalation and skin/eye contact. Take up small spills with earth, sand, vermiculite, or other absorbent, noncombustible material and place in suitable container. Dike far ahead of large spill for later reclamation or disposal. Report any release >1000 lb. Follow applicable OSHA regulations (29 CFR 1910.120). **Environmental Transport:** If released to soil, EB partially evaporates into the atmosphere, with a half-life of hrs to wks, and some leaches into groundwater, especially in soil with low organic carbon content. Biodegradation occurs with a half-life of 2 days. Some EB may absorb to sediment or bioconcentrate in fish. Evidence points to slow biodegradation in groundwater. In air, it reacts with photochemically produced hydroxyl radicals with a half-life of hrs to 2 days. Additional amounts may be removed by rain. **Ecotoxicity Values:** Shrimp (*Mysidopsis bahia*), $LC_{50}$ = 87.6 mg/L/96 hr; sheepshead minnow (*Cyprinodon variegatus*) $LC_{50}$ = 275 mg/L/96 hr; fathead minnow (*Pimephales promelas*) $LC_{50}$ = 42.3 mg/L/96 hr in hard water & 48.5 mg/L/96 hr in softwater. **Disposal:** A candidate for rotary kiln incineration at 1508 to 2912°F (820 to 1600°C), liquid injection incineration at 1202 to 2912°F (650 to 1600°C), and fluidized bed incineration at 842 to 1796°F (450 to 980°C). Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

**EPA Designations**

Listed as a RCRA Hazardous Waste (40 CFR 261.21): No. D001
Listed as a SARA Toxic Chemical (40 CFR 372.65)
SARA Extremely Hazardous Substance (40 CFR 355), TPQ: Not listed
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 1000 lb (454 kg) [* per CWA, Sec. 311 (b)(4) & CWA, Sec. 307 (a)]

**OSHA Designations**

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

## Section 8. Special Protection Data

**Goggles:** Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy. **Respirator:** Seek professional advice prior to selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For < 1000 ppm, use a powered air-purifying respirator with an appropriate organic vapor cartridge, a supplied-air respirator (SAR), SCBA, or chemical cartridge respirator with appropriate organic vapor cartridge. For < 2000 ppm, use a SAR or SCBA with a full facepiece. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas. **Other:** Wear chemically protective gloves, boots, aprons, and gauntlets made of Viton or polyvinylchloride to prevent skin contact. **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.[103] **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Separate contaminated work clothes from street clothes and launder before reuse. Remove this material from your shoes and clean PPE. **Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

## Section 9. Special Precautions and Comments

**Storage Requirements:** Store in a cool, dry, well-ventilated area away from ignition sources and oxidizers. Outside or detatched storage is preferred. If inside, store in a standard flammable liquids cabinet. Containers should have flame-arrester or pressure-vacuum venting. To prevent static sparks, electrically ground and bond all equipment used with ethylbenzene. Install Class 1, Group D electrical equipment. **Engineering Controls:** To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain levels as low as possible. Purge and ventilate reaction vessels before workers are allowed to enter for maintenance or cleanup. **Administrative Controls:** Consider preplacement and periodic medical exams of exposed workers that emphasize the CNS, skin, blood, and respiratory system.

**Transportation Data (49 CFR 172.101)**

**DOT Shipping Name:** Ethylbenzene
**DOT Hazard Class:** 3
**ID No.:** UN1175
**DOT Packing Group:** II
**DOT Label:** Flammable liquid
**Special Provisions (172.102):** T1

**Packaging Authorizations**
a) **Exceptions:** 173.150
b) **Non-bulk Packaging:** 173.202
c) **Bulk Packaging:** 173.242

**Quantity Limitations**
a) **Passenger Aircraft or Railcar:** 5L
b) **Cargo Aircraft Only:** 60 L

**Vessel Stowage Requirements**
a) **Vessel Stowage:** B
b) **Other:** —

*MSDS Collection* **References:** 26, 73, 100, 101, 103, 124, 126, 127, 132, 133, 136, 139, 140, 148, 153, 159, 162, 163, 164, 167, 168, 171, 176, 179

**Prepared by:** M Gannon, BA; **Industrial Hygiene Review:** D Wilson, CIH; **Medical Review:** W Silverman, MD

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## Section 1. Material Identification

39

**Xylene (Mixed Isomers) ($C_8H_{10}$) Description:** The commercial product is a blend of the three isomers [*ortho*-(*o*-), *meta*-(*m*-), *para*-(*p*-)] with the largest proportion being *m*- xylene. Xylene is obtained from coal tar, toluene by transalkylation, and pseudocumene. Used in the manufacture of dyes, resins, paints, varnishes, and other organics; as a general solvent for adhesives, a cleaning agent in microscope technique; as a solvent for Canada balsam microscopy; as a fuel component; in aviation gasoline, protective coatings, sterilizing catgut, hydrogen peroxide, perfumes, insect repellants, pharmaceuticals, and the leather industry; in the production of phthalic anhydride, isophthalic, and terephthalic acids and their dimethyl esters which are used in the manufacture of polyester fibers; and as an indirect food additive as a component of adhesives. Around the home, xylene is found as vehicles in paints, paint removers, degreasing cleaners, lacquers, glues and cements and as solvent/vehicles for pesticides.

**Other Designations:** CAS No. 1330-20-7 [95-47-6; 108-38-3; 106-42-3 (*o*-, *m*-, *p*-isomers)], dimethylbenzene, methyltoluene, NCI-C55232, Violet 3, xylol.

**Manufacturer:** Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*[73] for a suppliers list.

**Cautions:** Xylene is an eye, skin, and mucous membrane irritant and may be narcotic in high concentrations. It is a dangerous fire hazard.

| | |
|---|---|
| R | 1 |
| I | 2 |
| S | 2 |
| K | 3 |

NFPA: 3 / 2 / 0 / –

HMIS
H 2†
F 3
R 0
PPE ‡
† Chronic Effects
‡ Sec. 8

## Section 2. Ingredients and Occupational Exposure Limits

Xylene (mixed isomers): the commercial product generally contains ~ 40% *m*-xylene; 20% each of *o*-xylene, *p*-xylene, and ethylbenzene; and small quantities of toluene. Unpurified xylene may contain pseudocumene.

**1991 OSHA PELs**
8-hr TWA: 100 ppm (435 mg/m$^3$)
15-min STEL: 150 ppm (655 mg/m$^3$)

**1990 IDLH Level**
1000 ppm

**1990 NIOSH RELs**
TWA: 100 ppm (435 mg/m$^3$)
STEL: 150 ppm (655 mg/m$^3$)

**1992-93 ACGIH TLVs**
TWA: 100 ppm (434 mg/m$^3$)
STEL: 150 ppm (651 mg/m$^3$)
BEI (Biological Exposure Index): Methylhippuric acids in urine at end of shift: 1.5 g/g creatinine

**1990 DFG (Germany) MAK**
TWA: 100 ppm (440 mg/m$^3$)
Category II: Substances with systemic effects
Half-life: < 2 hr
Peak Exposure: 200 ppm, 30 min, average value, 4 peaks per shift

**1985-86 Toxicity Data***
Human, inhalation, $TC_{Lo}$: 200 ppm produced olfaction effects, conjunctiva irritation, and other changes involving the lungs, thorax, or respiration.
Man, inhalation, $LC_{Lo}$: 10000 ppm/6 hr; toxic effects not yet reviewed.
Human, oral, $LD_{Lo}$: 50 mg/kg; no toxic effect noted.
Rat, oral, $LD_{50}$: 4300 mg/kg; toxic effect not yet reviewed.
Rat, inhalation, $LC_{50}$: 5000 ppm/4 hr; toxic effects not yet reviewed.

* See NIOSH, *RTECS* (XE2100000), for additional toxicity data.

## Section 3. Physical Data

**Boiling Point Range:** 279 to 284 °F (137 to 140 °C)*
**Boiling Point:** *ortho:* 291 °F (144 °C); *meta:* 281.8 °F (138.8 °C); *para:* 281.3 °F (138.5 °C)
**Freezing Point/Melting Point:** *ortho:* -13 °F (-25 °C); *meta:* -53.3 °F (- 47.4 °C); *para:* 55 to 57 °F (13 to 14 °C)
**Vapor Pressure:** 6.72 mm Hg at 70 °F (21 °C)
**Saturated Vapor Density (Air = 1.2 kg/m$^3$):** 1.23 kg/m$^3$, 0.077 lbs/ft$^3$
**Appearance and Odor:** Clear, sweet-smelling liquid.
* Materials with wider and narrower boiling ranges are commercially available.

**Molecular Weight:** 106.16
**Specific Gravity:** 0.864 at 20 °C/4 °C
**Water Solubility:** Practically insoluble
**Other Solubilities:** Miscible with absolute alcohol, ether, and many other organic liquids.
**Octanol/Water Partition Coefficient:** logKow = 3.12-3.20
**Odor Threshold:** 1 ppm
**Viscosity:** <32.6 SUS

## Section 4. Fire and Explosion Data

| Flash Point: 63 to 77 °F (17 to 25 °C) CC | Autoignition Temperature: 982 °F (527 °C) (*m*-) | LEL: 1.1 (*m*-, *p*-); 0.9 (*o*-) | UEL: 7.0 (*m*-, *p*-); 6.7 (*o*-) |
|---|---|---|---|

**Extinguishing Media:** For small fires, use dry chemical, carbon dioxide ($CO_2$), water spray or regular foam. For large fires, use water spray, fog or regular foam. Water may be ineffective. Use water spray to cool fire-exposed containers. **Unusual Fire or Explosion Hazards:** Xylene vapors or liquid (which floats on water) may travel to an ignition source and flash back. The heat of fire may cause containers to explode and/or produce irritating or poisonous decomposition products. Xylene may present a vapor explosion hazard indoors, outdoors, or in sewers. Accumulated static electricity may occur from vapor or liquid flow sufficient to cause ignition. **Special Fire-fighting Procedures:** Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Structural firefighter's protective clothing will provide limited protection. If feasible and without risk, move containers from fire area. Otherwise, cool fire-exposed containers until well after fire is extinguished. Stay clear of tank ends. Use unmanned hose holder or monitor nozzles for massive cargo fires. If impossible, withdraw from area and let fire burn. Withdraw immediately in case of any tank discoloration or rising sound from venting safety device. Do not release runoff from fire control methods to sewers or waterways.

## Section 5. Reactivity Data

**Stability/Polymerization:** Xylene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur. Xylene is easily chlorinated, sulfonated, or nitrated. **Chemical Incompatibilities:** Incompatibilities include strong acids and oxidizers and 1,3-dichloro-5,5-dimethyl-2,4-imidazolidindione (dichlorohydrantoin). Xylene attacks some forms of plastics, rubber, and coatings. **Conditions to Avoid:** Avoid heat and ignition sources and incompatibles. **Hazardous Products of Decomposition:** Thermal oxidative decomposition of xylene can produce carbon dioxide, carbon monoxide, and various hydrocarbon products.

## Section 6. Health Hazard Data

**Carcinogenicity:** The IARC,[164] NTP,[169] and OSHA[164] do not list xylene as a carcinogen. **Summary of Risks:** Xylene is an eye, mucous membrane, and respiratory tract irritant. Irritation starts at 200 ppm; severe breathing difficulties which may be delayed in onset can occur at high concentrations. It is a central nervous system (CNS) depressant and at high concentrations can cause coma. Kidney and liver damage can occur with xylene exposure. With prolonged or repeated cutaneous exposure, xylene produces a defatting dermatitis. Chronic toxicity is not well defined, but it is less toxic than benzene. Prior to the 1950s, benzene was often found as a contaminant of xylene and the effects attributed to xylene such as blood dyscrasias are questionable. Since the late 1950s, xylenes have been virtually benzene-free and blood dyscrasias have not been associated with xylenes. Chronic exposure to high concentrations of xylene in animal studies have demonstrated milk reversible decrease in red and white cell counts as well as increases in platelet counts.

*Continue on next page*

## Section 6. Health Hazard Data, *continued*

ularity was reported in association with workplace exposure to xylene perhaps due to effects on liver metabolism. Xylene crosses the human enta, but does not appear to be teratogenic under conditions tested to date. **Medical Conditions Aggravated by Long-Term Exposure:** CNS, piratory, eye, skin, gastrointestinal (GI), liver and kidney disorders. **Target Organs:** CNS, eyes, GI tract, liver, kidneys, and skin. **Primary Entry Routes:** Inhalation, skin absorption (slight), eye contact, ingestion. **Acute Effects:** Inhalation of high xylene concentrations may cause dizziness; nausea, vomiting, and abdominal pain; eye, nose, and throat irritation; respiratory tract irritation leading to pulmonary edema (fluid in lung); drowsiness; and unconsciousness. Direct eye contact can result in conjunctivitis and corneal burns. Ingestion may cause a burning sensation in the oropharynx and stomach and transient CNS depression. **Chronic Effects:** Repeated or prolonged skin contact may cause drying and defatting of the skin leading to dermatitis. Repeated eye exposure to high vapor concentrations may cause reversible eye damage, peripheral and central neuropathy, and liver damage. Other symptoms of chronic exposure include headache, fatigue, irritability, chronic bronchitis, and GI disturbances such as nausea, loss of appetite, and gas.

**FIRST AID** *Emergency personnel should protect against exposure.* **Eyes:** *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately. **Skin:** *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician. Carefully dispose of contaminated clothing as it may pose a fire hazard. **Inhalation:** Remove exposed person to fresh air and support breathing as needed. Monitor exposed person for respiratory distress. **Ingestion:** Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center and unless otherwise advised, *do not induce vomiting!* If spontaneous vomiting should occur, keep exposed person's head below the hips to prevent aspiration (breathing liquid xylene into the lungs). *Aspiration of a few millimeters of xylene can cause chemical pneumonitis, pulmonary edema, and hemorrhage.* **Note to Physicians:** Hippuric acid or the ether glucuronide of *ortho*-toluic acid may be useful in diagnosis of *meta-*, *para-* and *ortho*-xylene exposure, respectively. Consider gastric lavage if a large quantity of xylene was ingested. Proceed gastric lavage with protection of the airway from aspiration; consider endotracheal intubation with inflated cuff.

## Section 7. Spill, Leak, and Disposal Procedures

**Spill/Leak:** Notify safety personnel, evacuate all unnecessary personnel, remove all heat and ignition sources, and ventilate spill area. Cleanup personnel should protect against vapor inhalation and skin or eye contact. If feasible and without undue risk, stop leak. Use appropriate foam to blanket release and suppress vapors. Water spray may reduce vapor, but does not prevent ignition in closed spaces. For small spills, absorb on paper and evaporate in appropriate exhaust hood or absorb with sand or some non-combustible absorbent and place in containers for later disposal. For large spills dike far ahead of liquid to contain. Do not allow xylene to enter a confined space such as sewers or drains. On land, dike to contain or divert to impermeable holding area. Apply water spray to control flammable vapor and remove material with pumps or vacuum equipment. On water, contain material with natural barriers, booms, or weirs; apply universal gelling agent; and use suction hoses to remove spilled material. Report any release in excess of 1000 lb. Follow applicable OSHA regulations (29 CFR 1910.120). **Environmental Transport:** Little bioconcentration is expected. Biological oxygen demand 5 (after 5 days at 20 °C): 0.64 (no stated isomer). **Ecotoxicity values:** $LD_{50}$, Goldfish, 13 mg/L/24 hr, conditions of bioassay not specified, no specific isomer. **Environmental Degradation:** In the atmosphere, xylenes degrade by reacting with photochemically produced hydroxyl radicals with a half-life ranging from 1-1.7 hr. in the summer to 10-18 hr in winter or a typical loss of 67-86% per day. Xylenes are resistant to hydrolysis. **Soil Absorption/Mobility:** Xylenes have low to moderate adsorption to soil and when spilled on land, ill volatilize and leach into groundwater. **Disposal:** As a hydrocarbon, xylene is a good candidate for controlled incineration. Contact your supplier a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

**PA Designations**
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)
Listed as a RCRA Hazardous Waste (40 CFR 261.33): No. U239, F003 (spent solvent)
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 1000 lb (454 kg) [* per Clean Water Act, Sec. 311(b)(4); per RCRA, Sec. 3001]

**OSHA Designations**
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

## Section 8. Special Protection Data

**Goggles:** Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy. **Respirator:** Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For concentrations >1000 ppm, use any chemical cartridge respirator with organic vapor cartridges; any powered, air-purifying respirator with organic vapor cartridges; any supplied-air respirator; or any self-contained breathing apparatus. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, **Other:** Wear chemically protective gloves, boots, aprons, and gauntlets to prevent all skin contact. With breakthrough times > 8 hr, consider polyvinyl alcohol and fluorocarbon rubber (Viton) as materials for PPE. **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.[103] **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Separate contaminated work clothes from street clothes. Launder contaminated work clothing before wearing. Remove this material from your shoes and clean PPE. **Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

## Section 9. Special Precautions and Comments

**Storage Requirements:** Store in clearly labelled, tightly closed, containers in a cool, well-ventilated place, away from strong oxidizing materials and heat and ignition sources. During transferring operations, electrically ground and bond metal containers. **Engineering Controls:** To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain concentrations at the lowest practical level. Use hermetically sealed equipment, transfer xylene in enclosed systems, avoid processes associated with open evaporating surfaces, and provide sources of gas release with enclosures and local exhaust ventilation. Use Class I, Group D electrical equipment. **Administrative Controls:** Establish air and biological monitoring programs and evaluate regularly. Consider preplacement and periodic medical examinations including a complete blood count, a routine urinalysis, and liver function tests. Consider hematologic studies if there is any significant contamination of the solvent with benzene. If feasible, consider the replacement of xylene by less toxic solvents such as petrol (motor fuel) or white spirit. Before carrying out maintenance and repair work, steam and flush all equipment to remove any xylene residues.

**Transportation Data (49 CFR 172.101)**

**OT Shipping Name:** Xylenes
**T Hazard Class:** 3
**No.:** UN1307
**DOT Packing Group:** II
**DOT Label:** Flammable Liquid
**Special Provisions (172.102):** T1

**Packaging Authorizations**
a) Exceptions: 173.150
b) Nonbulk Packaging : 173.202
c) Bulk Packaging: 173.242

**Quantity Limitations**
a) Passenger, Aircraft, or Railcar: 5L
b) Cargo Aircraft Only: 60L

**Vessel Stowage Requirements**
a) Vessel Stowage: B
b) Other: –

*MSDS Collection* **References:** 26, 73, 89, 100, 101, 103, 124, 126, 127, 132, 133, 136, 139, 140, 148, 149, 153, 159, 163, 164, 167, 171, 174, 176, 180.
**Prepared by:** MJ Wurth, BS; **Industrial Hygiene Review:** PA Roy, MPH, CIH; **Medical Review:** W Silverman, MD

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*Material Safety Data Sheets Collection:*

**Sheet No. 298**
**Jet Fuels**

Issued: 8/90

## Section 1. Material Identification

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**Jet Fuel Description:** A petroleum distillate similar to kerosine composed of $C_5$ to $C_{16}$ aliphatics, monocyclo-paraffins, aromatics, and olefins (for turbine engines only). Aromatics are a lower percentage for jet fuels, but there are a number of jet fuel types with somewhat different compositions and properties.
**Other Designations:** Jet A, Jet A-1, Jet B, Jet fuel HEF-3, JP-1, JP-4, JP-5, JP-6.
**Manufacturer:** Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*[73] for a suppliers list.
**Cautions:** *Jet fuel is volatile, combustible, and thus, a dangerous fire hazard.* It is a skin, eye, and respiratory tract irritant. *Ingestion can be harmful, even fatal.*

(a) Jet A and Jet A-1 (combustible) and JP-5 (flammable to combustible).
(b) Jet B (dangerous fire hazard) and JP-4 (dangerous fire hazard and moderate explosion hazard in the form of vapor).

R 1
I -
S 2
K 2-4*
* Varying flash points

NFPA (a): 2 / 0 / 0 / -
NFPA (b): 3 / 1 / 0 / -

| HMIS | | HMIS | |
|---|---|---|---|
| H | 1 | H | 1 |
| F | 2 | F | 3 |
| R | 0 | R | 0 |
| PPG† | | PPG† | |

† Sec. 8

## Section 2. Ingredients and Occupational Exposure Limits

Jet fuel, ca 100%

| 1989 OSHA PEL | 1989-90 ACGIH TLV | 1988 NIOSH REL | 1985-86 Toxicity Data* |
|---|---|---|---|
| None established | None established | None established | Rat, oral, $LD_{50}$: 40 mg/kg<br>Rat, inhalation, $LC_{50}$: 23 ppm/4 hr<br>Rat, skin, $LD_{50}$: 317 mg/kg |

* These toxicity data pertain to jet fuel HEF-3. See NIOSH, *RTECS* (MH5425100), for additional toxicity data.

## Section 3. Physical Data*

**Boiling Point:** 300 to 550 °F (149 to 288 °C)
**Vapor Pressure:** 0.1 mm Hg at 20 °C
**Viscosity:** 1.0 to 2.0 cSt at 72 °F (40 °C)
**Relative Density (15 °C/4 °C):** 0.79 to 0.84
**Water Solubility:** Negligible

**Appearance and Odor:** A clear liquid with a hydrocarbon odor.

* Physical data vary with fuel type. These data pertain to kerosine jet fuels in general.

## Section 4. Fire and Explosion Data

| Flash Point: 100 °F (37.8 °C), OC* | Autoignition Temperature: 446 °F (230.2 °C)* | LEL: 0.6% v/v | UEL: 3.7% v/v |
|---|---|---|---|
| Jet A and Jet A-1: 110 to 150 °F (43.4 to 65.6 °C)<br>Jet B: -16 to -30 °F (-26.7 to -34.5 °C)<br>JP-1: 95 to 145 °F (35.0 to 62.8 °C)<br>JP-4†: -10 to 30 °F (-23.4 to -1.1 °C)<br>JP-5: 95 to 145 °F (35.0 to 62.8 °C) | JP-1: 442 °F (228 °C)<br>JP-4: 468 °F (242 °C)<br>JP-5: 475 °F (246 °C) | JP-4: 1.3% v/v | JP-4: 8.0% v/v |

**Extinguishing Media:** For large fire, use water spray, fog, or foam. For small fires, use dry chemical or $CO_2$. Water may be ineffective in fighting fires involving materials with low flash points. Apply in the form of a spray.
**Unusual Fire or Explosion Hazards:** Jet fuel is volatile and combustible.
**Special Fire-fighting Procedures:** Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and full protective equipment. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

*A higher kerosene cut than JP-4 with fewer impurities.
† 65% gasoline and 35% light petroleum distillate.

## Section 5. Reactivity Data

**Stability/Polymerization:** Jet fuels are stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.
**Chemical Incompatibilities:** A violent reaction occurs with fluorine ($F_2$). Jet fuels are also incompatible with halogens, strong acids, alkalines, and oxidizers.
**Conditions to Avoid:** Avoid heat, sparks, flame, and build up of static electricity.
**Hazardous Products of Decomposition:** Thermal oxidative decomposition of jet fuel can produce carbon monoxide from incomplete combustion.

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## Section 6. Health Hazard Data

**Carcinogenicity:** The NTP, IARC, and OSHA do not list jet fuels as a carcinogen.
**Summary of Risks:** Jet fuel is a moderate skin, eye, and respiratory irritant. Ingestion may be harmful or fatal. The most serious toxic effect following ingestion is aspiration pneumonitis.
**Medical Conditions Aggravated by Long-Term Exposure:** Individuals with chronic pulmonary disease should not be exposed to jet fuel vapor.
**Target Organs:** Central nervous system, respiratory tract.
**Primary Entry Routes:** Inhalation, ingestion.
**Acute Effects:** Systemic exposure through the respiratory or gastrointestinal (GI) tract may result in increasing levels of central nervous system depression, manifest by a staggering gait, slurred speech, or mental confusion. These symptoms could progress to unconsciousness, coma, and death from respiratory failure. Exposure of lung tissue through aspiration of liquid jet fuel causes an immediate irritant and destructive reaction. The inflammatory lung changes cause a chemical pneumonitis, pulmonary edema (fluid in the lungs), and/or bleeding in the lung tissue. Secondary infection as a result of the injury, and scarring may occur with resultant permanent lung damage. The immediate clinical effects are increasing shortness of breath, coughing, bloody sputum, and chest pain. These symptoms may worsen over the following hours to days. Ingestion causes irritation to the GI tract characterized by vomiting, abdominal pain, and diarrhea. Other organs possibly injured through systemic exposure include parenchyma of the liver, kidney, pancreas, and spleen. Exposure to high mist concentrations may irritate the mucous membrane.
**Chronic Effects:** Chronic lung dysfunction may result from aspiration into the lungs. Prolonged or repeated skin contact can cause dermatitis.
**FIRST AID**
**Eyes:** Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.
**Skin:** *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. For reddened or blistered skin, consult a physician. Wash affected area with soap and water.
**Inhalation:** Remove exposed person to fresh air and support breathing as needed.
**Ingestion:** Never give anything by mouth to an unconscious or convulsing person. If ingested, *do not induce vomiting*. If the victim is nauseated, position head lower than knees to prevent aspiration. Administer vegetable oil and call a physician immediately.
**After first aid, get appropriate in-plant, paramedic, or community medical support.**

## Section 7. Spill, Leak, and Disposal Procedures

**Spill/Leak:** *Design and practice a jet fuel spill control and countermeasure program (SCCP).* Notify safety personnel, isolate hazard area and deny entry, remove all heat and ignition sources, and provide maximum explosion-proof ventilation. Cleanup personnel should protect against vapor inhalation and direct contact with skin or eyes. Immediately absorb spilled jet fuel with noncombustible, inert material such as fire-retardent treated sawdust or diatomaceous earth. Using nonsparking tools, immediately shovel spilled material in appropriate containers for disposal. After completing material pickup, ventilate area and wash spill site. Follow applicable OSHA regulations (29 CFR 1910.120).
**Disposal:** Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

**EPA Designations**
RCRA Hazardous Waste (40 CFR 261.33): Not listed
CERCLA Hazardous Substance (40 CFR 302.4): Not listed
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
SARA Toxic Chemical (40 CFR 372.65): Not listed

**OSHA Designations**
Air Contaminant (29 CFR 1910.1000, Subpart Z): Not listed

## Section 8. Special Protection Data

**Goggles:** Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).
**Respirator:** Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*
**Other:** Wear impervious gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Wear nonsparking shoes (rubber, cord, or sewn leather soles).
**Ventilation:** Provide general and local explosion-proof ventilation systems to maintain airborne concentrations that promote worker safety and productivity. Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[103]
**Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
**Contaminated Equipment:** Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.
**Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

## Section 9. Special Precautions and Comments

**Storage Requirements:** Store in tightly closed containers in a cool, dry, well-ventilated area away from all heat and ignition sources and incompatible materials (Sec. 5). Outside or detached storage is preferred.
**Engineering Controls:** Avoid vapor inhalation and skin or eye contact. Use with appropriate personal protective gear. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Jet fuel's greatest hazard is its fire potential. Train all employees to use fire-extinguishing equipment. Perform fire drill exercises periodically. Take all measures to prevent static electricity: electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations in production and storage areas. Maintain and test grounding and bonding connections. Do not use drag chains or cables on fueling vehicles. After filling jet fuel storage tanks, wait 30 min before opening hatches to permit the relaxation of any static charges generated during filling or hauling. Empty containers or drums retaining residue (liquid and/or vapor) can be dangerous. Do not expose to heat or ignition sources. All drums should be completely drained, properly bunged, and promptly disposed of per local regulations. Practice good personal hygiene and housekeeping procedures. Take care in handling hoses, cans, and funnels wet with jet fuel. Before touching with bare hands, carefully wipe jet fuel containers. Properly dispose of wet rags per EPA hazardous waste requirements. Avoid contamination of jet fuel with water, rust, scale, dirt, and other petroleum products. Use commercial kits (Hydrokit, Aqua-Glo, or "Clear and Bright") to detect water and dirt, respectively.

**Transportation Data (49 CFR 172.101, .102):** Not listed

*MSDS Collection* **References:** 1, 73, 84, 103, 126, 132, 133, 136
**Prepared by:** MJ Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** W Silverman, MD; **Edited by:** JR Stuart, MS


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*Material Safety Data Sheets Collection:*

Sheet No. 59
**Beryllium Metal/Powder**

Issued: 4/80 Revision: A, 11/89

## Section 1. Material Identification 30

**Beryllium Metal/Powder Description:** A naturally occurring ore found in chrysoberyl ($Be_2SiO_4$) or produced industrially from beryl ($3Be.OAl_2O_3.6SiO_2$). The ore is converted to the oxide or hydroxide, then to the fluoride or chloride. The halide may be reduced in a furnace by magnesium metal or by electrolysis. An alternative purification process is a liquid-liquid extraction with an organophosphate chelating agent. Used in aerospace structures, radio tube parts, inertial guidance systems, computer parts, Be-Cu alloys, gyroscopes; used as an additive in solid propellant rocket fuels, as a neutron source when bombarded with alpha particles, and as a neutron moderator and reflector in nuclear reactors.
**Other Designations:** Glucinium; Be; CAS No. 7440-41-7.
**Manufacturer:** Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide* (Genium ref. 73) for a suppliers list.

-R 1
I 4
S 2
K 1

Genium

HMIS
H 4
F 1
R 0
PPG*
* Sec. 8

## Section 2. Ingredients and Occupational Exposure Limits

Beryllium and compounds, ca 100%

**OSHA PELs**
8-hr TWA: 0.002 ppm
30-min STEL: 0.005 ppm
Ceiling level: 0.025 ppm

**ACGIH TLV, 1989-90***
TLV-TWA: 0.002 mg/m³
**NIOSH REL, 1987***
Not to exceed 0.5 μg/m³

**Toxicity Data†**
Human, inhalation, $TC_{Lo}$: 300 mg/m³, pulmonary effects
Rabbit, intravenous, $TD_{Lo}$: 20 mg/kg, neoplastic effects

* These values are for beryllium and its compounds.
† See NIOSH, *RTECS* (DS1750000), for additional data with references to mutagenic and tumorigenic effects.

## Section 3. Physical Data

**Boiling Point:** 5378 °F (2970 °C)
**Melting Point:** 2332 °F (1278 °C)
**Vapor Pressure:** 7.6 mm Hg at 3470 °F (1910 °C)
**Atomic Weight:** 9.01 g/mol

**Specific Gravity ($H_2O$ = 1 at 39 °F (4 °C)):** 1.848 at 68 °F (20 °C)
**Water Solubility, hot water:** Slight
cold water: Insoluble

**Appearance and Odor:** A grayish-white metal with a hexagonal and aniostropic crystal structure (i.e., their index of refraction varies with incident light direction), and a powdered metal, no odor.

## Section 4. Fire and Explosion Data

| Flash Point: None reported | Autoignition Temperature: Powder, ca 1200 °F (649 °C) | LEL: None reported | UEL: None reported |
|---|---|---|---|

**Extinguishing Media:** *Never* use water or $CO_2$. Instead, smother the fire with an approved dry-powder extinguisher. Sand, graphite powder, and sodium chloride are also recommended.
**Unusual Fire or Explosion Hazards:** Beryllium can be a moderate fire hazard if exposed to flame. The hazards increase as particulate size decreases. A beryllium dust cloud can be explosive (areas where dusting may occur require Class 2, Group E electrical services, 29 CFR 1910.309). This material's combustion products are *highly toxic*.
**Special Fire-fighting Procedures:** Fire fighters should use full protective clothing, eye protection, and a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode. After exposure to a beryllium fire, they should clean equipment and bathe carefully.

## Section 5. Reactivity Data

**Stability/Polymerization:** Beryllium is stable at room temperature in closed containers.* Hazardous polymerization cannot occur.
**Chemical Incompatibilities:** Acid and alkali soluble, it reacts with strong bases to evolve hydrogen.† Warm beryllium reacts incandescently with phosphorus, fluorine, or chlorine. Molten lithium metal at 356 °F (180 °C) severely attacks beryllium metal.
**Conditions to Avoid:** When heated in air or in mixed $CO_2$ and nitrogen, beryllium is ignitable. Mixtures of the powdered metal with $CCl_4$ or trichloroethylene flash on heavy impact.
**Hazardous Products of Decomposition:** Thermal oxidative decomposition of beryllium emits very toxic oxide of beryllium fumes.

* When moist, beryllium forms thin, acid-resistant oxide films on solid surfaces.
† A simple asphyxiant gas, hydrogen is extremely flammable.

## Section 6. Health Hazard Data

**Carcinogenicity:** The NTP, IARC, and ACGIH list beryllium as a carcinogen. Animal studies also indicate that beryllium produces lung and bone tumors.
**Summary of Risks:** Beryllium is highly toxic by inhalation of fume or dust and exposure to this element and its salts may cause death. Inhaled beryllium is partially deposited in the lungs, the blood system, and finally the bones, thus affecting all organ systems. Since the human body does not quickly eliminate beryllium, trace amounts in urine are detectable as long as 10 years after exposure. Prolonged or repeated skin contact can cause skin irritation or dermatitis. Eye contact can produce conjuctivitis and eye ulcers. If introduced through the skin via cuts or punctures, nonhealing ulcers may develop.

*Continue on next page*

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## Section 6. Health Hazard Data, continued

**Medical Conditions Aggravated by Long-Term Exposure:** Increased risk of lung, liver, gall bladder, and bile duct cancers. **Target Organs:** lungs, mucous membranes, eyes, skin. **Primary Entry:** Inhalation. **Acute Effects:** Symptoms may occur up to 72 hr after a massive exposure. Acute inhalation can produce pneumonitis with inflammation of the upper and lower respiratory tracts, nasal congestion, nonproductive coughing, and pulmonary edema. High dose exposures may cause acute respiratory distress, brain hemorrhaging, liver inflammation, and spleen hemorrhaging. **Chronic Effects:** Symptoms may be delayed up to 15 years. Chronic exposures result from long-term exposure to small (microgram) quantities and can produce berylliosis. Berylliosis is a progressive granuloma formation in the lungs which eventually causes increasing shortness of breath and, in some cases, death. Since it also circulates among other organs, beryllium causes eventual heart enlargement and failure, liver and spleen enlargement, kidney stones, various malignant tumors, and damaging cell death in any organ in which it accumulates.

**FIRST AID**

**Eyes:** Flush immediately, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 min. **Skin:** After rinsing affected area with flooding amounts of water, wash it with soap and water. **Inhalation:** Remove exposed person to fresh air and support breathing as needed. **Ingestion:** Never give anything by mouth to an unconscious or convulsing person. If ingested, have that conscious person drink 1 to 2 glasses of water, then induce repeated vomiting until vomit is clear. Present studies indicate that beryllium is so poorly absorbed through the intestinal tract, that ingestion is not an important hazard (*Industrial Toxicology*, 3rd Edition, Hamilton).

**After first aid, get appropriate in-plant, paramedic, or community medical attention and support.** Watch for signs of respiratory deterioration, and use oxygen as needed.

## Section 7. Spill, Leak, and Disposal Procedures

**Spill/Leak:** If powdered metal is spilled, notify safety personnel. Evacuate area except for cleanup personnel with protective equipment against contact or inhalation hazards. Provide ventilation and remove heat and ignition sources. To prevent dusting conditions, vacuum or wet mop powder spills. Collect particulate scrap, absorb on paper, and transfer to a sealed recovery or disposal container. **Disposal:** Dissolve beryllium in a small amount of 6M-HCl, filter it, and add a slight excess of 6M-$NH_4OH$ to the filtrate using litmus as an indicator (blue at pH 8.3). Heat and coagulate the precipitate. After 12 hr, filter and dry it. Handle beryllium waste unsuitable for recycling in accordance with Federal, state, and local regulations. Dispose of scrap or waste material by arranging its return to the supplier in a mutually acceptable form. Contact your supplier or a licensed contractor for detailed recommendations.

**OSHA Designations**

Listed as Air Contaminant (29 CFR 1910.1000, Table Z-2)

**EPA Designations**

RCRA Hazardous Waste (40 CFR 261.33): Not listed

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 100 lb (45.4 kg) [* per RCRA, Sec. 3001; per Clean Water Act, Sec. 307(a), 112]

SARA Extremely Hazardous Substance (40 CFR 355): Not listed

SARA Toxic Chemical (40 CFR 372.65): Not listed

## Section 8. Special Protection Data

**Goggles:** Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). **Respirator:** Wear a NIOSH-approved respirator for emergency and nonroutine use in concentrations above the 8-hr, 2-µg/m³ TWA. For any time period, a half-mask, air-purifying respirator with a high-efficiency filter is suitable for concentrations as high as 25-µg Be/m³ (see NIOSH, *A Recommended Standard for Occupational Exposure to Beryllium*, Sec. 4). A powered, air-purifying respirator equipped with a "fume filter" is suitable for concentrations up to 40 µg Be/m³. A full facepiece, air-purifying respirator with a high-efficiency filter is suitable for concentrations up to 100 µg Be/m³. A powered, air-purifying respirator equipped with a high-efficiency filter, operating in the positive-pressure mode, is suitable for concentrations up to 1000 µg Be/m³. An SCBA with a full facepiece operated in the pressure-demand or positive-pressure mode is suitable for concentrations above 1000 µg Be/m³. Follow OSHA respirator regulations (29 CFR 1910.134). **Warning:** Air-purifying respirators do *not* protect workers in oxygen-deficient atmospheres. **Other:** Wear impervious gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. When exposure levels exceed the TLV, change into clean protective clothing and shower at the end of your shift. **Ventilation:** Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below the OSHA PEL standards (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by eliminating it at its source (Genium ref. 103). **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Launder contaminated clothing before wearing. Remove this material from your shoes and equipment. **Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

## Section 9. Special Precautions and Comments

**Storage Requirements:** Clearly label and store beryllium away from incompatible materials (Sec. 5) in a clean, dry, low fire-hazard area. Protect containers from physical damage. **Engineering Controls:** Provide adequate ventilation in areas where beryllium can become airborne. Monitor these areas with personal samplers to limit and control exposure levels. Teach workers about beryllium's potential hazards. Practice good housekeeping to prevent accumulation of beryllium-containing deposits. Give preplacement and annual medical exams (chest x-rays, baseline pulmonary function tests [$FVC_1$ (functional vital capacity) and $FEV_1$ (the amount of air exhaled in the first second after maximum inhalation)] and body weight measurements to workers possibly exposed to concentrations above the TLV. Prevent exposing those with pulmonary disease, chronic skin, liver, heart, or kidney conditions; abnormal chest x-ray or blood count; or vital capacity depression greater than 10%. Ensure all engineering systems (production, transportation) are of maximum explosion-proof design. To prevent static sparks, electrically ground and bond all containers and pipelines used in shipping, transferring, reacting, producing, and sampling operations.

**Transportation Data (49 CFR 172.101, .102)**

**DOT Shipping Name:** Beryllium compound, n.o.s.
**DOT Hazard Class:** Poison B
**DOT ID No.:** UN1567

**IMO Shipping Name:** Beryllium, metal powder
**IMO Hazard Class:** 6.1
**IMO Label:** Poison, flammable solid

*MSDS Collection* References: 1-12, 18-20, 24-26, 81, 84, 85, 88-91, 100, 116, 117

**Prepared by:** MJ Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** Warren Silverman, MD



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*Material Safety Data Sheets Collection:*
Sheet No. 23
Cadmium Metal/Powder
Issued: 9/77 Revision: D, 5/93

## Section 1. Material Identification



**Cadmium Metal/Powder (Cd) Description:** Occurs naturally in the mineral greenockite (cadmium sulfide). This form is rare and most cadmium is obtained by extraction from other ores containing it as a mineral (lead, copper, and zinc). Zinc sulfide ores are the main source; by direct distillation or recovery from the electrolytic process. Used in electroplating other metals, fire protection systems, nickel-cadmium storage batteries, power transmission wire, TV phosphors, pigments for ceramic glazes, machinery enamels, baking enamels, photography and lithography, selenium rectifiers, electrodes for cadmium-vapor lamps, and photoelectric cells; as a fungicide and a Weston standard cell control of atomic fission in nuclear reactors.
**Other Designations:** CAS No. 7440-43-9, colloidal cadmium.
**Manufacturer:** Contact your supplier/distributor. Consult latest *Chemical Week Buyers' Guide*[73] for suppliers list.

**Cautions:** Cadmium is a highly toxic metal. Symptoms may be delayed several hours and include pulmonary edema (fluid in lungs) which can be fatal. Chronic effects include kidney damage. Cd is considered a carcinogen by several government agencies. The powder is pyrophoric and presents a significant fire/explosion hazard.

*Powder*

| HMIS | | | |
|---|---|---|---|
| H | 3* | R | 3 |
| F | 1 | I | 4 |
| R | 3 | S | 2 |
| | | K | 3 |

Genium

*Solid*

| HMIS | | | |
|---|---|---|---|
| H | 3* | R | 1 |
| F | 0 | I | 4 |
| R | 0 | S | 2 |
| | | K | 1 |

*Chronic effects PPE-Sec. 8

## Section 2. Ingredients and Occupational Exposure Limits

Cadmium, ca 100%

**1992 OSHA PEL**
8-hr TWA: 5 $\mu g/m^3$

**1992 OSHA SECAL***
TWA: 15 or 50 $\mu g/m^3$

**1990 IDLH Level**
50 $mg/m^3$

**1993-94 ACGIH TLVs**
TWA: 0.01 $mg/m^3$ (total dust), Class A2 carcinogen
TWA: 0.002 $mg/m^3$ (respirable fraction)

**1991 DFG (Germany) MAK**
None established

**1992 NIOSH REL**
Carcinogen, keep as low as possible

**1992 Toxicity Data†**
Human, inhalation, $LC_{Lo}$: 39 $mg/m^3$/20 min caused cardiac changes, thrombosis, and respiratory depression.
Rat, oral, $LD_{50}$: 225 mg/kg; details not reported.
Woman, inhalation, $LC_{Lo}$: 129 $\mu g/m^3$ for 20 continuous years produced lung tumors.
Man, $TC_{Lo}$: 88 $\mu g/m^3$/8.6 years caused kidney and ureter toxicity with protein in the urine.

* Separate engineering control limit: to be achieved in processes and work places where it is not possible to achieve the PEL through engineering and work practices alone. The SECAL for Cd is 15 or 50 $\mu g/m^3$ depending on the processes involved. See Federal Register 57 (178): 42222, Table VIII-B1, 9/14/92.
†See NIOSH, *RTECS* (EU9800000), for additional mutation, reproductive, tumorigenic, and toxicity data.

## Section 3. Physical Data

**Boiling Point:** 1409 °F (765 °C)
**Melting Point:** 610 °F (321 °C)
**Vapor Pressure:** 0.095 mm Hg at 609.6 °F (320.9 °C)
**Refraction Index:** 1.13
**Mohs Hardness:** 2.0
**Molecular Weight:** 112.4

**Density:** 8.642
**Water Solubility:** Insoluble
**Other Solubilities:** Soluble in nitric (rapidly), hydrochloric (slowly), and other acids. The solid is soluble in ammonium nitrate solution, but the powdered form undergoes an explosive reaction.

**Appearance and Odor:** Silver-white, blue-tinged, lustrous, odorless, soft metal that is easily cut with a knife. The powder is grayish-white.

## Section 4. Fire and Explosion Data

| Flash Point: None reported | Autoignition Temperature: None reported | LEL: None reported | UEL: None reported |
|---|---|---|---|

**Extinguishing Media:** The solid metal is not flammable, but the finely divided powder is pyrophoric. As a rule, the more finely divided the powder is, the greater the potential for explosion. Use carbon dioxide, dry chemical, or sand. **Unusual Fire or Explosion Hazards:** Processes that create cadmium dust such as cutting, grinding, or welding present a serious explosion hazard in presence of ignition sources. Avoid creation of cadmium dust clouds. **Special Fire-fighting Procedures:** Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Do not release runoff from fire control methods to sewers or waterways; dike for proper disposal.

## Section 5. Reactivity Data

**Stability/Polymerization:** Cadmium easily tarnishes in moist air as it is oxidized to cadmium oxide. The solid is stable in dry air. The powder is pyrophoric. Cd becomes brittle at 176 °F (80 °C). Hazardous polymerization cannot occur. **Chemical Incompatibilities:** Include ammonium nitrate (powdered Cd), hydrazoic acid, tellurium, zinc, ammonia, sulfur, selenium, nitryl fluoride, an oxidizing agents. **Conditions to Avoid:** Creation of Cd dust clouds, exposure to heat and ignition sources, and contact with incompatibles. **Hazardous Products of Decomposition:** Thermal oxidative decomposition of Cd can produce toxic cadmium oxide (CdO) fumes.

## Section 6. Health Hazard Data

**Carcinogenicity:** The following agencies list Cd as a carcinogen: IARC Class 2A (probably carcinogenic in humans),[183] NTP Class 2 (reasonably anticipated to be a carcinogen),[169] and NIOSH Class X (carcinogen defined without further categorization),[183] ACGIH TLV-A2 (suspected human carcinogen),[183] EPA-B1 (Probable human carcinogen) and DFG MAK-A2 (unmistakably carcinogenic in animal experimentation only).[183]
**Summary of Risks:** Dust or fume inhalation generally results in acute symptoms delayed up to 24 hr. Effects include a flu-like syndrome similar to metal fume fever with chills, fever, and muscle pain in the back and limbs. Pulmonary edema (fluid in lungs) can develop after severe exposure and may result in death. If victim recovers, residual changes may include lung fibrosis (thickening) and vascular changes. Long-term exposure to Cd damages the liver and kidneys (accumulates, half-life = 7 to 30 yr). Proteinuria (protein in urine) of low molecular weight is the first sign of tubular dysfunction. Excess urinary glucose is also seen. Bone demineralization similar to osteoporosis (decreased bone density)...

*Continue on next page*

## Section 6. Health Hazard Data, *continued*

occurs *not* as a direct effect of Cd exposure, but indirectly by altering kidney regulation of calcium and phosphorus which are needed for strong, healthy bones. Some studies show a correlation between anemia (low hemoglobin in blood) and high Cd levels. Selenium (Se) and zinc (Zn) appear to suppress Cd toxicity; Se binds up Cd preventing it from entering body tissue and Zn may compete for the same metabolic site. **Medical Conditions Aggravated by Long-Term Exposure:** Kidney, blood, or respiratory disorders. **Target Organs:** Blood, kidney, liver, respiratory system. **Primary Entry Routes:** Inhalation, ingestion. **Acute Effects:** Inhalation may cause irritation of the eyes, nose, and throat, nausea and vomiting, abdominal colic, diarrhea, chest tightness, cough, headache, and weakness. Pulmonary edema could develop up to 24 hr post exposure. Kidney damage may occur after acute exposures but is more likely with chronic exposure. **Chronic Effects:** Symptoms may be delayed several yr after last exposure and include perforation of the nasal septum (tissue between the nostrils), loss of smell, chronic bronchitis, severe progressive emphysema, anorexia, insomnia, fatigue, pallor, anemia, kidney damage, bone demineralization, lung fibrosis and possible cancer of the respiratory tract.

**FIRST AID**

**Eyes:** *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.

**Skin:** *Quickly* remove contaminated clothing. Wash exposed area with soap and water.

**Inhalation:** Remove exposed person to fresh air and support breathing as needed.

**Ingestion:** Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless otherwise advised, have that *conscious and alert* person drink 1 to 2 glasses of water to dilute. *Do not* induce vomiting because of cadmium's irritating nature.

**Note to Physicians:** ß-2 microglobulin excretion of > 200 µg/g creatinine indicates kidney dysfunction as does a renal cortex [Cd] of 180 to 220 µg/g of wet kidney cortex. Blood Cd levels are *not* indicative of exposure.

## Section 7. Spill, Leak, and Disposal Procedures

**Spill/Leak:** Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Shut off ignition sources. Cleanup personnel should protect against inhalation. Carefully scoop up small spills and place in sealed impermeable containers. *Do not* disperse dust by sweeping. Remember that Cd powder can be pyrophoric and must be handled carefully. Prevent entry into sewers, drains, and waterways. Follow applicable OSHA regulations (29 CFR 1910.120).

**Disposal:** Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

**EPA Designations**

Listed as a RCRA Hazardous Waste (40 CFR 261.24): D006, Characteristic of Toxicity; regulatory level = 1.0 mg/L

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 10 lb (4.54 kg)† [* per CWA, Sec. 307(a)]

SARA Extremely Hazardous Substance (40 CFR 355), TPQ: Not listed

Listed as a SARA Toxic Chemical (40 CFR 372.65)

**OSHA Designations**

Listed as an Air Contaminant (29 CFR 1910.1027)

No reporting of releases of this substance is required if the diameter of the pieces of the solid metal is equal to or exceeds 100 µm (0.004 in.)

## Section 8. Special Protection Data

**Goggles:** Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy. **Respirator:** Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For any detectable concentration, use a SCBA or supplied air respirator (with auxiliary SCBA) with a full facepiece operated in pressure-demand or other positive-pressure mode. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas. **Other:** Wear gloves, boots, aprons, and gauntlets to prevent Cd dust from contacting skin. **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations below the OSHA PEL or SECAL (Sec. 2). Lunchroom facilities should not have concentrations above 2.5 µg/m$^3$ at any time. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.[103] **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Separate contaminated work clothes from street clothes; launder before reuse. Remove Cd from shoes and clean PPE. **Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using Cd, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

## Section 9. Special Precautions and Comments

**Storage/Handling Requirements:** Store in a cool, dry, well-ventilated area away from heat, ignition sources, and incompatibles. Do not allow cadmium dust to build up in storage area.

**Engineering Controls:** To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain concentrations at the lowest practical level.

**Administrative Controls:** Prohibit workers from removing Cd from protective clothing and equipment by blowing, shaking, or any other means that disperses Cd into the air. Employees must not enter eating facilities while wearing PPE unless it is vacuumed with a HEPA. Consider preplacement and periodic medical exams of exposed workers emphasizing the blood, kidneys, liver, and respiratory system. Educate workers on Cadmium's carcinogenicity.

**Transportation Data (49 CFR 172.101)**

**DOT Shipping Name:** Poisonous solids, n.o.s.*, Pyrophoric metals, n.o.s.†

**DOT Hazard Class:** 6.1*, 4.2†

**ID No.:** UN2811*, UN1383†

**DOT Packing Group:** III*, I†

**DOT Label:** Keep away from food*, Spontaneously Combustible†

**Special Provisions (172.102):** —*, B11†

* Solid metal, † Powder

**Packaging Authorizations**

**a) Exceptions:** 173.153*, None†

**b) Non-bulk Packaging:** 173.213*, .187†

**c) Bulk Packaging:** 173.240*, .242†

**Quantity Limitations**

**a) Passenger Aircraft or Railcar:** 100 kg*, Forbidden†

**b) Cargo Aircraft Only:** 200 kg*, Forbidden†

**Vessel Stowage Requirements**

**a) Vessel Stowage:** A*, D†

**b) Other:**

***MSDS Collection* References:** 26, 73, 100, 101, 103, 124, 126, 127, 132, 133, 136, 139, 148, 159, 167, 169, 183, 185, 186

**Prepared by:** M Gannon, BA; **Industrial Hygiene Review:** PA Roy, MPH, CIH; **Medical Review:** TW Thoburn, MPH, MD

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*Material Safety Data Sheets Collection:*

Sheet No. 83
**Chromium Metal/Powder**

Issued: 3/81 Revision: A, 11/89

## Section 1. Material Identification 30

**Chromium Metal/Powder Description:** Obtained from chrome ore, chromite ($FeCr_2O_4$), by electrolysis of chromium solutions, by direct reduction (ferrochrome), and by reducing the oxide with finely divided carbon or aluminum. Used for chromeplating other metals; for greatly increasing metal resistance and durability; in manufacturing chrome-steel or chrome-nickel-steel alloys (stainless steel); as a constituent of inorganic pigments; as protective coating for automotive and equipment accessories; and in nuclear and high-temperature research.
**Other Designations:** Chrome; Cr; CAS No. 7440-47-3.
**Manufacturer:** Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide* (Genium ref. 73) for a suppliers list.

R 1
I 4
S 1
K 1

Genium

HMIS
H 2
F 1
R 1
PPG*
* Sec. 8

## Section 2. Ingredients and Occupational Exposure Limits

Chromium metal/powder, ca 100%

| OSHA PEL | ACGIH TLV, 1988-89* | NIOSH REL, 1987† | Toxicity Data‡ |
|---|---|---|---|
| 8-hr TWA: 1 mg/m³ | TLV-TWA: 0.5 mg/m³ | 8-hr TWA (for chromium metal and insoluble salts): 1 mg Cr/m³ | Rat, implant, $TD_{Lo}$: 1200 µg/kg body weight administered intermittently over six weeks |

* This TLV is applicable to $Cr^{+2}$ and $Cr^{+3}$ compounds. For water soluble and water-insoluble $Cr^{+6}$, the 8-hr TWA is 0.05 mg $Cr^{+6}$/m³. Certain water-insoluble $Cr^{+6}$ compounds (zinc chromate, calcium chromate, lead chromate, barium chromate, strontium chromate, and sintered chromium trioxide) are designated as A1a (human carcinogen).
† The NIOSH REL (10-hr TWA) for carcinogen $Cr^{+6}$ compounds is 1 µg/m³; for noncarcinogenic $Cr^{+6}$ compounds (including chromic acid), the RELs (10-hr TWAs) are 25 µg/m³ and 50 µg/m³ (15-min ceiling ). The noncarcinogenic compounds include mono- and dichromates of hydrogen, cesium, sodium, lithium, potassium, rubidium, ammonia, and $Cr^{+6}$ (chromic acid anhydride). Any and all $Cr^{+6}$ materials excluded from the noncarcinogenic group above are carcinogenic $Cr^{+6}$ compounds.
‡ See NIOSH, *RTECS* (GB4200000), for additional data with references to tumorigenic effects.

## Section 3. Physical Data

**Boiling Point:** 4788 °F (2642 °C)
**Melting Point:** 3452 °F (1900 °C)
**Vapor Pressure:** 1 mm Hg at 2941 °F (1616 °C)
**Vapor Density (Air = 1):** 1.79
**Atomic Weight:** 51.996 g/mol
**Specific Gravity ($H_2O$ = 1 at 39 °F (4 °C)):** 7.2 at 68 °F (20 °C)
**Water Solubility:** Insoluble

**Appearance and Odor:** Steel-gray, lustrous metal; no odor.

## Section 4. Fire and Explosion Data

| Flash Point: None reported | Autoignition Temperature: Cloud, 1076 °F (580 °C); dust layer, 752 °F (400 °C) | LEL: Dust cloud explosion, 0.230 oz/ft³ | UEL: None reported |
|---|---|---|---|

**Extinguishing Media:** Use dry chemical or sand.
**Unusual Fire or Explosion Hazards:** Particle size and dispersion in air determine reactivity. Chromium powder explodes spontaneously in air, while chromium dust suspended in $CO_2$ is ignitable and explosive when heated.
**Special Fire-fighting Procedures:** Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

*One hundred percent of dust goes through a 74-µm sieve. A 140-mJ spark can ignite a dust cloud.

## Section 5. Reactivity Data

**Stability/Polymerization:** Chromium is stable when properly handled and stored. Hazardous polymerization cannot occur.
**Chemical Incompatibilities:** Chromium reacts readily with dilute, not nitric, acids to form chromous salts. It is soluble in acids (not nitric) and strong alkalis. Its powder is incompatible with strong oxidizing agents, including high $O_2$ concentration. Evaporation of mercury (Hg) from Cr amalgam leaves pyrophoric chromium. Finely divided Cr attains incandescence with nitrogen oxide, potassium chlorate, and sulfur dioxide. Molten lithium at 18 °C severely attacks Cr. Fused ammonium nitrate below 200 °C reacts explosively and may ignite or react violently with bromine pentafluoride.
**Hazardous Products of Decomposition:** Thermal oxidative decomposition of Cr can produce toxic chromium oxide fumes.

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## Section 6. Health Hazard Data

**Carcinogenicity:** The NTP and OSHA list chromium as a human carcinogen.

**Summary of Risks:** When ingested chromium is a human poison, with gastrointestinal (GI) effects. Chromium 3 ($Cr^{+3}$) compounds show little or no toxicity. Less soluble chromium 6 ($Cr^{+6}$) compounds are suspected carcinogens and severe irritants of the larynx, nasopharynx, lungs, and skin (Sec. 2). Chromic acid or chromate salts cause irritation of the skin and respiratory passage. Ingestion leads to severe irritation of the gastrointestinal tract, renal damage, and circulatory shock. Chromium metal (when heated to high temperatures) and insoluble salts are said to be involved in histological fibrosis of the lungs, which may progress to clinically evident pneumoconiosis. Exposure to chromate dust and powder can cause skin (dermatitis) and eye irritation (conjunctivitis).

**Medical Conditions Aggravated by Long-Term Exposure:** An incresed incidence of bronchogenic carcinoma occurs in workers exposed to chromate dust.

**Target Organs:** Respiratory system.

**Primary Entry:** Inhalation, percutaneous absorption, and ingestion.

**Acute Effects:** Acute exposures to dust may cause headache, coughing, shortness of breath, pneumoconiosis, fever, weight loss, nasal irritation, inflammation of the conjunctiva, and dermatitis.

**Chronic Effects:** Asthmatic bronchitis.

**FIRST AID**

**Eyes:** Flush immediately, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 min.

**Skin:** Brush off chromium dust. After rinsing affected area with flooding amounts of water, wash it with soap and water.

**Inhalation:** Remove exposed person to fresh air and support breathing as needed.

**Ingestion:** Never give anything by mouth to an unconscious or convulsing person. If ingested, have that conscious person slowly drink 1 to 2 glasses of water to dilute. Do not induce vomoting. A physician should evaluate all ingestion cases.

**After first aid, get appropriate in-plant, paramedic, or community medical attention and support.**

**Physician's Note:** Acute toxicity causes a two-phase insult: 1) multisystem shock due to gastrointestinal corrosivity and 2) hepatic, renal, hematopoetic insult. Treatment should use ascorbic acid as a neutralizer with gastric lavage. If the ingestion is substantial, exchange transfusions and/or consider hemodialysis. Treat allergic dermatitis with local cortisone or 10% ascorbic acid to reduce $Cr^{+6}$ to $Cr^{+3}$. Ten percent EDTA in a lanolin base applied every 24 hr helps heal skin ulcers.

## Section 7. Spill, Leak, and Disposal Procedures

**Spill/Leak:** Notify safety personnel of large spills. Cleanup personnel should wear protective clothing and approved respirators. Remove heat and ignition sources. Provide adequate ventilation. Keep airborne dust at a minimum. Remove spills quickly and place in appropriate containers for disposal or reuse.

**Disposal:** Reclaim salvageable metal. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

**OSHA Designations**

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1 )

**EPA Designations**

RCRA Hazardous Waste (40 CFR 261.33): Not listed

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 1 lb (0.454 kg) [* per Clean Water Act, Sec. 307(a)]

SARA Extremely Hazardous Substance (40 CFR 355): Not listed

Listed as a SARA Toxic Chemical (40 CFR 372.65)

## Section 8. Special Protection Data

**Goggles:** Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).

**Respirator:** Wear a NIOSH-approved respirator if necessary. Wear an SCBA with a full facepiece when the particle concentration's upper limit is 50 $mg/m^3$.

**Warning:** Air-purifying respirators do *not* protect workers in oxygen-deficient atmospheres.

**Other:** Wear impervious rubber gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact.

**Ventilation:** Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below the OSHA standard (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by eliminating it at its source (Genium ref. 103).

**Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

**Contaminated Equipment:** Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Launder contaminated clothing before wearing. Remove this material from your shoes and equipment.

**Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

## Section 9. Special Precautions and Comments

**Storage Requirements:** Store material in cool, dry, well-ventilated area separate from acids and oxidizing agents. Seal and protect containers from physical damage. Keep away from heat or ignition sources.

**Engineering Controls:** Avoid dust inhalation. Practice good housekeeping (vacuuming and wet sweeping) to minimize airborne particulates and to prevent dust accumulation. Use nonsparking tools and ground electrical equipment and machinery.

**Transportation Data (49 CFR 172.101, .102):** Not listed

***MSDS Collection* References:** 1, 2, 26, 38, 80, 87, 88, 89, 100, 109, 124, 126

**Prepared by:** MJ Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** MJ Hardies, MD M8

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*Material Safety Data Sheets Collection:*

Sheet No. 162
Copper

Issued: 12/85 Revision: A, 8/90

## Section 1. Material Identification

32

**Copper (Cu) Description:** Widely distributed in nature in elemental state, arsenites, sulfides, chlorides, and carbonates. Prepared by crushing, grinding, and concentrating copper ores by flotation and leaching or by smelting copper ore concentrates to yield a blister (96 to 98%) copper which is electrolytically refined to yield 99.9+% copper. Copper is the most widely used structural metal, next to iron and aluminum. Used in electric wiring; switches, heating, plumbing, roofing, and building construction; alloys (brass, bronze, Monel metal, beryllium-copper); coins; chemical and pharmaceutical machinery; electroplated protective coatings and undercoats for nickel, chromium, zinc, etc., cooking utensils; insecticides; antifouling paints; and as a catalyst. Copper whiskers are used in thermal and electrical composites. Copper flakes are used as insulation for liquid fuels.

**Other Designations:** CAS No. 7440-50-8, bronze powder, copper slag-airborne, copper slag-milled.

**Manufacturer:** Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*[73] for a suppliers list.

**Cautions:** *Copper may be toxic through contact, inhalation, and ingestion.* It may cause skin and eye irritation and metal fume fever. Copper is not considered a fire hazard, but fine particles may burn in air.

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## Section 2. Ingredients and Occupational Exposure Limits

Copper, ca 100%

| 1989 OSHA PELs | 1989-90 ACGIH TLVs | 1988 NIOSH REL | 1985-86 Toxicity Data‡ |
|---|---|---|---|
| 8-hr TWA: 1 mg/m³* | TLV-TWA: 1 mg/m³* | None established | Human, oral, $TD_{Lo}$: 120 µg/kg affects the gastrointestinal tract (nausea or vomiting) |
| 8-hr TWA: 0.1 mg/m³† | TLV-TWA: 0.2 mg/m³† | | Rat, oral, $TD_{Lo}$: 1210 µg/kg (35 weeks prior to mating) affects fertility (pre- and post-implantation mortality) |

* Copper dusts and mists, as Cu.
† Copper fume.
‡ See NIOSH, *RTECS* (GL5325000), for additional reproductive, tumorigenic, and toxicity data.

## Section 3. Physical Data

**Boiling Point:** 4703 °F (2595 °C)
**Melting Point:** 1981 °F (1083 °C)
**Vapor Pressure:** 1 mm Hg at 2962 °F (1628 °C)
**Molecular Weight:** 63.546
**Density/Specific Gravity:** 8.94
**Water Solubility:** Insoluble

**Appearance and Odor:** Solid, various shapes, odorless, red/brown-colored metal or powder. Copper is ductile, tough, and easily worked. It is very resistant to corrosion, but readily attacked by alkalies.

## Section 4. Fire and Explosion Data

| Flash Point: None reported | Autoignition Temperature: None reported | LEL: None reported | UEL: None reported |
|---|---|---|---|

**Extinguishing Media:** Use extinguishing media appropriate to the surrounding fire since copper does not burn. Finely divided copper burns in air, and in extreme cases ignites spontaneously.

**Unusual Fire or Explosion Hazards:** Liquid copper explodes on contact with water. High concentrations of fine copper particles in the air may present an explosion hazard.

**Special Fire-fighting Procedures:** Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and a fully encapsulating suit.

## Section 5. Reactivity Data

**Stability/Polymerization:** Copper is stable at room temperature in closed containers under normal storage and handling conditions. However, on long standing, a white, highly explosive peroxide deposit may form. Copper's vapors are uninhibited and may form polymers in vents and flame arresters.

**Chemical Incompatibilities:** Copper reacts violently with ammonium nitrate, bromates, iodates, chlorates, ethylene oxide, hydrazoic acid, potassium oxide, dimethyl sulfoxide + trichloroacetic acid, hydrogen peroxide, sodium peroxide, sodium azide, sulfuric acid, hydrogen sulfide + air, and lead azide. A potentially explosive reaction occurs with actylenic compounds. Copper ignites on contact with chlorine, fluorine [above 250 °F (121 °C)], chlorine trifluoride, and hydrazinium nitrate [above 158 °F (70 °C)]. It is also incompatible with 1-bromo-2-propyne; an incandescent reaction occurs with potassium dioxide.

**Conditions to Avoid:** Avoid prolonged exposure to air and moisture. On exposure to moist air, copper slowly converts to the carbonate.

**Hazardous Products of Decomposition:** Thermal oxidative decomposition of copper can produce metallic oxides (copper fumes).

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## Section 6. Health Hazard Data

**Carcinogenicity:** The NTP, IARC, and OSHA do not list copper as a carcinogen. Experimental studies show tumorigenic and teratogenic effects in laboratory animals.

**Summary of Risks:** Copper is a necessary human nutrient, excessive intake levels of which the kidneys normally eliminate. In individuals with kidney disease or, rarely, Wilson's disease (abnormal retention and storage of copper in the body that damages the liver, kidneys, brain, blood, bones, and endocrine glands), copper levels may accumulate. Significant industrial exposure to copper occurs mainly through inhalation of fumes during welding, smelting, or refining operations; or through exposure to copper dusts and mists during mining, extracting, refining, or manufacturing processes. Copper particles may irritate, discolor, and damage eyes. Exposure to copper salts in many applications is potentially toxic. Copper dusts, fumes, and salts may irritate the upper respiratory tract. Long-term exposure may irritate the skin and discolor the skin or hair.

**Medical Conditions Aggravated by Long-Term Exposure:** Individuals with impaired pulmonary or renal function should avoid exposure.

**Target Organs:** Respiratory system, skin, eyes, liver, kidneys.

**Primary Entry Routes:** Inhalation, ingestion.

**Acute Effects:** Inhalation of copper fumes may give rise to metal fume fever (after an incubation period of about 5 hr), an allergic reaction with flu-like symptoms—high temperature, metallic taste, nausea, coughing, general weakness, muscle aches, and exhaustion. These symptoms usually disappear within 24 hr. Direct contact with copper causes skin and (less often) eye irritation, and itching of the linings of the nose, mouth, and respiratory tract. Exposure to copper dust may cause a greenish-black skin discoloration. Copper ingestion causes nausea, vomiting, abdominal pain, and diarrhea. Ingestion of large doses may cause stomach and intestine ulceration, jaundice, and kidney and liver damage.

**Chronic Effects:** Continued exposure to copper may cause mild dermatitis and degeneration of the mucous membranes. Repeated or prolonged exposure to copper dusts and mists can discolor skin and hair and irritate the skin. Repeated inhalation can cause chronic respiratory disease. Individuals with Wilson's disease (1 in 200,000 individuals) are more susceptible to chronic copper poisoning. If undetected and untreated, this progressive condition is eventually fatal.

**FIRST AID**

**Eyes:** Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.

**Skin:** *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. For reddened or blistered skin, consult a physician. Wash affected area with soap and water.

**Inhalation:** Remove exposed person to fresh air and support breathing with artificial respiration.

**Ingestion:** Never give anything by mouth to an unconscious or convulsing person. If ingested, have that *conscious* person drink 1 to 2 glasses of water, then induce vomiting.

**After first aid; get appropriate in-plant, paramedic, or community medical support.**

**Physician's Note:** A blood count shows leucocytosis if an individual has metal fume fever. Consider chellation with penicillamine or BAL (British Anti-Lewisite or dimercaprol) for chronic intoxication.

## Section 7. Spill, Leak, and Disposal Procedures

**Spill/Leak:** Notify safety personnel, remove all heat and ignition sources, and provide adequate ventilation. Avoid creating dusty conditions. Cleanup personnel should protect against vapor inhalation and skin and eye contact. Cleanup methods such as vacuuming (with the appropriate filter) or wet mopping minimizes dust dispersion. Absorb liquid containing copper with vermiculite, dry sand, or other inert materials. Place in appropriate containers for disposal. Follow applicable OSHA regulations (29 CFR 1910.120).

**Disposal:** Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

**EPA Designations**

RCRA Hazardous Waste (40 CFR 261.33): Not listed

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 5000 lb (2270 kg) [* per Clean Water Act, 307(a)]

SARA Extremely Hazardous Substance (40 CFR 355): Not listed

Listed as a SARA Toxic Chemical (40 CFR 372.65)

**OSHA Designations**

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

## Section 8. Special Protection Data

**Goggles:** Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).

**Respirator:** Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. Some recommendations follow. For copper dust and mists greater than 50 mg/m$^3$, wear a high-efficiency particulate respirator, a supplied-air respirator, or an SCBA, all with a full facepiece. For copper dust and mists greater than 2000 mg/m$^3$, wear a supplied-air respirator equipped either with a full facepiece operated in pressure-demand or positive-pressure mode or with a hood in continuous-flow mode. For copper fumes over 100 mg/m$^3$, wear either a powered air-purifying respirator with a high-efficiency filter, or a supplied-air respirator equipped either with a full facepiece operated in pressure-demand or positive-pressure mode or with a hood in continuous-flow mode. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*

**Other:** Wear impervious gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Eye and face protection is required when grinding, welding, cutting, or remelting. Protect skin from molten metal and radiant heat when melting scrap. Machine turnings may also present a laceration hazard. When handling oil-contaminated copper, wear rubber gloves to prevent skin contact.

**Ventilation:** Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below OSHA PELs and ACGIH TLVs (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[103]

**Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

**Contaminated Equipment:** Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.

**Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

## Section 9. Special Precautions and Comments

**Storage Requirements:** Store copper in tightly closed containers in a cool, dry, well-ventilated area. Avoid exposure to air and moisture.

**Engineering Controls:** Avoid dust and fume inhalation and direct contact with skin and eyes. Use only with adequate ventilation and appropriate personal protective gear. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Practice good personal hygiene and housekeeping procedures. Maintain exposures below the PEL/TLV. Monitor copper dust and mist levels in the air.

**Other Precautions:** Provide placement and periodic examinations that emphasize the skin, eyes, and respiratory system. Prevent exposing individuals with chronic respiratory disease or Wilson's disease.

**Transportation Data (49 CFR 172.101, .102):** Not listed

***MSDS Collection* References:** 26, 38, 73, 84, 88, 89, 100, 101, 103, 109, 124, 126, 127, 132, 133, 134, 136, 138, 139, 143, 144

**Prepared by:** MJ Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** W Silverman, MD; **Edited by:** JR Stuart, MS



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*Material Safety Data Sheets Collection:*

Sheet No. 713
Lead (Inorganic)

Issued: 8/90

## Section 1. Material Identification

32

**Lead (Inorganic) (Pb) Description:** Exists widely throughout the world in a number of ores. Its main commercial source is galena (lead sulphide). Lead mineral is separated from crude ores by blast-furnace smelting, drossing, or electrolytic refining. Lead is used mostly in manufacturing storage batteries. Other uses are in manufacturing tetraethyllead and both organic and inorganic lead compounds in ceramics, plastics, and electronic devices; in producing ammunition, solder, cable covering, sheet lead, and other metal products (brass, pipes, caulking); in metallurgy; in weights and as ballast; as a chemical intermediate for lead alkyls and pigments; as a constuction material for the tank linings, piping, and equipment used to handle the corrosive gases and liquids used in sulfuric acid manufacturing, petroleum refining, halogenation, sulfonation, extraction, and condensation; and for x-ray and atomic radiation protection.
**Other Designations:** CAS No. 7439-92-1, lead oxide; lead salts, inorganic; metallic lead; plumbum.
**Manufacturer:** Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*(73) for a suppliers list.

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**Cautions:** *Inorganic lead is a potent systemic poison.* Organic lead (for example, tetraethyl lead) has severe, but different, health effects. Occupational lead poisoning is due to inhalation of dust and fumes. Major affected organ systems are the nervous, blood, and reproductive systems, and kidneys. Health impairment or disease may result from a severe acute short- or long-term exposure.

## Section 2. Ingredients and Occupational Exposure Limits

Lead (inorganic) fumes and dusts, as Pb, ca 100%

**1989 OSHA PELs (Lead, Inorganic compounds)**
8-hr TWA: 50 μg/m³
Action Level TWA*: 30 μg/m³

**29 CFR 1910.1025 Lead Standard**
Blood Lead Level: 40 μg/100 g

**1989-90 ACGIH TLV (Lead, inorganic, fumes and dusts)**
TLV-TWA: 150 μg/m³

**1988 NIOSH REL**
10-hr TWA: <100 μg/m³

**1985-86 Toxicity Data†**
Human, inhalation, $TC_{Lo}$: 10 μg/m³ affects gastrointestinal tract and liver
Human, oral, $TD_{Lo}$: 450 mg/kg ingested over 6 yr affects peripheral and central nervous systems
Rat, oral, $TD_{Lo}$: 790 mg/kg affects multigeneration reproduction

* Action level applies to employee exposure without regard to respirator use.
† See NIOSH, *RTECS* (OF7525000), for additional mutative, reproductive, and toxicity data.

## Section 3. Physical Data

**Boiling Point:** 3164 °F (1740 °C)
**Melting Point:** 621.3 °F (327.4 °C)
**Vapor Pressure:** 1.77 mm Hg at 1832 °F (1000 °C)
**Viscosity:** 3.2 cp at 621.3 °F (327.4 °C)
**Molecular Weight:** 207.20
**Specific Gravity (20 °C/4 °C):** 11.34
**Water Solubility:** Relatively insoluble in hot or cold water*

**Appearance and Odor:** Bluish-white, silvery, gray, very soft metal.

* Lead dissolves more easily at a low pH.

## Section 4. Fire and Explosion Data

| Flash Point: None reported | Autoignition Temperature: None reported | LEL: None reported | UEL: None reported |
|---|---|---|---|

**Extinguishing Media:** Use dry chemical, carbon dioxide, water spray, or foam to extinguish fire.
**Unusual Fire or Explosion Hazards:** Flammable and moderately explosive in the form of dust when exposed to heat or flame.
**Special Fire-fighting Procedures:** Isolate hazard area and deny entry. Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and full protective equipment. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

## Section 5. Reactivity Data

**Stability/Polymerization:** Lead is stable at room temperature in closed containers under normal storage and handling conditions. It tarnishes on exposure to air. Hazardous polymerization cannot occur.
**Chemical Incompatibilities:** Mixtures of hydrogen peroxide + trioxane explode on contact with lead. Lead is incompatible with sodium azide, zirconium, disodium acetylide, and oxidants. A violent reaction on ignition may occur with concentrated hydrogen peroxide, chlorine trifluoride, sodium acetylide (with powdered lead), ammonium nitrate (below 200 °C with powdered lead). Lead is attacked by pure water and weak organic acids in the presence of oxygen. Lead is resistant to tap water, hydrofluoric acid, brine, and solvents.
**Conditions to Avoid:** Rubber gloves containing lead may ignite in nitric acid.
**Hazardous Products of Decomposition:** Thermal oxidative decomposition of lead can produce highly toxic fumes of lead.

## Section 6. Health Hazard Data

**Carcinogenicity:** Although the NTP and OSHA do not list lead as a carcinogen, the IARC lists it as probably carcinogenic to humans, but having (usually) no human evidence. However, the literature reports instances of lead-induced neoplasms, both benign and malignant, of the kidney and other organs in laboratory rodents. Excessive exposure to lead has resulted in neurologic disorders in infants. Experimental studies show lead has reproductive and teratogenic effects in laboratory animals. Human male and female reproductive effects are also documented.
**Summary of Risks:** Lead is a potent, systemic poison that affect a variety of organ systems, including the nervous system, kidneys, reproductive system, blood formation, and gastrointestinal (GI) system . The most important way lead enters the body is through inhalation, but it can also be ingested when lead dust or unwashed hands contaminate food, drink, or cigarettes. Much of ingested lead passes through feces without absorption into the body. Adults may absorb only 5 to 15% of ingested lead; children may absorb a much larger fraction. Once in the body, lead enters the bloodstream and circulates to various organs. Lead concentrates and remains in bone for many years. The amount of lead the body stores increases as exposure continues, with possibly cumulative effects. Depending on the dose entering the body, lead can be deadly within several days or affect health after many years. Very high doses can cause brain damage (encephalopathy).
**Medical Conditions Aggravated by Exposure:** Lead may aggravate nervous system disorders (e.g., epilepsy, neuropathies), kidney diseases, high blood pressure (hypertension), infertility, and anemia. Lead-induced anemia and its effect on blood presssure can aggravate cardiovascular disease.

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## Section 6. Health Hazard Data, *continued*

**Target Organs:** Blood, central and peripheral nervous systems, kidneys, and gastrointestinal (GI) tract.
**Primary Entry Routes:** Inhalation, ingestion.
**Acute Effects:** An acute, short-term dose of lead could cause acute encephalopathy with seizures, coma, and death. However, short-term exposures of this magnitude are rare. Reversible kidney damage can occur from acute exposure, as well as anemia.
**Chronic Effects:** Symptoms of chronic long-term overexposure include appetite loss, nausea, metallic taste in the mouth, lead line on gingival (gum) tissue, constipation, anxiety, anemia, pallor of the face and the eye grounds, excessive tiredness, weakness, insomnia, headache, nervous irritability, fine tremors, numbness, muscle and joint pain, and colic accompanied by severe abdominal pain. Paralysis of wrist and, less often, ankle extensor muscles may occur after years of increased lead absorption. Kidney disease may also result from chronic overexposure, but few, if any, symptoms appear until severe kidney damage has occurred. Reproductive damage is characterized by decreased sex drive, impotence, and sterility in men; and decreased fertility, abnormal menstrual cycles, and miscarriages in women. Unborn children may suffer neurologic damage or developmental problems due to excessive lead exposure in pregnant women. Lead poisoning's severest result is encephalopathy manifested by severe headache, convulsions, coma, delirium, and possibly death.
**FIRST AID**
**Eyes:** Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.
**Skin:** *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Consult a physician if any health complaints develop.
**Inhalation:** Remove exposed person to fresh air and support breathing as needed. Consult a physician.
**Ingestion:** Never give anything by mouth to an unconscious or convulsing person. If large amounts of lead were ingested, induce vomiting with Ipecac syrup. Consult a physician immediately.
**After first aid, get appropriate in-plant, paramedic, or community medical support.**
**Physician's Note:** For diagnosis, obtain blood pressure, blood lead level (PbB), zinc protoporphyrin (ZPP), complete blood count for microcytic anemia and basophilic stippling, urinalysis, and blood urea nitrogen (BUN) of creatinine. Examine peripheral motor neuropathy, pallor, and gingival lead line. Use Ca-EDTA to treat poison, but *never* chelate prophylactically. Consult an occupational physician or toxicologist.

## Section 7. Spill, Leak, and Disposal Procedures

**Spill/Leak:** Notify safety personnel and evacuate all unnecessary personnel immediately. Cleanup personnel should protect against inhalation of dusts or fume and contact with skin or eyes. Avoid creating dusty conditions. Water sprays may be used in large quantities to prevent the formation of dust. Cleanup methods such as vacuuming (with an appropriate filter) or wet mopping minimizes dust dispersion. Scoop the spilled material into closed containers for disposal or reclamation. Follow applicable OSHA regulations (29 CFR 1910.120).
**Disposal:** Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.
**EPA Designations**
Listed as a RCRA Hazardous Waste (40 CFR 261.33, Appendix II—EP Toxicity Test Procedures)
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 1 lb (0.454 kg) [* per Clean Water Act, Sec. 307(a)]
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)
**OSHA Designations**
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

## Section 8. Special Protection Data

**Goggles:** Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).
**Respirator:** Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*
**Other:** Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact. Protective clothing made of man-made fibers and lacking turn-ups, pleats, or pockets retain less dust from lead.
**Ventilation:** Provide general and local ventilation systems to maintain airborne concentrations below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[103]
**Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
**Contaminated Equipment:** Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.
**Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially washing hands before eating, drinking, smoking, using the toilet, or applying cosmetics.

## Section 9. Special Precautions and Comments

**Storage Requirements:** Store in tightly closed containers in a cool, dry, well-ventilated area away from all incompatible materials, direct sunlight, and heat and ignition sources.
**Engineering Controls:** Educate worker about lead's hazards. Follow and inform employees of the lead standard (29 CFR 1910.1025). Avoid inhalation of lead dust and fumes and ingestion of lead. Use only with appropriate personal protective gear and adequate ventilation. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Avoid creating dusty conditions. Segregate and launder contaminated clothing. Take precautions to protect laundry personnel. Practice good personal hygiene and housekeeping procedures. For a variety of reasons, the lead concentration in workroom air may not correlate with the blood lead levels in individuals.
**Other Precautions:** Provide preplacement and periodic medical examinations which emphasize blood, nervous system, gastrointestinal tract, and kidneys, including a complete blood count and urinalysis. Receive a complete history including previous surgeries and hospitalization, allergies, smoking history, alcohol consumption, proprietary drug intake, and occupational and nonoccupational lead exposure. Maintain records for medical surveillance, airborne exposure monitoring, employee complaints, and physician's written opinions for at least 40 years or duration of employment plus 20 years. Measurement of blood lead level (PbB) and zinc protoporphyrin (ZPP) are useful indicators of your body's lead absorption level. Maintain worker PbBs at or below 40 µg/100 g of whole blood. To minimize adverse reproductive health effects to parents and developing fetus, maintain the PbBs of workers intending to have children below 30 µg/100 g. Elevated PbBs increase your risk of disease, and the longer you have elevated PbBs, the greater your chance of substantial permanent damage.

**Transportation Data (49 CFR 172.102)**
**IMO Shipping Name:** Lead compounds, soluble, n.o.s.
**IMO Hazard Class:** 6.1
**ID No.:** UN2291
**IMO Label:** St. Andrews Cross (X, Stow away from foodstuffs)
**IMDG Packaging Group:** III

***MSDS Collection* References:** 26, 38, 73, 84, 85, 88, 89, 90, 100, 101, 103, 109, 124, 126, 132, 133, 134, 136, 138, 139, 142, 143
**Prepared by:** MJ Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** MJ Upfal, MD, MPH; **Edited by:** JR Stuart, MS


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*Material Safety Data Sheets Collection:*

Sheet No. 73
Zinc Metal/Powder

Issued: 7/80 Revision: A, 11/89

## Section 1. Material Identification

30

**Zinc Metal/Powder Description:** A metallic element extracted from ores which are first roasted to form zinc oxide and then: 1) the zinc oxide is leached from the roasted material with sulfuric acid to form a zinc sulfate solution which is electrolyzed in cells to deposit zinc on cathodes and 2) the zinc oxide is reduced with carbon in retorts (distilling vessels) to yield distilled and condensed zinc. Used as ingredient in alloys such as brass, bronze, and die-casting alloys; galvanizing sheet iron; for electrical apparatus, especially castings, building materials, dry cell batteries, automotive equipment, household utensils, railroad car linings; as a fungicide; in nutrition (essential growth element); as reagent in analytical chemistry; in bleaching bone glue, manufacturing sodium hydrosulfite, and insulin zinc salts.
**Other Designations:** Blue powder; spelter; granular zinc; jasad; merrillite; pasco; Zn; CAS No. 7440-66-6.
**Manufacturer:** Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide* (Genium ref. 73) for a suppliers list.

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PPG*
* Sec. 8

## Section 2. Ingredients and Occupational Exposure Limits

Zinc metal/powder, ca 99%

| OSHA PEL | ACGIH TLV, 1989-90 | NIOSH REL, 1987 | Toxicity Data† |
|---|---|---|---|
| None established* | None established* | None established* | Human, inhalation, $TC_{Lo}$: 124 mg/m³/50 min, pulmonary system effects |

* The current OSHA standard and ACGIH (1989-1990) TWA for zinc oxide (ZnO) fumes is 5 mg/m³. The ACGIH TWA for zinc oxide dust is 10 mg/m³, providing that total contains no asbestos and is <1% crystalline silica. NIOSH has recommended a 10-hr TWA of 5 mg/m³ and a ceiling level of 15 mg/m³ (15-min sample) for zinc oxide fume. The TLV-TWA level was set to prevent metal fume fever.
† See NIOSH, *RTECS* (ZG8600000), for additional data with references to irritative effects.

## Section 3. Physical Data

**Boiling Point:** 907 °F (1663 °C)
**Melting Point:** 419 °F (787 °C)
**Vapor Pressure:** 1 mm Hg at 909 °F (487 °C)
**Brinell Hardness:** 31
**Atomic Weight:** 65.37 g/mol
**Specific Gravity ($H_2O$ = 1 at 39 °F (4 °C)):** 7.13 at 77 °F (25 °C)
**Water Solubility:** Insoluble
**Index of Explosibility, Zn Powder (<0.1 weak, >10 severe):** 0.1

**Appearance and Odor:** Bluish-white lustrous metal, also finely divided forms.

## Section 4. Fire and Explosion Data

| Flash Point: None reported | Autoignition Temperature: Cloud, 1256 °F (680 °C);* dust layer, 860 °F (460°C);* powder, 650 mJ* | LEL: Dust cloud explosion, 0.5 oz/ft³ | UEL: None reported |
|---|---|---|---|

**Extinguishing Media:** Use special dry chemical or clean dry sand. *Never* use $CO_2$. Using a direct stream of water may scatter the fire or disperse dust, creating a potentially explosive mixture if exposed to heat or ignition sources. A water spray may be used to cool fire-exposed containers and disperse vapors.
**Unusual Fire or Explosion Hazards:** Flammable hydrogen gas is liberated by reaction with alkali hydroxides (sodium, potassium, and calcium hydroxides), acids, or even water (when material is in dust form) and is an explosion hazard in a confined space. In a fire, zinc may melt, vaporize, and burn to form ZnO fumes (Sec. 2).
**Special Fire-fighting Procedures:** For major fires, or if large quantities of this material are involved, fire fighters should wear appropriate protective clothing and respiratory protection. Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

* Zinc dust refers to the product of zinc vapor condensation, and zinc powder to the product of molten zinc atomization (*Zinc Dust and Zinc Powder: Their Production, Properties, and Applications*, B.C. Hafford, W.E. Pepper, and T.B. Lloyd, 1982). Dust 100% thru 74-µm sieve; a 0.96-J spark can ignite a cloud. The ignition temperature in $CO_2$ is 896 °F (480 °C). The reaction temperature in a nitrogen atmosphere is 1112 °F (600 °C).

## Section 5. Reactivity Data

**Stability/Polymerization:** Zinc is stable in dry air at room temperature. Moist zinc dust can react exothermically and ignite spontaneously in air. Hazardous polymerization cannot occur.
**Chemical Incompatibilities:** Zinc dust is an explosion hazard when reacted with acids, chlorates, oxidizing agents (sulfur and oxygen), halogenated hydrocarbons, hydrazine mononitrate, hydroxylamine, ammonium nitrate, barium dioxide, barium nitrate, cadmium, performic acid, manganese chloride, nitric acid, ethyl acetoacetate and tribromoneopentyl alcohol, tellurium, carbon disulfide, lead azide, magnesium and barium nitrate and barium dioxide, selenium, sodium peroxide, potassium nitrate, and water. In humans, a toxic effect results from inhaling 124 mg/m³ of zinc metal/powder for 50 min.
**Hazardous Products of Decomposition:** Thermal oxidative decomposition of zinc can produce highly toxic fumes. Above 999 °F (537 °C) vaporized zinc burns in air with a blue-green flame to produce zinc oxide fumes.

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## Section 6. Health Hazard Data

**Carcinogenicity:** Neither the NTP, IARC, nor OSHA lists zinc as a carcinogen.

**Summary of Risks:** Zinc is relatively nontoxic, but when combined with other materials such as oxygen or mineral acids, the resulting compounds can have toxic effects. It is not readily absorbed through the skin, gastrointestinal (GI tract), or lungs. Although most inorganic zinc compounds are potential causes of gastroenteric irritation, a high-level dose is relatively nontoxic when ingested. Zinc is considered essential to life. Ingestion of soluble salts may cause nausea and vomiting, sluggishness, and light-headedness. Inhalation of zinc fumes normally generated by zinc and extreme heat may cause *metal fume fever*, which is accompanied by throat dryness and irritation, coughing, weakness, dyspnea, and generalized aching that generally passes within 24 hr. These symptoms usually begin 3 to 10 hr after exposure and resolve within 24 to 48 hr. Inhalation of zinc dust may cause mild irritation to the upper respiratory tract. Prolonged skin contact with zinc may cause a mild, drying dermatitis.

**Medical Conditions Aggravated by Long-Term Exposure:** Since metallic zinc particulates can be considered a niusance dust, repeated inhalation of zinc dust could lead to respiratory complications.

**Target Organs:** Respiratory system.

**Primary Entry:** Inhalation, ingestion.

**Acute Effects:** Metal fume fever is an acute, self-limiting condition, without recognized complications, aftereffects, or chronic forms. Symptoms appear several hours after exposure. Removal from exposure normally alleviates symptoms with no residual or chronic effects. A degree of tolerance may result from continued exposure, but is quickly lost after a day or two of nonexposure.

**Chronic Effects:** Zinc and zinc powder have little history of causing chronic effects.

**FIRST AID**

**Eyes:** Flush immediately, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 min.

**Skin:** After rinsing affected area with flooding amounts of water, wash it with soap and water.

**Inhalation:** Remove exposed person to fresh air and support breathing as needed.

**Ingestion:** Never give anything by mouth to an unconscious or convulsing person. If ingested, have that conscious person drink 1 to 2 glasses of water, then induce repeated vomiting until vomit is clear. **Physician's Note:** Calcium disodium edetate ($CaNa_2$-EDTA) has been used medically to increase the rate of zinc removal from the body; however, this usually results from chronic fume exposure or exposure to zinc salts, not to zinc metal powders.

**After first aid, get appropriate in-plant, paramedic, or community medical attention and support.**

## Section 7. Spill, Leak, and Disposal Procedures

**Spill/Leak:** Notify safety personnel of powder spills. Eliminate all heat and ignition sources. Cleanup personnel should protect against dust inhalation and eye contact. Use nonsparking tools for cleanup. Sweep or otherwise place the spilled material in an appropriate, pressure-vented, dry-metal container (with lid) for later disposal. Container should be pressure vented. Avoid creating airborne dust conditions.

**Disposal:** Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

**OSHA Designations**

Air Contaminant (29 CFR 1910.1000, Subpart Z): Not listed

**EPA Designations**

RCRA Hazardous Waste (40 CFR 261.33): Not listed

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 1000 lb (454 kg) [* per Clean Water Act, Sec. 307(a)]

SARA Extremely Hazardous Substance (40 CFR 355): Not listed

Zinc (fume or dust) is listed as SARA Toxic Chemical (40 CFR 372.65)

## Section 8. Special Protection Data

**Goggles:** Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).

**Respirator:** For zinc oxide dust or fume concentrations up to 50 mg/m³ and 250 mg/m³, use, respectively, a fume (high-efficiency particulate) respirator or an air-supplied or self-contained respirator with a full facepiece. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA.

**Warning:** Air-purifying respirators do *not* protect workers in oxygen-deficient atmospheres.

**Other:** Wear impervious gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact.

**Ventilation:** Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below established TLVs-TWAs (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by eliminating it at its source (Genium ref. 103).

**Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

**Contaminated Equipment:** Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Launder contaminated clothing before wearing. Remove this material from your shoes and equipment. Wash thoroughly before changing to street clothes.

**Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

## Section 9. Special Precautions and Comments

**Storage Requirements:** Store in covered metal containers in a dry, well-ventilated, low fire risk area. Protect containers from physical damage. Never store with acids, halogenated hydrocarbons, or strong alkalis.

**Engineering Controls:** Avoid breathing dust or fumes. Use good housekeeping and cleaning techniques to minimize airborne particulates and to prevent dust accumulation. Provide suitable training in personal hygiene and in the cause and effect of metal fume fever. Prevent exposure of workers with respiratory problems or gastrointestinal disorders.

**Transportation Data (49 CFR 172.102)**

| | |
|---|---|
| **IMO Shipping Name:** Zinc, powder or dust, nonpyrophoric | **IMO Shipping Name:** Zinc, powder or dust, pyrophoric |
| **IMO Hazard Class:** 4.3 | **IMO Hazard Class:** 4.2 |
| **IMO Label:** Dangerous when wet | **IMO Label:** Spontaneously combustible |
| **IMDG Packaging Group:** II | **IMDG Packaging Group:** II |

*MSDS Collection* **References:** 2, 4-11, 24, 31, 39-41, 80, 81,84,85,91, 109

**Prepared by:** MJ Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** Warren Silverman, MD

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*CLOTHING:* WEAR IMPERVIOUS CLOTHING TO PREVENT CONTACT WITH THE GAS FORM. IF CONTACT WITH THE LIQUIFIED GAS IS POSSIBLE, EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE CLOTHING AND EQUIPMENT TO PREVENT SKIN FROM FREEZING.

*GLOVES:* WEAR FULL PROTECTIVE, COLD INSULATING GLOVES.

*EYE PROTECTION:* EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES AND A FACESHIELD TO PREVENT CONTACT WITH THIS SUBSTANCE.

EMERGENCY WASH FACILITIES: WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES AND/OR SKIN MAY BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN AND QUICK DRENCH SHOWER WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

AUTHORIZED BY- OCCUPATIONAL HEALTH SERVICES, INC.
*CREATION DATE:* 02/08/90 *REVISION DATE:* 05/16/90

## MATERIAL SAFETY DATA SHEET

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EMERGENCY CONTACT:
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## SUBSTANCE IDENTIFICATION

*CAS-NUMBER* 7664-93-9

*SUBSTANCE:* SULFURIC ACID

*TRADE NAMES/SYNONYMS:* OIL OF VITRIOL; BOV; DIPPING ACID; VITRIOL BROWN OIL; HYDROGEN SULFATE; NORDHADSEN ACID; DIHYDROGEN SULFATE; SULPHURIC ACID; MATTING ACID; DITHIONIC ACID; STCC 4930040; UN 1830; SULFURIC ACID 66 BAUME (COLLIER CARBON & CHEMICAL CORP.); H2O4S; OIL OF VITRIOL BATTERY ACID (SPECTRUM CHEMICAL MFG.CORP.); PST22350

*CHEMICAL FAMILY:* INORGANIC ACID

*MOLECULAR FORMULA:* H2-S-O4

*MOLECULAR WEIGHT:* 98.07

*CERCLA RATINGS (SCALE 0-3):* HEALTH = 3 FIRE = 0 REACTIVITY = 2 PERSISTENCE = 0

*NFPA RATINGS (SCALE 0-4):* HEALTH = 3 FIRE = 0 REACTIVITY = 2

## COMPONENTS AND CONTAMINANTS

*COMPONENT:* SULFURIC ACID *PERCENT:* 98

*COMPONENT:* WATER *PERCENT:* 2

*OTHER CONTAMINANTS:* NONE

*EXPOSURE LIMITS:* SULFURIC ACID: 1 MG/M3 OSHA TWA 1 MG/M3 ACGIH TWA; 3 MG/M3 ACGIH STEL 1 MG/M3 NIOSH RECOMMENDED 10 HOUR TWA 1000 POUNDS SARA SECTION 302 THRESHOLD PLANNING QUANTITY 1000 POUNDS SARA SECTION 304 REPORTABLE QUANTITY 1000 POUNDS CERCLA SECTION 103 REPORTABLE QUANTITY SUBJECT TO SARA SECTION 313 ANNUAL TOXIC CHEMICAL RELEASE REPORTING

## PHYSICAL DATA

*DESCRIPTION:* ODORLESS, CLEAR, COLORLESS, DENSE HYGROSCOPIC OILY LIQUID WITH A MARKED ACID TASTE WHEN PURE.

*BOILING POINT:* 558 F (290 C)

*MELTING POINT:* 50 F (10 C) *SPECIFIC GRAVITY:* 1.84

*VAPOR PRESSURE:* <0.001 @ 20 C *PH:* <3 *SOLUBILITY IN WATER:* SOLUBLE

*ODOR THRESHOLD:* >1 MG/M3 (MIST) *VAPOR DENSITY:* 3.4

*SOLVENT SOLUBILITY:* DECOMPOSES IN ETHYL ALCOHOL @ 340 C IT DECOMPOSES INTO SULFUR TRIOXIDE AND WATER

## FIRE AND EXPLOSION DATA

*FIRE AND EXPLOSION HAZARD:* NEGLIGIBLE FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME.

OXIDIZER: OXIDIZERS DECOMPOSE, ESPECIALLY WHEN HEATED, TO YIELD OXYGEN OR OTHER GASES WHICH WILL INCREASE THE BURNING RATE OF COMBUSTIBLE MATTER. CONTACT WITH EASILY OXIDIZABLE, ORGANIC, OR OTHER COMBUSTIBLE MATERIALS MAY RESULT IN IGNITION, VIOLENT COMBUSTION OR EXPLOSION.

*FIREFIGHTING MEDIA:* DRY CHEMICAL, CARBON DIOXIDE OR HALON (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FOR LARGER FIRES, FLOOD AREA WITH WATER FROM A DISTANCE (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

*FIREFIGHTING:* DO NOT GET SOLID STREAM OF WATER ON SPILLED MATERIAL. MOVE CONTAINERS FROM FIRE AREA IF POSSIBLE. COOL CONTAINERS EXPOSED TO FLAMES WITH WATER FROM SIDE UNTIL WELL AFTER FIRE IS OUT. KEEP AWAY FROM STORAGE TANK ENDS (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4 GUIDE PAGE 39).

USE AGENT SUITABLE FOR TYPE OF FIRE; USE FLOODING AMOUNTS OF WATER AS A FOG. COOL CONTAINERS WITH FLOODING AMOUNTS OF WATER, APPLY FROM AS FAR A DISTANCE AS POSSIBLE. AVOID BREATHING CORROSIVE VAPORS, KEEP UPWIND.

## TRANSPORTATION DATA

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49 CFR 172.101: CORROSIVE MATERIAL

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49 CFR 172.101 AND SUBPART E: CORROSIVE

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49 CFR 173.272 EXCEPTIONS: 49 CFR 173.244

## TOXICITY

SULFURIC ACID: IRRITATION DATA: 1380 UG EYE-RABBIT SEVERE; 5 MG/30 SECONDS RINSED EYE-RABBIT SEVERE. TOXICITY DATA: 3 MG/M3/24 WEEKS INHALATION-HUMAN TCLO; 510 MG/M3/2 HOURS INHALATION-RAT LC50; 320 MG/M3/2 HOURS INHALATION-MOUSE LC50; 18 MG/M3 INHALATION-GUINEA PIG LC50; 2140 MG/KG ORAL-RAT LD50; 135 MG/KG UNREPORTED-MAN LDLO; REPRODUCTIVE EFFECTS DATA (RTECS); TUMORIGENIC DATA (AJEPAS 120(3), 358, 84). CARCINOGEN STATUS: NONE. LOCAL EFFECTS: CORROSIVE- INHALATION, SKIN, AND EYES. ACUTE TOXICITY LEVEL: HIGHLY TOXIC BY INHALATION; MODERATELY TOXIC BY INGESTION. TARGET EFFECTS: POISONING MAY AFFECT THE BODY'S PH BALANCE AND IN TURN AFFECT THE NERVOUS SYSTEM.

## HEALTH EFFECTS AND FIRST AID

*INHALATION:* SULFURIC ACID: CORROSIVE/HIGHLY TOXIC. 80 MG/M3 IMMEDIATELY DANGEROUS TO LIFE OR HEALTH. ACUTE EXPOSURE- INHALATION OF MISTS MAY CAUSE MUCOUS MEMBRANE IRRITATION PRINCIPALLY AFFECTING THE RESPIRATORY TRACT EPITHELIUM. LOW CONCENTRATIONS, 0.35-5 MG/M3, MAY CAUSE INCREASED PULMONARY AIR FLOW RESISTANCE AND SUBSEQUENT SHALLOWER AND MORE RAPID BREATHING. HOT CONCENTRATED MISTS MAY CAUSE RAPID LOSS OF CONSCIOUSNESS WITH POSSIBLE DAMAGE TO LUNG TISSUE. VAPORS MAY CAUSE NASAL SECRETIONS, SNEEZING, A BURNING OR TICKLING SENSATION IN THE NOSE AND THROAT AND RETROSTERNAL REGION, FOLLOWED BY COUGH, RESPIRATORY DISTRESS, TRACHEOBRONCHITIS, CHEMICAL PNEUMONITIS AND POSSIBLE SPASM OF THE VOCAL CORDS. HIGH CONCENTRATIONS MAY PRODUCE BLOODY NASAL SECRETIONS AND SPUTUM, HEMATEMESIS GASTRITIS, AND PULMONARY EDEMA. A SINGLE OVEREXPOSURE MAY LEAD TO LARYNGEAL, TRACHEOBRONCHIAL AND PULMONARY EDEMA. ONE INDIVIDUAL SPRAYED IN THE FACE WITH SULFURIC ACID LIQUID EXPERIENCED DELAYED SYMPTOMS OF PULMONARY FIBROSIS, RESIDUAL BRONCHITIS, AND PULMONARY EMPHYSEMA. VAPORS FROM DILUTE SOLUTIONS MAY IRRITATE MUCOUS MEMBRANES. CHRONIC EXPOSURE- REPEATED EXPOSURE TO THE MIST MAY CAUSE INFLAMMATION OF THE UPPER RESPIRATORY TRACT, CHRONIC BRONCHITIS AND ETCHING OF THE DENTAL ENAMEL. THE CENTRAL AND LATERAL INCISORS ARE PRIMARILY AFFECTED. REPEATED EXCESSIVE EXPOSURE OVER LONG PERIODS OF TIME HAVE RESULTED IN BRONCHITIC SYMPTOMS, RHINORRHEA, FREQUENT RESPIRATORY TRACT INFECTIONS, EMPHYSEMA, STOMATITIS AND DIGESTIVE DISTURBANCES. CHRONIC INHALATION MAY CAUSE ALKALINE DEPLETION OF THE BODY PRODUCING AN ACIDOSIS WHICH AFFECTS THE NERVOUS SYSTEM AND PRODUCES AGITATION, HESITANT GAIT AND GENERALIZED WEAKNESS. AN EPIDEMIOLOGICAL STUDY OF WORKERS AT A REFINERY AND CHEMICAL PLANT SUGGESTS AN INCREASED RISK OF LARYNGEAL CANCER FROM EXPOSURE TO HIGH CONCENTRATIONS OF SULFURIC ACID. REPRODUCTIVE EFFECTS HAVE BEEN REPORTED IN ANIMALS.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, GIVE ARTIFICIAL RESPIRATION. MAINTAIN AIRWAY AND BLOOD PRESSURE AND ADMINISTER OXYGEN IF AVAILABLE. KEEP AFFECTED PERSON WARM AND AT REST. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. ADMINISTRATION OF OXYGEN SHOULD BE PERFORMED BY QUALIFIED PERSONNEL. GET MEDICAL ATTENTION IMMEDIATELY.

*SKIN CONTACT:* SULFURIC ACID: CORROSIVE. ACUTE EXPOSURE- CONTACT WITH CONCENTRATED SULFURIC ACID MAY CAUSE SEVERE SECOND AND THIRD DEGREE SKIN BURNS WITH NECROSIS DUE TO ITS AFFINITY FOR WATER AND SUBSEQUENT SEVERE DEHYDRATING ACTION, AND ITS EXOTHERMIC REACTION WITH MOISTURE. POSSIBLE CHARRING MAY OCCUR LEADING TO SHOCK AND COLLAPSE DEPENDING ON THE AMOUNT OF TISSUE INVOLVED. THE RESULTING WOUNDS MAY BE LONG IN HEALING AND MAY CAUSE EXTENSIVE SCARRING THAT MAY RESULT IN FUNCTIONAL INHIBITION. CONTACT WITH DILUTE SOLUTIONS MAY CAUSE SKIN

IRRITATION. CHRONIC EXPOSURE- REPEATED CONTACT WITH LOW CONCENTRATIONS MAY CAUSE SKIN DESICCATION AND ULCERATION OF THE HANDS, AND PANARIS OR CHRONIC PURULENT INFLAMMATION AROUND THE NAILS. REPEATED CONTACT WITH DILUTE SOLUTIONS MAY CAUSE DERMATITIS.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (AT LEAST 15-20 MINUTES). IN CASE OF CHEMICAL BURNS, COVER AREA WITH STERILE, DRY DRESSING. BANDAGE SECURELY, BUT NOT TOO TIGHTLY. GET MEDICAL ATTENTION IMMEDIATELY.

*EYE CONTACT:* SULFURIC ACID: CORROSIVE. ACUTE EXPOSURE- EXPOSURE TO THE VAPORS MAY CAUSE A BURNING OR STINGING SENSATION IN THE EYES WITH LACRIMATION, BLURRED VISION AND CONJUNCTIVAL CONGESTION. SPLASHES OF ACID IN THE EYES MAY PRODUCE DEEP CORNEAL ULCERATION, KERATO-CONJUNCTIVITIS AND PALPEBRAL LESIONS WITH SEVERE SEQUELAE. IRREPARABLE CORNEAL DAMAGE AND BLINDNESS AS WELL AS SCARRING OF THE EYELIDS MAY OCCUR. SEVERE SULFURIC ACID EYE BURNS HAVE INCLUDED GLAUCOMA AND CATARACT AS COMPLICATIONS IN THE MOST SEVERE CASES. CONTACT WITH DILUTED ACID MAY PRODUCE MORE TRANSIENT EFFECTS FROM WHICH RECOVERY MAY BE COMPLETE. CHRONIC EXPOSURE- REPEATED EXPOSURE MAY RESULT IN LACRIMATION AND CHRONIC CONJUNCTIVITIS.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (AT LEAST 15-20 MINUTES). CONTINUE IRRIGATING WITH NORMAL SALINE UNTIL THE PH HAS RETURNED TO NORMAL (30-60 MINUTES). COVER WITH STERILE BANDAGES. GET MEDICAL ATTENTION IMMEDIATELY.

*INGESTION:* SULFURIC ACID: CORROSIVE: ACUTE EXPOSURE- INGESTION MAY CAUSE BURNING PAIN IN THE MOUTH, THROAT, ESOPHAGUS AND ABDOMEN, A SOUR TASTE AND NAUSEA FOLLOWED BY VOMITING AND DIARRHEA OF CHARRED BLACK STOMACH CONTENTS. DEHYDRATION AND CARBONIZATION OF TISSUE MAY OCCUR WITH ESCHARS ON THE LIPS AND MOUTH. BROWNISH OR YELLOWISH STAINS MAY BE FOUND AROUND THE MOUTH, INTENSE THIRST, DIFFICULT SWALLOWING, ACIDEMIA, STOMATITIS, RAPID AND WEAK PULSE, SHALLOW BREATHING, SHOCK AND POSSIBLE CONVULSIONS MAY OCCUR. ALBUMIN, BLOOD AND CASTS IN URINE, ANURIA, ESOPHAGEAL AND DELAYED GASTRIC STENOSIS HAS BEEN REPORTED. POSSIBLE PERFORATION OF THE GASTROINTESTINAL TRACT MAY RESULT IN PERITONITIS. CHRONIC EXPOSURE- NO DATA AVAILABLE.

FIRST AID- DO NOT USE GASTRIC LAVAGE OR EMESIS. DILUTE THE ACID IMMEDIATELY BY DRINKING LARGE QUANTITIES OF WATER OR MILK. IF VOMITING PERSISTS, ADMINISTER FLUIDS REPEATEDLY. INGESTED ACID MUST BE DILUTED APPROXIMATELY 100 FOLD TO RENDER IT HARMLESS TO TISSUES. MAINTAIN AIRWAY AND TREAT SHOCK (DREISBACH, HANDBOOK OF POISONING, 12TH ED.). GET MEDICAL ATTENTION IMMEDIATELY. IF VOMITING OCCURS, KEEP HEAD BELOW HIPS TO HELP PREVENT ASPIRATION.

*ANTIDOTE:* NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

## REACTIVITY

*REACTIVITY:* SULFURIC ACID: VIOLENT EXOTHERMIC REACTION WITH WATER.

*INCOMPATIBILITIES:* SULFURIC ACID: ACETALDEHYDE: VIOLENTLY POLYMERIZED BY CONCENTRATED ACID. ACETIC ANHYDRIDE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER. ACETONE + NITRIC ACID: VIOLENT DECOMPOSITION. ACETONE + POTASSIUM DICHROMATE: IGNITION. ACETONE CYANHYDRIN: PRESSURE INCREASE WITH POSSIBLE EXPLOSIVE RUPTURE OF VESSEL. ACETONITRILE: VIOLENT EXOTHERM ON HEATING; SULFUR TRIOXIDE REDUCES INITIATION TEMPERATURE. ACROLEIN: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER. ACRYLONITRILE: VIGOROUS EXOTHERMIC POLYMERIZATION. ALCOHOL: EXOTHERMIC REACTION AND CONTRACTION OF VOLUME. ALCOHOLS AND HYDROGEN PEROXIDE: POSSIBLE EXPLOSION. ALLYL ALCOHOL: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER. ALLYL CHLORIDE: VIOLENT POLYMERIZATION. ALKYL NITRATES: MAY CAUSE VIOLENT REACTION. 2-AMINOETHANOL: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER. AMMONIUM HYDROXIDE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER. AMMONIUM IRON(III) SULFATE DODECAHYDRATE: VIOLENT, EXOTHERMIC REACTION ON HEATING. AMMONIUM TRIPERCHROMATE: FIRE OR EXPLOSION HAZARD. ANILINE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER. BASES: VIOLENT REACTION. BENZYL ALCOHOL: MAY DECOMPOSES EXPLOSIVELY AT ABOUT 180 C. BROMATES + METALS: POSSIBLE IGNITION. BROMINE PENTAFLUORIDE: VIOLENT REACTION WITH POSSIBLE IGNITION. TERT-BUTYL-M-XYLENE: VIOLENT EXOTHERMIC REACTION WITHOUT AGITATION. N-BUTYRALDEHYDE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER. CARBIDES: HAZARDOUS MIXTURE. CESIUM ACETYLIDE: IGNITION ON CONTACT. 4-CHLORONITROBENZENE AND SULFUR TRIOXIDE: POSSIBLE EXPLOSIVE REACTION. CHLORATES: ALL CHLORATES, WHEN BROUGHT IN CONTACT WITH SULFURIC ACID MAY GIVE OFF EXPLOSIVE CHLORINE DIOXIDE GAS. A VIOLENT EXPLOSION IS USUAL. CHLORATES + METALS: POSSIBLE IGNITION. CHLORINE TRIFLUORIDE: VIOLENT REACTION. CHLOROSULFONIC ACID: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER. CHROMATES: FIRE AND EXPLOSION HAZARD. COATINGS: ATTACKED. COMBUSTIBLE MATERIALS (FINELY DIVIDED): MAY IGNITE. COPPER: EVOLUTION OF SULFUR DIOXIDE. CUPROUS NITRIDE: VIOLENT REACTION. 2-CYANO-4-NITROBENZENEDIAZONIUM HYDROGEN SULFATE: EXOTHERMIC REACTION. 2-CYANO-2-PROPANOL: VIOLENT REACTION WITH INCREASE IN PRESSURE. CYCLOPENTADIENE: VIOLENT OR EXPLOSIVE REACTION. CYCLOPENTANONE OXIME: VIOLENT REACTION. 1,3-DIAZIDOBENZENE: IGNITION FOLLOWED BY EXPLOSIVE REACTION. DIETHYLAMINE: EXOTHERMIC REACTION. DIISOBUTYLENE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER. DIMETHYLBENZYLCARBINOL + HYDROGEN PEROXIDE: EXPLODES. DIMETHOXYANTHRAQUINONE: EXOTHERMIC REACTION ABOVE 150 C. 2,6-DINITRO-3-METHYLBENZOIC ACID + SODIUM AZIDE: EXPLOSIVE REACTION. 1,5-DINITRONAPHTHALENE + SULFUR: EXOTHERMIC REACTION. EPICHLOROHYDRIN: VIOLENT REACTION. ETHOXYLATED NONYLPHENOL: POSSIBLE IGNITION. ETHANOL + HYDROGEN PEROXIDE: POSSIBLE EXPLOSION. ETHYLENE CYANOHYDRIN: VIOLENT REACTION. ETHYLENE DIAMINE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER. ETHYLENE GLYCOL: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER. ETHYLENIMINE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER. FULMINATES: EXTREMELY HAZARDOUS MIXTURE. HEXALITHIUM DISILICIDE: INCANDESCENT REACTION. HYDROCHLORIC ACID: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER. HYDROGEN PEROXIDE (>50%): EXPLOSIVE REACTION AFTER EVAPORATION. HYDROFLUORIC ACID: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER. INDANE + NITRIC ACID: POSSIBLE EXPLOSION. IODINE HEPTAFLUORIDE: THE ACID BECOMES EFFERVESCENT. IRON: POSSIBLE EXPLOSION DUE TO HYDROGEN GAS FROM THE ACID-METAL REACTION. ISOPRENE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER. LITHIUM SILICIDE: INCANDESCENT REACTION. MERCURY NITRIDE: EXPLOSION ON CONTACT. MESITYL OXIDE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER. METALS: MAY LIBERATE FLAMMABLE HYDROGEN GAS. METALS (POWDERED): EXTREMELY HAZARDOUS MIXTURE. METAL ACETYLIDES: IGNITION REACTION. METAL CHLORATES: VIOLENT EXPLOSION UNLESS PROPERLY COOLED. METAL PERCHLORATES: FORMATION OF EXPLOSIVE PERCHLORIC ACID. 4-METHYLPYRIDINE: EXOTHERMIC REACTION. NITRAMIDE: MAY DECOMPOSE EXPLOSIVELY ON CONTACT. NITRATES: INCOMPATIBLE. NITRIC ACID + GLYCERIDES: EXPLOSION. NITRIC ACID + ORGANIC MATERIAL: MAY CAUSE VIOLENT REACTION. NITRIC ACID + TOLUENE: POSSIBLE VIOLENT REACTION OR EXPLOSION. NITROARYL BASES AND DERIVATIVES: MAY CAUSE VIOLENT REACTION OR EXPLOSION. NITROBENZENE: EXOTHERMIC REACTION AT ELEVATED TEMPERATURES. 3-NITROBENZENESULFONIC ACID: EXOTHERMIC REACTION. NITROMETHANE: FORMATION OF EXPLOSIVE MIXTURE. N-NITROMETHYLAMINE: EXPLOSIVE DECOMPOSITION. 4-NITROTOLUENE: EXPLOSIVE AT 80 C. ORGANICS: VIOLENT EXOTHERMIC REACTION. PENTASILVER TRIHYDROXYDIAMIDOPHOSPHATE: EXPLOSION ON CONTACT. PERCHLORATES: POSSIBLE EXPLOSION. PERCHLORIC ACID: FORMATION OF DANGEROUS ANHYDROUS PERCHLORIC ACID. PERMANGANATES: FORMATION OF PERMANGANIC ACID. PERMANGANATES + BENZENE: POSSIBLE EXPLOSION. 1-PHENYL-2-METHYL-PROPYL ALCOHOL + HYDROGEN PEROXIDE: POSSIBLE EXPLOSION. PHOSPHORUS (WHITE OR YELLOW): IGNITION IN CONTACT WITH BOILING ACID. PHOSPHORUS ISOCYANATE: VIOLENT REACTION. PHOSPHORUS TRIOXIDE: VIOLENT OXIDATION WITH POSSIBLE IGNITION. PICRATES: EXTREMELY HAZARDOUS MIXTURE. PLASTICS: ATTACKED. POLYSILYLENE: EXPLOSION ON CONTACT. POTASSIUM: EXPLOSIVE INTERACTION. POTASSIUM TERT-BUTOXIDE: IGNITION. POTASSIUM CHLORATE: POSSIBLE FIRE AND EXPLOSION. POTASSIUM PERMANGANATE: POSSIBLE EXPLOSION IN THE PRESENCE OF MOISTURE. POTASSIUM PERMANGANATE + POTASSIUM CHLORIDE: VIOLENT EXPLOSION. PROPIOLACTONE (BETA): TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER. PROPYLENE OXIDE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER. 3-PROPYNOL: POSSIBLE EXPLOSION UNLESS ADEQUATELY COOLED. PYRIDINE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER. REDUCING AGENTS: REACTS. RUBBER: ATTACKED. RUBIDIUM ACETYLIDE: IGNITION ON CONTACT. SILVER PERMANGANATE (MOIST): EXPLOSIVE REACTION. SILVER PEROXOCHROMATE: EXPLOSIVE REACTION. SODIUM: EXPLOSIVE REACTION WITH AQUEOUS ACID. SODIUM CARBONATE: VIOLENT REACTION. SODIUM CHLORATE: POSSIBLE FIRE OR EXPLOSION. SODIUM HYDROXIDE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER. SODIUM TETRAHYDROBORATE: VIOLENT, EXOTHERMIC REACTION. SODIUM THIOCYANATE: VIOLENT EXOTHERMIC WITH EVOLUTION OF CARBONYL SULFIDE. STEEL: POSSIBLE EXPLOSION DUE TO HYDROGEN GAS FROM THE ACID-METAL REACTION. STYRENE MONOMER: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER. TETRAMETHYLBENZENES: VIOLENT REACTION IN CLOSED CONTAINERS. 1,2,4,5-TETRAZINE: VIOLENT DECOMPOSITION ON CONTACT. THALLIUM(I) AZIDIDITHIOCARBONATE: MAY EXPLODE ON CONTACT. 1,3,5-TRINITROSOHEXAHYDRO-1,3,5-TRIAZINE: EXPLOSIVE DECOMPOSITION ON

CONTACT. VINYL ACETATE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER. ZINC CHLORATE: LIKELY TO CAUSE FIRES AND EXPLOSIONS. ZINC IODIDE: VIOLENT INTERACTION.

***DECOMPOSITION:*** THERMAL DECOMPOSITION MAY RELEASE TOXIC OXIDES OF SULFUR.

***POLYMERIZATION:*** HAZARDOUS POLYMERIZATION HAS NOT BEEN REPORTED TO OCCUR UNDER NORMAL TEMPERATURES AND PRESSURES.

## STORAGE AND DISPOSAL

OBSERVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE. FOR ASSISTANCE, CONTACT THE DISTRICT DIRECTOR OF THE ENVIRONMENTAL PROTECTION AGENCY.

****STORAGE****

PROTECT AGAINST PHYSICAL DAMAGE AND WATER. SEPARATE FROM CARBIDES, CHLORATES, FULMINATES, NITRATES, PICRATES, POWDERED METALS, AND COMBUSTIBLE MATERIALS (NFPA 49, HAZARDOUS CHEMICALS DATA, 1975). STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

THRESHOLD PLANNING QUANTITY (TPQ): THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) SECTION 302 REQUIRES THAT EACH FACILITY WHERE ANY EXTREMELY HAZARDOUS SUBSTANCE IS PRESENT IN A QUANTITY EQUAL TO OR GREATER THAN THE TPQ ESTABLISHED FOR THAT SUBSTANCE NOTIFY THE STATE EMERGENCY RESPONSE COMMISSION FOR THE STATE IN WHICH IT IS LOCATED. SECTION 303 OF SARA REQUIRES THESE FACILITIES TO PARTICIPATE IN LOCAL EMERGENCY RESPONSE PLANNING (40 CFR 355.30).

****DISPOSAL****

DISPOSAL MUST BE IN ACCORDANCE WITH STANDARDS APPLICABLE TO GENERATORS OF HAZARDOUS WASTE, 40 CFR 262. EPA HAZARDOUS WASTE NUMBER D002. 100 POUND CERCLA SECTION 103 REPORTABLE QUANTITY.

## CONDITIONS TO AVOID

MAY IGNITE OTHER COMBUSTIBLE MATERIALS (WOOD, PAPER, OIL, ETC.). VIOLENT REACTION WITH WATER. FLAMMABLE, POISONOUS GASES MAY ACCUMULATE IN CONFINED SPACES. RUNOFF TO SEWER MAY CREATE FIRE OR EXPLOSION HAZARD.

## SPILL AND LEAK PROCEDURES

***SOIL SPILL:*** DIG HOLDING AREA SUCH AS LAGOON, POND OR PIT FOR CONTAINMENT. DIKE FLOW OF SPILLED MATERIAL USING SOIL OR SANDBAGS OR FOAMED BARRIERS SUCH AS POLYURETHANE OR CONCRETE.
USE CEMENT POWDER OR FLY ASH TO ABSORB LIQUID MASS.
NEUTRALIZE SPILL WITH SLAKED LIME, SODIUM BICARBONATE OR CRUSHED LIMESTONE.

***AIR SPILL:*** APPLY WATER SPRAY TO KNOCK DOWN AND REDUCE VAPORS. KNOCK-DOWN WATER IS CORROSIVE AND TOXIC AND SHOULD BE DIKED FOR CONTAINMENT AND LATER DISPOSAL.

***WATER SPILL:*** NEUTRALIZE WITH AGRICULTURAL LIME, SLAKED LIME, CRUSHED LIMESTONE, OR SODIUM BICARBONATE.

***OCCUPATIONAL SPILL:*** KEEP COMBUSTIBLES (WOOD, PAPER, OIL, ETC.) AWAY FROM SPILLED MATERIAL. DO NOT TOUCH SPILLED MATERIAL. DO NOT GET WATER INSIDE CONTAINER. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. USE WATER SPRAY TO REDUCE VAPORS. DO NOT PUT WATER ON LEAK OR SPILL AREA. CLEAN UP ONLY UNDER THE SUPERVISION OF AN EXPERT. DIKE SPILL FOR LATER DISPOSAL. DO NOT APPLY WATER UNLESS DIRECTED TO DO SO. KEEP UNNECESSARY PEOPLE AWAY. ISOLATE HAZARD AREA AND DENY ENTRY. VENTILATE CLOSED SPACES BEFORE ENTERING.
REPORTABLE QUANTITY (RQ): 1000 POUNDS THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) SECTION 304 REQUIRES THAT A RELEASE EQUAL TO OR GREATER THAN THE REPORTABLE QUANTITY FOR THIS SUBSTANCE BE IMMEDIATELY REPORTED TO THE LOCAL EMERGENCY PLANNING COMMITTEE AND THE STATE EMERGENCY RESPONSE COMMISSION (40 CFR 355.40). IF THE RELEASE OF THIS SUBSTANCE IS REPORTABLE UNDER CERCLA SECTION 103, THE NATIONAL RESPONSE CENTER MUST BE NOTIFIED IMMEDIATELY AT (800) 424-8802 OR (202) 426-2675 IN THE METROPOLITAN WASHINGTON, D.C. AREA (40 CFR 302.6).

## PROTECTIVE EQUIPMENT

***VENTILATION:*** PROCESS ENCLOSURE RECOMMENDED TO MEET PUBLISHED EXPOSURE LIMITS.

***RESPIRATOR:*** THE FOLLOWING RESPIRATORS AND MAXIMUM USE CONCENTRATIONS ARE RECOMMENDATIONS BY THE U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, NIOSH POCKET GUIDE TO CHEMICAL HAZARDS; NIOSH CRITERIA DOCUMENTS OR BY THE U.S. DEPARTMENT OF LABOR, 29 CFR 1910 SUBPART Z. THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE, MUST NOT EXCEED THE WORKING LIMITS OF THE RESPIRATOR AND BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION (NIOSH-MSHA).

SULFURIC ACID:
25 MG/M3- ANY POWERED AIR-PURIFYING RESPIRATOR WITH AN ACID GAS CARTRIDGE(S) AND HAVING A HIGH-EFFICIENCY PARTICULATE FILTER. ANY SUPPLIED-AIR RESPIRATOR OPERATED IN A CONTINUOUS FLOW MODE.
50 MG/M3- ANY CHEMICAL CARTRIDGE RESPIRATOR WITH A FULL FACEPIECE AND ACID GAS CARTRIDGE(S) IN COMBINATION WITH A HIGH-EFFICIENCY PARTICULATE FILTER. ANY SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE. ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE. ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR (GAS MASK) WITH A CHIN-STYLE OR FRONT- OR BACK-MOUNTED ACID GAS CANISTER HAVING A HIGH-EFFICIENCY PARTICULATE FILTER.
80 MG/M3- ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE AND OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.
ESCAPE- ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR (GAS MASK) WITH A CHIN-STYLE OR FRONT- OR BACK-MOUNTED ACID GAS CANISTER HAVING A HIGH-EFFICIENCY PARTICULATE FILTER. ANY APPROPRIATE ESCAPE-TYPE SELF-CONTAINED BREATHING APPARATUS.
FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:
SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.
SUPPLIED-AIR RESPIRATOR WITH FULL FACEPIECE AND OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE IN COMBINATION WITH AN AUXILIARY SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

***CLOTHING:*** WEAR APPROPRIATE PROTECTIVE CLOTHING TO AVOID ANY POSSIBILITY OF SKIN CONTACT WITH LIQUIDS CONTAINING MORE THAN 1% SULFURIC ACID. AVOID REPEATED OR PROLONGED SKIN CONTACT WITH LIQUIDS CONTAINING 1% OR LESS SULFURIC ACID.

***GLOVES:*** EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS SUBSTANCE.

***EYE PROTECTION:*** EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES AND A FACESHIELD TO PREVENT CONTACT WITH THIS SUBSTANCE.
EMERGENCY WASH FACILITIES: WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES AND/OR SKIN MAY BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN AND QUICK DRENCH SHOWER WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

AUTHORIZED BY- OCCUPATIONAL HEALTH SERVICES, INC.
***CREATION DATE:*** 11/17/89 ***REVISION DATE:*** 05/18/90

## MATERIAL SAFETY DATA SHEET

OCCUPATIONAL HEALTH SERVICES, INC.
AGRICULTURE AND PESTICIDE DIVISION
450 SEVENTH AVENUE, SUITE 2407
NEW YORK, NEW YORK 10123
1-800-445-MSDS OR (212) 967-1100

EMERGENCY CONTACT:
JOHN S. BRANSFORD, JR. (615) 292-1180

## SUBSTANCE IDENTIFICATION

***CAS-NUMBER*** 2699-79-8
***SUBSTANCE:*** SULFURYL FLUORIDE
***TRADE NAMES/SYNONYMS:*** SULFURIC OXYFLUORIDE; VIKANE; VIKANE FUMIGANT; STCC 4904578; UN 2191; PST22380
***CHEMICAL FAMILY:*** INORGANIC GAS
***MOLECULAR FORMULA:*** F2-O2-S MOL WT: 102.06
***CERCLA RATINGS (SCALE 0-3):*** HEALTH=3 FIRE=0 REACTIVITY=0 PERSISTENCE=0
***NFPA RATINGS (SCALE 0-4):*** HEALTH=3 FIRE=0 REACTIVITY=0

## COMPONENTS AND CONTAMINANTS

***COMPONENT:*** SULFURYL FLUORIDE ***PERCENT:*** >99
CAS# 2699-79-8
***EXPOSURE LIMITS:*** SULFURYL FLUORIDE: 5 PPM (20 MG/M3) OSHA TWA; 10 PPM (40 MG/M3) OSHA STEL 5 PPM (20 MG/M3) ACGIH TWA; 10 PPM (40 MG/M3) ACGIH STEL

## PHYSICAL DATA

***DESCRIPTION:*** COLORLESS, ODORLESS GAS
***BOILING POINT:*** -68 F (-55 C)
***MELTING POINT:*** -214 F (-137 C) ***SPECIFIC GRAVITY:*** 1.8 (-80 C)

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# GROUNDWATER TECHNOLOGY, INC.
# HEALTH & SAFETY POLICY & PROCEDURE No. 9

## HAZARD COMMUNICATION PROGRAM

### 1.0 Purpose:

This document specifies requirements and documentation required for implementing Groundwater Technology, Inc.'s ("GTI") Hazard Communication Program. The purpose of this program is to help Groundwater Technology employees safely perform their work. Hazard Communication represents one of the elements of the safety program for protecting Groundwater Technology Employees. This program is a legal requirement under OSHA standard 29 CFR 1910.1200.

### 2.0 Policy:

All Groundwater Technology employees and Subcontractors shall receive the appropriate training and guidance to achieve understanding of the chemical, physical and biological hazards they may encounter with their work, and to perform their tasks safely.

### 3.0 Responsibilities:

The responsibilities and role(s) are described:

Manager: Shall assure that appropriate information is provided to each Groundwater Technology employee in their business unit according to the specifications of this program. Shall assure the availability of hazard communication materials. The manager shall assign a trainer for communicating and documenting this training. The manager shall assure the training is adequate and that documentation is present by techniques such as inspection, attendance in training, and audits of the program.

Assigned Trainer: Shall cover the assigned task of presenting, showing the location for and using available Hazard Communication materials. The trainer shall provide written documentation of all Hazard Communication training.

Health and Safety Representative: Shall act as a technical resource to provide materials or content such as Material Safety Data Sheets or selection criteria for specific chemical resistance barriers. Where qualified, the Health and Safety Representative may perform this Hazard Communication training.

Employee: Shall complete all required Hazard Communication training prior to working with hazardous materials and perform work tasks. Each employee has the right to know when a potential for exposure to a hazardous material exists. The Employee is responsible to perform his/her duties in a safe manner and in conformance with company standards, Federal, state, and local regulations.

## 4.0 Requirements, Standards and Program Elements:

The Groundwater Technology requirements for all business units is to assure no employee is exposed to tasks with potential for hazards without having first completed Hazard Communication training that instructs the harmful effects, the pathways for exposure, the barriers and personal protection to put on, and safe guidelines for handling and doing the job. The Hazard Communication program elements are described in the addendum portion of this document.

## 5.0 References:

This program conforms to requirements set forth in the U.S.A. by OSHA 29 CFR 1910.1200.

**6.0** The following documents and information tools should assist the business unit in implementing the policies and requirements for delivering Hazard Communication to Groundwater Technology employees, subcontractors, customers and the community as needed. These materials are to be used as guidelines and recommendations for Hazard Communication program content. Some of the Hazard Communication training program elements that should be included:

- Hazard Communication Program
- Employee Right to Know Responsibilities
- Hazardous Material and Chemical Product Labels (Exhibit A)
- Pipe Labeling
- Hazard Area Warning Signs (Exhibit B)
- Material Safety Data Sheets (Exhibit C)
- Request for MSDS Sample letter (Exhibit C)
- Chemical Inventory (Exhibit D)
- Hazard Communication Training
- Hazard Communication Documentation Procedures
- Hazard Communication Training Documentation Forms (Exhibit E)
- Audit for Hazard Communication (Exhibit G)

# GROUNDWATER TECHNOLOGY, INC.
# HEALTH & SAFETY POLICY & PROCEDURE No. 9

## HAZARD COMMUNICATION PROGRAM

1.0 Health and Safety Policy for Hazard Communication:

- 1.1 Inventory Hazards:
  - 1.1.1 for office
  - 1.1.2 for field sites
- 1.2 Assess Hazards sources and tasks
- 1.3 Devise precautions for each hazard area or task
- 1.4 Train employees to avoid hazards and use hazard controls
- 1.5 Keep documentation records for all hazard controls and hazard communication training
- 1.6 No employee may work in the field without first completing all required training.
- 1.7 An appropriate site safety plan and waste notification form must be established for every field project.
- 1.8 All accidents and injuries must be reported and properly recorded.
- 1.9 No Groundwater Technology employee may enter a confined space until a qualified supervisor has determined that confined space entry requirements have been met.
- 1.10 Required safety equipment must be available and employed at Groundwater Technology sites.
- 1.11 Unsafe or questionable procedures must be corrected immediately.
- 1.12 Employee health monitoring must be completed prior to field work.
- 1.13 Fit testing and clearance for respirator use is required prior to donning a respirator.
- 1.14 Hazardous materials will be handled in accordance with all regulatory standards.
- 1.15 Job site recordkeeping must include employee exposure (air monitoring) data.
- 1.16 It is the responsibility of each Groundwater Technology employee to adhere to these policies and ensure his/her personal safety and the safety of coworkers.

Note:
The Hazard Communication Program and procedures are administered by the Corporate Health and Safety Director.

**2.0** Health and Safety Managers and representatives maintain a master file of current updated Material Safety Data Sheets ("MSDS") representing chemicals used on Groundwater Technology Locations. *Note: Manufacturers publish updated MSDS Sheets annually.*

**3.0** Managers are responsible for current MSDS Sheets for chemicals in use in their office, warehouse and field locations, which will be kept in the Right to Know Stations MSDS notebook, and for field sites attached to the specific site safety plan for each location.

**4.0** Managers are responsible for obtaining current appropriate, legible MSDS sheets (Exhibit C), Hazard Warning Signs (Exhibit B) Hazard Labeling for Containers (Exhibit A), Hazard Pipe Labeling, and chemical inventory sheets (Exhibit D), electrical hazards labeling (see Exhibit F) for warehouses, project sites and offices.

**5.0** Managers shall provide appropriate hazard communication training to employees, and assure proper communication materials are at the site Health and Safety Representatives may provide the technical assistance and training for these employees.

**6.0** Hazard Communication training for employees will utilize the following types of information sources:

- Chemical Material Safety Data Sheets (MSDS)
- Container Hazard Labels: D.O.T., E.P.A., NFPA, HMIS
- Product Hazard information sheets (Manufacturer)
- Hazardous Chemical Warning sheets (ACGIH - Biological Exposure Indices)
- Hazard warning signs (OSHA)
- Written Hazard Communication Plan (HCP) for each office, site (Site Safety Plan)
- Site Safety Plan (Every field project site)
- Standard Operating Procedure (SOP) (Correct methods for performing the work)
- Task or job guideline sheets (Engineering and Safety guides for wrk)

**7.0** Hazard communication training shall occur before any Groundwater Technology employee is authorized to begin work or could potentially be exposed to a hazard. Part of hazard communication is a discussion of employee rights and responsibilities.

**8.0** Site specific hazard communication shall occur prior to the employee's first day at work on the site.

**9.0** Hazard communication for all Groundwater Technology employees on hazardous sites include:

9.1 40 hours of hazardous waste site activities safety training (certificate)(or equivalent certificate) [29 CFR 1910.120]

9.2 3 days (24 hours) field orientation by a supervisor to hazardous site activities (documented) [29 CFR 1910.120]

9.3 Chemical, Biological, and Physical hazard communication prior to contact or exposure (documented)[29 CFR 1910.1200]

9.4 Site specific training by the Manager shall ensure the employee understands:

- the potential for chemical, biological, or physical injury
- the proper method or guideline for working safely
- the appropriate personal protective equipment to wear to prevent injury
- the standard operating procedures for doing the task safely.

## Employee Rights and Responsibilities

### OSHA (For U.S. Operations)

The Occupational Safety and Health Act of 1970 created the Occupational Safety and Health Administration (OSHA) within the Department of Labor. OSHA was chartered to develop and enforce workplace health and safety standards. It has promulgated this standard in 29 CFR 1910.1200.

### Employee Right-To-Know

Groundwater Technology has established a written, comprehensive hazard communication program that includes provisions for container labeling, Material Safety Data Sheets and an employee training program. This program shall include a list of the hazardous chemicals in each work area, the means that Groundwater Technology uses to inform employees of the hazards of non-routine tasks (for example, the cleaning of reactor vessels), hazards associated with chemicals, and the way Groundwater Technology managers will inform other employers (e.g., sub-contractors) of the hazards to which *p2025Xtheir employees may be exposed.

### Employee Rights According to OSHA:

- Review copies of appropriate standards, rules, regulations and requirements that Groundwater Technology offices should have available for inspection by the employee.

- To have awareness and instruction about:

  - Chemical, Biological and Physical Hazards
  - Hazard warning signs, labels and safety tags
  - Material Safety Data Sheets for chemicals they handle or have exposure
  - Orientation to workplace safety procedures, rules and standards
  - The hazards and safety precautions to use
  - Emergency information for notification and response
  - New chemicals before employee starts the job

- Request information from Groundwater Technology managers on safety and health hazards in the workplace, precautions that shall be taken, and procedures that must be followed if an employee is involved in an accident or is exposed to toxic substances.

- Have access to relevant employee exposures and medical records information from the corporate health monitoring manager.

- Request that OSHA conduct an inspection if the employee believes hazardous conditions or violations of standards exist in the workplace.

- Have an authorized employee representative accompany the OSHA compliance officer during

the inspection tour. This provision would apply to our subcontractor's employees who are represented by a union.

- Respond to questions from the OSHA compliance officer, particularly if there is no authorized employee representative accompanying the OSHA compliance officer on the inspection "walkaround".

- Observe any monitoring or measuring of hazardous materials by Groundwater Technology or OSHA officers and see the resulting records, as specified under the Act and as required by OSHA standards.

- Have an authorized representative, or themselves, review the Log and Summary of Occupational Injuries (OSHA No. 200) at a reasonable time and in a reasonable manner. The OSHA 200 Log must be publicly posted each February.

- Object to the abatement period set by OSHA for correcting any violation in the citation issued to the employer by writing to the OSHA area director within 15 working days from the date the employer receives the citation. Groundwater Technology must publicly post any citations we receive for violation of OSHA regulations.

- Submit a written request to the National Institute for Occupational Safety and Health (NIOSH) for information whether any substance in the workplace has potentially toxic effects in the concentration being used, and have their names withheld from Groundwater Technology, if that is requested.

- Be notified by Groundwater Technology if it applied for a variance from an OSHA standard, and be able to testify at a variance hearing, and appeal the final decision.

- Be advised of OSHA actions regarding a complaint and request an informal review of any decision not to inspect or to issue a citation.

- File a section 11(c) Discrimination Complaint if punished for exercising the above rights or for refusing to work when faced with an imminent danger of death or serious injury.

**Employee Responsibilities According to OSHA:**

A Groundwater Technology employee should do the following:

- Read the OSHA poster at the Groundwater Technology job site

- Comply with all applicable OSHA standards

- Follow all Groundwater Technology safety and health rules and regulations, and wear or use prescribed protective equipment while working.

- Report hazardous conditions to the Groundwater Technology supervisor or manager.

- Report any job related injury or illness to the Groundwater Technology supervisor or manager and seek treatment promptly.

- Cooperate with the OSHA compliance officer conducting an inspection if he or she inquires about safety and health conditions in the workplace. (See steps for the employee to take during an OSHA inspection)

- Exercise rights under the OSHA Act in a responsible manner.

**Steps for the Groundwater Technology Employee to Take During an OSHA Inspection**

I. Identify the OSHA Inspector

a. Ask to see credentials
b. Write down the relevant inforation
- inspector's name
- agency affiliation
- telephone number
- action item: Why he's there on site

c. Ask to see documentation for the inspector's medical monitoring and 40-hour hazardous waste site training.

II. Notify the Groundwater Technology project manager and district health and safety specialist **immediately**.

III. Take documentation notes on:
a. What is said
b. What is seen
c. Who spoke to whom
d. Any samples or pictures taken
e. Any corrective actions done in the inspector's presence
f. Any activity, including where, when, who and what
g. Any other occurrence, even if minor

IV. If asked a question by the OSHA inspector and the employee does not know the answer, Do Not Bluff your Answer. Ask the inspector to put the question in writing. Never lie or fabricate an answer

V. Carefully review the Groundwater Technology site safety plan with the OSHA inspector

VI. If complaints initiated the inspection, find out the specifics of what the complaints were.

## Hazardous Materials and Chemical Product Labels

**1.0** Project managers, operations managers, supervisors, office safety coordinators and all other Groundwater Technology employees shall ensure that chemical, biological, other hazardous materials containers are properly labeled. This labeling of containers includes properly marking containers of hazardous waste.

**2.0** Containers of hazardous materials used, stored or handled at GTI shall bear the following information:

- Identity of the chemical (or material), trade name and composition
- Appropriate hazard warnings: (flammable, corrosive, reactive, toxic, explosive)
- Name and address of chemical manufacturer, generator, responsible arty
- Product labels shall not be removed if the container still holds the original material
- NFPA labels, HMIS™ labels, chemical name labels shall be at each site.
- All secondary containers shall be marked with the same information as the original container.
- All hazardous waste containers shall be properly labeled.
- The site or office must have an MSDS for each chemical on site.
- A chemical inventory is required for all chemicals in use on each site.
- All chemicals in use at field sites must have a representative MSDS attached to the Site Safety Plan.
- Any changes in MSDS requires a hazard communication update to the employees by the manager, supervisor, project manager or office safety coordinator.

*See Exhibit A -- Examples of Hazardous Materials Container Labels*

## Pipe Labeling

**1.0** Project managers, operations managers, supervisors, or office safety coordinators are responsible for assuring proper pipe labeling on project site installations, office and warehouse.

**2.0** Managers and supervisors must include pipe labeling requirements in the hazard communication training.

**3.0** All chemical and waste pipelines shall be properly labeled.

**4.0** Examples of Hazard Color Coding for Pipe Labels

| ANSI* Color Codes Corresponding to Chemical Hazard Codes | |
|---|---|
| **ANSI Coding** | **Definition** |
| yellow labels/black letters | hazardous |
| green label/white letters | low hazard (liquid) |
| blue label/white letters | low hazard (gas) |
| Red label/white letters | fire quenching materials |

*ANSI - America National Standards Institute

**5.0** Colored pipe labels shall be placed near each pipe joint, valve or bend and every 25 linear feet or less, (with directional flow colored arrows).

**6.0** A colored pipe code key will be visible and prominently displayed at each area where pipes are coded and labeled. All pipes shall be appropriately labeled at each Groundwater Technology facility. (See section 7.0 for labeling key)

**7.0** Standard Pipe labeling key for products in use at Groundwater Technology facilities:

| Legend | Color | Legend | Color |
|---|---|---|---|
| Acid | yellow | oxygen | yellow |
| Air | blue | steam | yellow |
| Compressed Air | blue | BTEX | yellow |
| Exhaust Air | blue | Plumbing Vent | green |
| Ammonia | yellow | City Water | green |
| Caustic | yellow | Drain Water | green |
| Condensate | yellow | Non Potable Water | yellow |
| Domestic Water | green | Potable Water | green |
| Sanitary drain | green | Unsafe Well Water | yellow |
| Engine Exhaust | yellow | Peroxide | yellow |
| Sprinkler-Fire | red | Sulfuric Acid | yellow |
| Natural gas | yellow | Lime Mud | yellow |
| City Gas | yellow | Feed to Tower | yellow |
| Propane | yellow | Water | yellow |
| Hot Water | yellow | Chlorine | blue |
| Fuel Oil | yellow | Instrument Air | yellow |
| Suction | yellow | Waste Oil | green |
| | | Deionized Water | yellow |
| | | Carbon Dioxide | yellow |
| | | Hydrogen | green |
| | | Inert Gas | |

## Standard Electrical Circuit Hazard Labeling

**1.0** Standard labeling of all electrical circuits in the wiring boxes is part of hazard communication.

**1.1** Managers shall assure through inspection and training that all project site installations, offices, and warehouses have proper labeling of circuits in electrical control boxes.

**1.2** Lockout/tagout labeling sources. See Exhibit F.

## Hazard Area Warning Signs

**1.0** Hazard signs shall be placed in appropriate positions at eye height to warn of potential hazards, special protective equipment zones and unauthorized entry areas.

**2.0** General hazard communication training shall be performed by operations managers, project managers supervisors or office coordinators to assure all field or office employees understand the meaning and reason for erecting the signs.

*See Exhibit B--Examples of OSHA Hazard Warning Signs*

## Material Safety Data Sheets (MSDS)

**1.0** Operations Managers, project managers, supervisors and office safety coordinators are responsible to obtain and maintain an up to date file of all chemicals in use at the office, warehouse and all project sites and assure hazardous chemicals shall not be placed in service or use on sites until:

- An MSDS is available for the office file for all chemicals in use on project installations, offices, and warehouses.
- A copy is attached to the Site Safety Plan on each project site.
- A Hazard Communication Training Session with the MSDS has taken place for all employees with potential for exposure in attendance and documentation is placed in their training files

See Exhibit C: Examples of Material Safety Data Sheets (MSDS)

## Chemical Inventory

**1.0** In the event of a hazardous chemical exposure to any employee on a Groundwater site, the operations manager shall assure a copy of the MSDS will be sent to the appropriate medical facility and if possible transported with the exposed employee.

**2.0** Operations managers, project managers, supervisors and office safety coordinators shall make available a master chemical inventory list for each site, and assure it is available for the local fire department. This contingency plan shall also have a floor plan of each facility and site with the location and legend of all chemicals on site. This plan shall be updated annually, in January.

See Exhibit D: Example of a Warehouse Chemical Inventory Sheet

**2.1** Elements of the chemical inventory shall include:

- Maximum amount of hazardous chemical in each category
- Average daily amount for each hazardous chemical category
- General location for each category of hazardous chemical
- A brief description of how each category of hazardous chemical is stored
- Location for each hazardous chemical on each project installation, office and warehouse (floor plan)

## Hazard Communication Training

1.0 Managers or their designee shall explain the elements of hazard communication and provide training for each employee, an outline of these elements include:

- Explanation of OSHA Hazard Communication Standard [29 CFR 1910.1200].
- Explanation of Groundwater Technology's responsibility in a Hazard Communication Program ("HCP").
- Demonstration, review and explanation of the written hazard communication plan available at the local office. All employees shall be told where the HCP is stored in the office.
- Show where the material Safety Data Sheets are stored
- Review all chemicals and hazardous chemicals are located or used in the local office that are available in the MSDS notebook.
- Discuss the work activities and environment that require hazardous chemicals and explain the engineering safeguards, personal protective equipment or standard operating procedures or methods used to avoid hazardous exposure.
- Explain or demonstrate proper procedures and equipment to sue for detecting the presence of hazardous materials.
- Discuss the routes for all hazardous chemicals to enter the body and the resulting effect on the body.
- Show the proper type of protective equipment to wear, discuss appropriate occasions for wearing the equipment, show where it is stored and proper methods for donning, doffing, and disposal of contaminated equipment.
- Explain the emergency procedures to follow for fires, personal injury, evacuation, chemical spills and other incidents.
- Discuss areas or activities on the sites that offer high risk for physical or biological exposures that will cause injury or illness to the employee.
- Explain to the employees what types of environmental monitoring or health monitoring is being done for employees working on site and documentation to be retained for thirty (30) years after termination.
- Explain that all MSDS files of currently used chemicals must be retained for thirty years and archived.

Managers are responsible to assure all employees have been trained in Hazard communication for all chemicals and other hazards before they encounter a potential exposure at the worksite.

NOTE: See documentation procedures for hazard communication and documentation forms in exhibit E.

## Hazard Communication Documentation Procedures

**1.0** Managers shall assure that hazard communication written documentation for all hazardous chemicals have been filed for each employee in their health and safety training folder, through inspections and audits.

**2.0** Managers, shall audit and maintain accurate hazard communication documentation. See Exhibit E for forms.

**3.0** Hazard communication training documentation must contain the following basic information:

- Employee's name
- Job Title
- Social Security Number
- Title of Course
- Description of Contents
- Number of hours training
- name of the instructor
- Date of training

**4.0** Health monitoring results and confidential employee medical information are in the health and safety department. Requests for information should be made by contacting the corporate health monitoring manager.

**5.0** It shall be assured that subcontractor personnel have received Hazard Communication training.

**6.0** Subcontractor's employees must follow and obey all federal, state and local standards, as well as site safety plan requirements and safety guidelines in the employee safety handbook.

**7.0** Subcontractor's employees must have the prerequisite 40 Hour and hazardous site orientation training before working on hazardous waste sites. Managers, project managers, supervisors and office safety coordinators must verify certificates and hazard communication training.

*See Exhibit E--Initial Hazard Communication Form and Training Documentation*

# EXHIBIT A

## SOURCES FOR ORDERING AND

## EXAMPLES OF HAZARDOUS MATERIAL CONTAINER LABELS

## HAZARD COMMUNICATION LABELS

### SOURCES FOR ORDERING:

| | |
|---|---|
| Seton Identification Products<br>P. O. Box JB-1331<br>New Haven, CT 06505 | 1(800)243-6624 |
| Emed Graphic Communications<br>P. O. Box 369<br>Buffalo, NY 14240-0369 | 1(800)442-3633 |
| D & C Sign and Label<br>P. O. Box KA-157<br>Northford, CT 06472 | 1(800)356-9269 |
| Brady Sign Mark Division<br>727 W. Glendale Ave<br>P. O. Box 571<br>Milwaukee, WI 53201 | 1(800)635-7557 |

HMIS®

**HEALTH**

**FLAMMABILITY**

**REACTIVITY**

PERSONAL PROTECTION

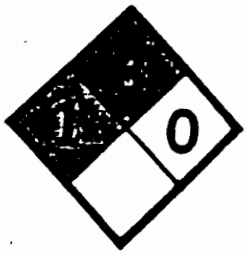
© HMIS NPCA Since BC LSHR
American Labelmark Co., Chgo. IL 60646

NATIONAL FIRE PROTECTION ASSOCIATION
(NFPA) SYSTEM

**HEALTH HAZARD—BLUE**

- 4 Materials which on very short exposure could cause death or major residual injury even though prompt medical treatment were given
- 3 Materials which on short exposure could cause serious temporary or residual injury even though prompt medical treatment were given
- 2 Materials which on intense or continued exposure could cause temporary incapacitation or possible residual injury unless prompt medical treatment is given
- 1 Materials which on exposure would cause irritation but only minor residual injury even if no treatment is given
- 0 Materials which on exposure under fire conditions would offer no hazard beyond that of ordinary combustible material

H-NFWC Printed by LABELMASTER, Chicago, IL 60646 (800) 621-5808




**ACETONE**

**NITRIC ACID**

# NON-CLASSIFIED WASTE MATERIAL

## LABORATORY ANALYSIS IN PROGRESS

**CAUTION:** THE CONTENTS OF THIS CONTAINER HAVE NOT BEEN CLASSIFIED AND MUST BE MANAGED WITH CAUTION UNTIL CLASSIFIED AND THEN MANAGED ACCORDINGLY. DO NOT OPEN OR MOVE WITHOUT PRIOR APPROVAL FROM GENERATOR/CONTRACTOR. CONTENTS MAY BE HARMFUL TO HUMAN HEALTH OR THE ENVIRONMENT.

MATERIAL: _____

SITE ADDRESS: _____

_____

_____

ACCUMULATION DATE: _____

GENERATOR: _____

GENERATOR CONTACT & PHONE: _____

CONTRACTOR CONTACT & PHONE: _____

_____

_____

**NOTE:** THIS CONTAINER CANNOT BE SHIPPED UNTIL CLASSIFICATION IS COMPLETE AND CONTAINER IS APPROPRIATELY MARKED AND LABELED IN ACCORDANCE WITH EPA AND D.O.T. REGULATIONS.

NCWM-P

Printed by: Mesa Label Express, 8525 Arjons, Ste. T, San Diego, CA 92126 (619) 693-4988

# EXHIBIT B

## SOURCES FOR ORDERING

## AND

## EXAMPLES OF HAZARD AREA WARNING SIGNS

## HAZARD COMMUNICATION LABELS

### SOURCES FOR ORDERING:

| | |
|---|---|
| Seton Identification Products<br>P. O. Box JB-1331<br>New Haven, CT 06505 | 1(800)243-6624 |
| Emed Graphic Communications<br>P. O. Box 369<br>Buffalo, NY 14240-0369 | 1(800)442-3633 |
| D & C Sign and Label<br>P. O. Box KA-157<br>Northford, CT 06472 | 1(800)356-9269 |
| Brady Sign Mark Division<br>727 W. Glendale Ave<br>P. O. Box 571<br>Milwaukee, WI 53201 | 1(800)635-7557 |

# GRAPHIC OSHA SIGNS

- Choice of Semi-Rigid or Metal Backed Plastic Signs
- Designed to Meet Proposed ANSI Z535 Specifications

Promote safety with easy to understand wording and eye catching graphics.

373-G

387-G

285-G

381-G

389-G

1200-G

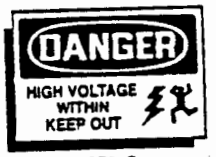
284-G

286-G

335-G

336-G

288-G



375-G

372-G

281-G

388-G

155-G

154-G

290-G

376-G

377-G

378-G

392-G

380-G

151-G

391-G

386-G

173-G

337-G

292-G

480-G

481-G

475-G

476-G

482-G

478-G

707-G

587-G

579-G

585-G

593-G

580-G

552-G

# GRAPHIC OSHA SIGNS

TO ORDER: Specify Style Number, Size, Material and Quantity.
PRICE: Per Sign. OK to assort for best price.

| MATERIAL | 10"x 7" | | | 14"x 10" | | |
|---|---|---|---|---|---|---|
| | 1-5 | 6-11 | 12 & Up | 1-5 | 6-11 | 12 & Up |
| Semi-Rigid Plastic (BSR) | $10.90 | $9.60 | $8.45 | $15.65 | $13.60 | $11.40 |
| Metal-Backed Plastic (BMB) | 13.60 | 11.30 | 9.70 | 20.55 | 18.30 | 14.50 |
| Pressure Sensitive Vinyl | 8.25 | 7.50 | 6.75 | 9.90 | 8.75 | 8.05 |

# EXHIBIT C

## REQUEST FOR MISSING MSDS SHEETS LETTER

## AND

## EXAMPLES OF MATERIAL SAFETY DATA SHEETS

Name of Manufacturer
Address

Dear Technical Information Representative:

This letter is written to request information concerning the potential safety and health hazards from using your product, _____. Please provide me with a Material Safety Data Sheet (MSDS) for your product.

The following specific information is requested for the purpose of fully evaluating the health risk to the employees at our facility who use your product:

1. The identity of any chemical component which may present a health hazard when skin contact, inhalation, or ingestion occurs.

2. The identity of any component which may cause an allergic sensitization.

3. The concentration and identity of any component which is a recognized or suspected carcinogen or reproductive toxin.

4. The concentration of any lead compounds.

Please contact me at _____ should you need this request clarified. Thank you for your assistance on this most important matter.

Sincerely,

Name
Title

# Material Safety Data Sheet

May be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200. Standard must be consulted for specific requirements.

**U.S. Department of Labor**
Occupational Safety and Health Administration
(Non-Mandatory Form)
Form Approved
OMB No. 1218-0072

IDENTITY *(As Used on Label and List)*

*Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.*

## Section I

| | |
|---|---|
| Manufacturer's Name | Emergency Telephone Number |
| Address *(Number, Street, City, State, and ZIP Code)* | Telephone Number for Information |
| | Date Prepared |
| | Signature of Preparer *(optional)* |

## Section II — Hazardous Ingredients/Identity Information

| Hazardous Components (Specific Chemical Identity; Common Name(s)) | OSHA PEL | ACGIH TLV | Other Limits Recommended | % *(optional)* |
|---|---|---|---|---|
| | | | | |
| | | | | |
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## Section III — Physical/Chemical Characteristics

| | | | |
|---|---|---|---|
| Boiling Point | | Specific Gravity ($H_2O$ = 1) | |
| Vapor Pressure (mm Hg.) | | Melting Point | |
| Vapor Density (AIR = 1) | | Evaporation Rate (Butyl Acetate = 1) | |

Solubility in Water

Appearance and Odor

## Section IV — Fire and Explosion Hazard Data

| | | | |
|---|---|---|---|
| Flash Point (Method Used) | Flammable Limits | LEL | UEL |

Extinguishing Media

Special Fire Fighting Procedures

Unusual Fire and Explosion Hazards

printed on recycled paper

## Section V — Reactivity Data

| Stability | Unstable | | Conditions to Avoid |
|---|---|---|---|
| | Stable | | |

Incompatibility (*Materials to Avoid*)

Hazardous Decomposition or Byproducts

| Hazardous Polymerization | May Occur | | Conditions to Avoid |
|---|---|---|---|
| | Will Not Occur | | |

## Section VI — Health Hazard Data

Route(s) of Entry: Inhalation? Skin? Ingestion?

Health Hazards (*Acute and Chronic*)

Carcinogenicity: NTP? IARC Monographs? OSHA Regulated?

Signs and Symptoms of Exposure

Medical Conditions
Generally Aggravated by Exposure

Emergency and First Aid Procedures

## Section VII — Precautions for Safe Handling and Use

Steps to Be Taken in Case Material Is Released or Spilled

Waste Disposal Method

Precautions to Be Taken in Handling and Storing

Other Precautions

## Section VIII — Control Measures

Respiratory Protection (*Specify Type*)

| Ventilation | Local Exhaust | Special |
|---|---|---|
| | Mechanical (*General*) | Other |

| Protective Gloves | Eye Protection |
|---|---|

Other Protective Clothing or Equipment

Work/Hygienic Practices



★ USGPO 1986-491-529/45775

# Material Safety Data Sheet

From Genium's Reference Collection
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GENIUM PUBLISHING CORP.

No. 52

HYDROGEN SULFIDE
(Revision A)
Issued: July 1979
Revised: April 1988

## SECTION 1. MATERIAL IDENTIFICATION

25

**Material Name:** HYDROGEN SULFIDE

**Description (Origin/Uses):** Used as a reagent in analytical chemistry and in metallurgy; used to make heavy water.

**Other Designations:** Sulfureted Hydrogen; $H_2S$; NIOSH *RTECS* No. MX1225000; CAS No. 7783-06-4

**Manufacturer:** Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.

HMIS
H 4
F 4 R 1
R 3 I 3
PPG* S 2
*See sect. 8 K 4

## SECTION 2. INGREDIENTS AND HAZARDS

| SECTION 2. INGREDIENTS AND HAZARDS | % | EXPOSURE LIMITS |
|---|---|---|
| Hydrogen Sulfide, CAS No. 7783-06-4 | * | IDLH** Level: 300 ppm<br>**OSHA PEL**<br>Ceiling:*** 20 ppm<br>**ACGIH TLVs, 1987-88**<br>TLV-TWA: 10 ppm, 14 mg/m³<br>TLV-STEL: 15 ppm, 21 mg/m³<br>**NIOSH REL**<br>10-Min Ceiling: 10 ppm, 15 mg/m³<br>**Toxicity Data****<br>Human, Inhalation, $LC_{Lo}$: 600 ppm (30 Mins) |

*Contact your supplier to determine the exact composition of this gas and if any contaminants are present.
**Immediately dangerous to life and health.
***OSHA sets the maximum peak above ceiling PEL as 50 ppm only in an 8-hour shift with no other measurable exposures.
****See NIOSH, *RTECS*, for additional data.

## SECTION 3. PHYSICAL DATA

**Boiling Point:** -76°F (-60°C)
**Melting Point:** -117°F (-83°C)
**Vapor Density:** 1.2
**Vapor Pressure:** >760 Torrs (Normal Atmospheric Pressure)

**Water Solubility (%):** At 68°F (20°C), 1 gram of $H_2S$ dissolves in 242 ml of water.
**Molecular Weight:** 34 Grams/Mole

**Appearance and Odor:** A colorless gas; odor of rotten eggs. **Warning:** Paralysis of olfactory sense occurs at 200 ppm.

## SECTION 4. FIRE AND EXPLOSION DATA

| Flash Point and Method | Autoignition Temperature | Flammability Limits in Air % by Volume | LOWER | UPPER |
|---|---|---|---|---|
| Not Applicable | 500°F (260°C) | | 4.3 | 46 |

**Extinguishing Media:** Hydrogen sulfide gas is a severe fire and explosion hazard; treat any fire involving it as an emergency. Try to shut off the gas; use a water spray to protect personnel attempting this. **Unusual Fire or Explosion Hazards; Danger:** Fire-exposed cylinders containing hydrogen sulfide gas can rupture violently. If it is safe to do so, remove them from the fire area or try to cool them with a direct water spray. This gas is denser than air and can travel a considerable distance to a low-lying source of ignition and flash back. It is flammable or explosive over a wide range of gas/air mixtures (see LEL and UEL). **Special Fire-fighting Procedures:** Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode. Fire fighters must use the maximum personal protective equipment available. Fight fires from explosion-proof or unmanned locations.

## SECTION 5. REACTIVITY DATA

Hydrogen sulfide is stable in closed, airtight, pressurized containers at room temperature under normal storage and handling conditions. It does not undergo hazardous polymerization.

**Chemical Incompatibilities:** This material is very reactive; hazardous reactions occur between it and strong oxidizing agents, nitric acid, soda lime, sodium, sodium peroxide, acetaldehyde, copper, and others (see Genium ref. 84, p. 491M-107).

**Conditions to Avoid:** Do not allow sources of ignition such as open flame, unprotected heaters, lighted tobacco products, electric sparks, or excessive heat in work areas because of the extreme flammability of hydrogen sulfide.

**Hazardous Products of Decomposition:** During fires hydrogen sulfide may produce toxic gases such as sulfur oxides ($SO_x$).

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## SECTION 6. HEALTH HAZARD INFORMATION

Hydrogen sulfide is not listed as a carcinogen by the NTP, IARC, or OSHA.

**Summary of Risks:** High concentrations (500-1000 ppm) of this material can cause systemic poisoning symptomized by respiratory paralysis, and unconsciousness, followed by death. Exposures of 50 to 500 ppm are characterized by respiratory irritation (coughing, difficulty in breathing). Eye and upper respiratory tract (URT) irritation start around 20 ppm; the severity increases with the duration and intensity of exposure. The sense of smell can be paralyzed immediately by exposure to 200 ppm. Collapse quickly followed by coma and possibly death can occur after breathing only a small amount at >1000 ppm.

**Medical Conditions Aggravated by Long-Term Exposure:** None reported. **Target Organs:** Eyes, respiratory system.

**Primary Entry:** Skin contact, inhalation. **Acute Effects:** Eye and URT irritation, dizziness, headache, and nausea.

**Chronic Effects:** None reported.

**FIRST AID**

**Eyes:** Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes.

**Skin:** Treat for possible frostbite damage (cryogenic injury) if liquid hydrogen sulfide touches skin. Treat also for corrosive, acidic burns from either the gas or liquid. **Inhalation:** Remove the exposed person to fresh air; restore and/or support his or her breathing as needed. Rescuers must use good judgment to minimize their own personal risk. **Ingestion:** Unlikely.

**GET MEDICAL HELP (IN PLANT, PARAMEDIC, COMMUNITY) FOR ALL EXPOSURES. Seek prompt medical assistance for further treatment, observation, and support after first aid.**

## SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

**Spill/Leak:** *Treat any hydrogen sulfide gas leak as an emergency.* Preplan for gas leaks and make these preparations known to all relevant personnel. Notify safety personnel, evacuate all nonessential personnel, provide maximum explosion-proof ventilation, and eliminate all sources of ignition immediately. Try to stop the flow of gas; use a water spray to protect personnel attempting to do this. Cleanup personnel require a complete set of protective clothing, including an SCBA.

**Waste Disposal:** Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

**OSHA Designations**

Air Contaminant (29 CFR 1910.1000 Subpart Z)

**EPA Designations (40 CFR 302.4)**

RCRA Hazardous Waste, No. U135

CERCLA Hazardous Substance, Reportable Quantity: 100 lbs (45.4 kg)

## SECTION 8. SPECIAL PROTECTION INFORMATION

**Goggles:** Always wear protective eyeglasses or chemical safety goggles. Follow the eye- and face-protection guidelines in 29 CFR 1910.133. **Respirator:** Wear a NIOSH-approved respirator per the *NIOSH Pocket Guide to Chemical Hazards* for the maximum-use concentrations and/or the exposure limits cited in section 2. Follow the respirator guidelines in 29 CFR 1910.134. For emergency or nonroutine use (e.g., cleaning reactor vessels or storage tanks), wear an SCBA with a full facepiece operated in the pressure-demand or positive-pressure mode. **Warning:** Air-purifying respirators will *not* protect workers in oxygen-deficient atmospheres. **Other:** Wear impervious gloves; boots; aprons; and clean, impervious, body-covering clothing to prevent any possibility of hydrogen sulfide's contact with skin. All clothing must be flame resistant. **Ventilation:** Install and operate general and local ventilation systems powerful enough to maintain airborne levels of hydrogen sulfide below the exposure limit cited in section 2. Make all ventilation systems of maximum explosion-proof design (e.g., nonsparking, electrically grounded and bonded, etc.)

**Safety Stations:** Make eyewash stations, washing facilities, and safety showers available in use and handling areas.

**Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them. Do *not* wear contact lenses in any work area. **Other:** All piping and equipment used with this gas must be pressure checked and leak tight.

**Comments:** Practice good personal hygiene; always wash thoroughly after using this material. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do *not* eat, drink, or smoke in any work area.

## SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

**Storage/Segregation:** Store hydrogen sulfide in a cool, dry, well-ventilated area away from oxidizing agents, sources of heat or ignition, any flammable/explosive materials, cylinders containing oxygen, and incompatible chemicals (see sect. 5). Use outside or detached storage. Store cylinders upright and secure them tightly. **Special Handling/Storage:** Hydrogen sulfide is shipped and stored as a pressurized gas in cylinders or tank cars. Protect them against physical damage and regularly inspect them for cracks, leaks, or faulty valves. Electrically ground and bond all containers used in shipping or transferring operations to prevent static sparks. Do not drag or slide cylinders; move them in a carefully supervised manner with a suitable hand truck. Do not smoke in any use or storage area. Shade containers from radiant heat and direct sunlight. **Engineering Controls:** Make all engineering systems (ventilation, production, etc.) of maximum explosion-proof design. Hydrogen sulfide must be used in closed engineering systems because of its explosibility (see sect. 4). Evacuate and purge all lines with an inert gas such as nitrogen ($N_2$) before and after using hydrogen sulfide. **Comments:** Perform all operations with hydrogen sulfide carefully to prevent accidental ignition. Keep the valve-protection cap in place until immediately before use. Insert a check valve or trap into the transferral line to prevent a dangerous backflow into the original container. Use pressure-reducing regulators when connecting a cylinder to a lower-pressure piping system. Obtain detailed handling, shipping, and storage information from your supplier. A trained chemist or safety specialist familiar with the physical and chemical properties of this material should be present during all work operations.

**Transportation Data (49 CFR 172.101-2)**

| | | |
|---|---|---|
| **DOT Shipping Name:** Hydrogen Sulfide | **DOT Label:** Flammable Gas and Poison | **IMO Class:** 2.1 |
| **DOT ID No.** UN1053 | **DOT CLass:** Flammable Gas | **IMO Label:** Flammable Gas and Poison Gas |

**References:** 1, 2, 12, 73, 84-94, 100, 103.

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WORKPLACE ENVIRONMENTAL EXPOSURE LEVEL GUIDE

AMERICAN INDUSTRIAL HYGIENE ASSOCIATION

# METHYL TERT-BUTYL ETHER

(1991)

## I. IDENTIFICATION

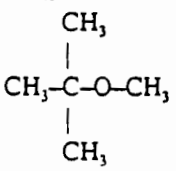
Chemical Name: Methyl tert-butyl ether

Synonyms: 2-methoxy-2-methyl-propane; tert-butyl methyl ether; MTBE; 2,2-MMOP

CAS Number: 1634-04-4

Molecular Formula: $C_5H_{12}O$

Structural Formula:



## II. CHEMICAL AND PHYSICAL PROPERTIES[1,2]

Physical State: Colorless liquid

Molecular Weight: 88.15

Conversion Factor: 1 ppm = 3.61 mg/m$^3$; 1 mg/m$^3$ = 0.28 ppm at 25°C

Boiling Point: 55°C (131°F) at 760 mmHg

Melting Point: −109°C (−164°F)

Vapor Pressure: 245 mmHg at 25°C (77°F)

Saturated Vapor Concentration: 322 000 ppm at 25°C (77°F)

Odor Description: Slight terpene-like odor

Odor Threshold: 0.6 ppm

Flammability Limits: Lower explosive limit: 2.5%; upper explosive limit: 15.1%

Flash Point: −10°C (−14°F) (closed-cup)

Autoignition Temperature: 224°C (435°F)

Specific Gravity: 0.74 at 20°C (68°F)

Vapor Density: 3.1 (air = 1)

Solubility in Water: 4.8% at 25°C (77°F)

Stability: Unstable in acid solutions

Reactivity and Incompatibilities: May react with air to form unstable peroxide; incompatible with strong acids, bases, and oxidizers

## III. USES AND VOLUME

MTBE is used as an octane booster in gasoline. The 1981 production of MTBE was $3.45 \times 10^8$ kg.[3]

## IV. TOXICOLOGY DATA

A. Acute Toxicity

1. *Oral Toxicity*

   Rat: $LD_{50}$ 2.8 g/kg[4]

2. *Eye Toxicity*

   Rabbit: 0.1 mL of undiluted MTBE instilled into the conjunctival sac of the eye produced mild irritation[4]

3. *Skin Toxicity*

   a. Irritation

   Rabbit: minimally irritating(5)

   b. Absorption

   Rabbit: $LD_{50}$ >10.2 g/kg(4)

4. *Inhalation*

   Rat: 4-hr $LC_{50}$ 23 546 ppm[4]

   Mouse: 15-min $LC_{50}$ 39 070 ppm[1]

   A single 6-hr exposure of rats to MTBE resulted in several functional observation battery findings in the 8000 ppm exposure group and occasional findings in the 4000 ppm exposure group. Clear motor activity changes were observed in the 8000 ppm exposure group. The pattern and time course of effects were indicative of transient central nervous system (CNS) sedation. In contrast to the effects observed in the 8000 ppm group, transient increases in motor activity were observed for males in the 800 and 4000 ppm exposure groups. The biological significance of the increase in activity was unclear but might reflect an exposure-related stimulant effect or an exaggerated response following recovery from possible anesthetic effect.[6]

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Two Rhesus monkeys were exposed 6 hr/day for 5 days to progressively higher concentrations of MTBE. No adverse effects were noted until after 65 min of the third exposure period (8500 ppm), at which time both monkeys became ataxic. On the fourth exposure, the female monkey was unconscious after 58 min of exposure (18 000 ppm), and the male monkey was unconscious after 50 min of exposure (31 000 ppm). On the last exposure, the female monkey was unconscious after 43 min of exposure to 49 000 ppm, and the male monkey was unconscious after 24 min of exposure to 95 500 ppm.[7]

B. Genotoxicity

MTBE was not mutagenic when tested in *Salmonella* and *Saccharomyces* or in tests for sister chromatid exchange and chromosomal aberrations in Chinese hamster ovary cells.[8] MTBE was mutagenic in the L5178Y mouse lymphoma assay only in the presence of an S-9 metabolic activation system.[8] It was surmised that a metabolite, possibly formaldehyde rather than MTBE itself, was the mutagenic agent. MTBE was not mutagenic in the *Drosophila melanogaster* sex-linked recessive lethal test.[9] Rats exposed to 800, 4000, and 8000 ppm MTBE 6 hr/day for 5 days did not exhibit any significant increase in the incidence of chromosomal aberrations in the bone marrow cells.[10]

C. Metabolism and Pharmacokinetics

[$^{14}$C]-MTBE (7.3 or 14.6 mg/kg) injected intraperitoneally (i.p.) to rats was excreted rapidly in expired air (65%–79% in 24 hr). Small amounts were recovered in the urine (3%–5%) and feces (0.5%–1.5%) 48 hr following administration. About 8%–16% remained in the body 96 hr after treatment.[11] In another study, rats injected i.p. with 230 mg/kg [$^{14}$C]-MTBE eliminated 92% of the dose in the expired air within 6 hr. About 1% and 3% of the dose was found in the feces and urine, respectively. Analysis indicated that the majority of the fecal and urinary metabolite was formic acid.[12] Another study also reported that expired air was the major route of excretion in rats given a single intravenous injection (10 or 40 mg/kg) of MTBE.[13] The pharmacokinetics of MTBE following a single oral dose (40 mg/kg) was also investigated. The oral bioavailability of MTBE was determined to be about 37%.[13] The pharmacokinetics of [$^{14}$C]-MTBE (58 mg/kg) administered i.p. to monkeys was similar to that in rats. The monkey excreted MTBE rapidly in expired air (68% within 8 hr). About 5% appeared in the urine with <0.5% excreted via feces. About 7% was retained in the body 96 hr following treatment. Total recoveries of 82%–85% were reported.[14]

D. Reproductive/Developmental Toxicity

Male rats exposed to 250, 1000, and 2500 ppm MTBE 6 hr/day, 5 days/week, for a 12-week period were mated to female rats exposed to the same concentrations for a 3-week period. Exposures continued through the mating period, and exposure continued for females during gestation and from Days 5 through 21 of the lactation period. The litters were not exposed. No adverse effects were seen in the treated adult animals and the pups.[15]

Mated rats and mice were exposed during the period of organogenesis to 250, 1000, and 2500 ppm MTBE. No teratogenic effect was observed in the rat. No significant effects were observed in any groups of treated mice on external and soft-tissue examination or evaluation of skeletal abnormalities or ossification variations. The incidence of fused sternabrae in the high-concentration group increased slightly, which might be attributed to fetotoxicity.[16]

Mice were exposed to 1000, 4000, and 8000 ppm MTBE 6 hr/day on Days 8 through 15 of pregnancy. Maternal toxicity (significant reduction in body weight and clinical signs of toxicity) and developmental toxicity (decreased number of viable implantations, reduced fetal body weights) were observed at 4000 and 8000 ppm. There was a significant increase in the incidence of cleft palate at 8000 ppm. The no observed effect level for both maternal toxicity and developmental toxicity was 1000 ppm.[17]

Rabbits were exposed to 1000, 4000, and 8000 ppm MTBE 6 hr/day on Days 6 through 18 of gestation. Maternal toxicity was observed at 4000 and 8000 ppm (significant reduction in weight gain and food consumption at 4000 and 8000 ppm and in increase in relative liver weight at 8000 ppm). Gestational parameters, including number of implantation sites and fetal body weights, exhibited no significant changes. There were no significant changes in the incidence of malformations.[18]

E. Subacute Toxicity

Rats were exposed to 100, 300, 1000, or 3000 ppm MTBE 6 hr/day, 5 days/week, for 9 exposures. Lacrimation, conjunctival swelling, and corneal changes were seen in rats exposed to 1000 and 3000 ppm. A reduced reaction to auditory stimuli at 3000 ppm was noted. There were no other macroscopic pathology findings other than chronic inflammatory changes in the nasal mucosa and trachea at the 1000 and 3000 ppm exposure levels.[19]

No adverse effects were noted in rats[20] and monkeys[21] exposed to 2000 and 3000 ppm MTBE 6 hr/day, 5 days/week, for 2 weeks.

F. Subchronic Toxicity

Rats were exposed to 50, 100 or 300 ppm MTBE 6 hr/day, 5 days/week, for 2 to 15 weeks. Exposures caused a transient increase in UDP-glucuronosyltransferase activities in liver and kidney microsomes but no other changes.[22]

No adverse effects were seen in rats exposed to 250, 500, and 1000 ppm MTBE 6 hr/day, 5 days/week for 13 weeks.[23]

Rats were exposed to 800, 4000, or 8000 ppm MTBE 6 hr/day, 5 days/week, for 13 weeks. Statistically significant increases in the mean absolute and relative weights of the liver, kidneys, and adrenal gland were noted in rats exposed to 4000 and 8000 ppm. Mild hematologic changes (less than 5%) were also observed in all the exposed animals. These alterations were not judged to be significant since the changes were minor and not dependent on concentration. There were no other treatment-related lesions or microscopic changes.[24]

G. Chronic Toxicity and Carcinogenicity

No data are currently available. The MTBE Task Force of the Oxygenated Fuels Association is conducting an oncogenicity study under the Environmental Protection Agency Toxic Substance Control Act Section 4, Testing Consent Agreement. Results of this study will be available in November 1992.

## V. HUMAN USE AND EXPERIENCE

Industrial hygiene monitoring data reported by a user company indicated airborne concentrations were generally below 5 ppm under normal operating conditions, which included loading/unloading gasoline trucks and performing maintenance work near sources of MTBE.[25]

Another company reported results of industrial hygiene monitoring conducted at an MTBE manufacturing plant, a marketing terminal, three refineries, and two marine barges loading and transporting blended gasoline. The mean concentrations of MTBE at the manufacturing plant and the marketing terminal were below 2 ppm. At the refineries and the marine barges, the mean full-shift personnel exposures were less than 31 ppm and 15 ppm, respectively.[26]

## VI. RATIONALE

MTBE has low acute toxicity and is mildly irritating to the eyes and skin. Results from several developmental toxicity studies in mice, rats, and rabbits suggest that the no observed effect level (NOEL) is about 1000 to 2500 ppm. The weight of evidence from subacute and subchronic inhalation studies in rats and monkeys indicate that the NOEL is 800 ppm or higher. A workplace environmental exposure level (WEEL) guide of 100 ppm for an 8-hr time-weighted average (TWA) is recommended [illegible] repeated exposure.

## VII. RECOMMENDED WEEL GUIDE

8-hr TWA: 100 ppm (360 mg/m$^3$)

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# EXHIBIT D

## EXAMPLE OF CHEMICAL INVENTORY SHEETS FOR A WAREHOUSE

# NORWOOD WAREHOUSE MSDS COLLECTION
# HAZ COMM/RTG PROGRAM
# INDEX


| Product Name | Manufacturer |
|---|---|
| ACETIC ACID | AXTON CROSS |
| | LIQUID-CARBONIC |
| ALCONOX | ALCONOX |
| ANTIFOAM | BIOLAB INC. |
| ANTIFORM, 1410 | ASHLAND CHEMICAL |
| ANTIFREEZE | PIONEER OIL COMPANY |
| BENTONITE, ENVIROPLUG, COARSE | WYO-BEN |
| BENTONITE, ENVIROPLUG, MED | WYO-BEN |
| BENTONITE, ENVIROPLUG, FINE | WYO-BEN |
| CARBON, ACTIVATED | ATO-CHEM. |
| CARBON, ACTIVATED | CALGON |
| CAUSTIC SODA, FLAKES | OCCIDENTAL CHEMICAL |
| CAUSTIC SODA, LIQUID | LCP CHEMICALS |
| CHICO | CROUSE HINDS |
| CHLORINE PELLETS | AUTOTROL |
| CONCRETE MIX | AMERICAN STONE-MIX INC. |
| DEGREASER | ENVIRONMENTAL TECHNILOGIES |
| DEGREASER, HEAVY DUTY | THE HOTSY CORPORATION |
| DICHLOROETHANE | SUPELCO INC. |
| DICHLOROETHYLENE | SUPELCO INC. |
| DI-N-OCTYL-PHTHALATE | SUPELCO INC. |
| DIOCTYL PHTHALATE, 99% | ALDRISH CHEMICAL |
| DISINFECTANT DETERGENT | DECON LABS |
| EPOXY-POLYAMIDE COATING | DAMPNEY COMPANY |
| ERTHORBIC ACID | PFIZER CHEMICAL |
| EYEWASH SOLUTION | FENDALL COMPANY |

| Product Name | Manufacturer |
|---|---|
| GAS, COMPRESSED AIR (21% $O_2$/79%N) | MSA |
| GAS, HEXANE | GAS TECH INC. |
| GAS, ISOBUTYLENE | LIQUID-CARBONIC |
| GAS, METHANE | GASTECH INC. |
| GAS, OXYGEN | BERNZOMATIC CORPORATION |
| GAS, PROPANE | BERNZOMATIC CORPORATION |
| GASOLINE, UNLEADED | EXXON COMPANY |
| GLUE-ALL, ELMERS | BORDON, INC. |
| GLUE, PVC, WELD-ON | I.P.S. |
| GLUE, WOOD, ELMERS | BORDON INC. |
| GRANCONTROL O | C&A PRODUCTS INC. |
| GROUT | WYO-BEN, INC. |
| HYDROCHLORIC ACID, 20° | E&F KING |
| HYDROCHLORIC ACID, 18°, 20°, 22° | BALTIMORE CHEMICAL PLANT |
| HYDROCHLORIC ACID, 365-38% | J.T. BAKER |
| HYDROGEN PEROXIDE | E.F. KING |
| LIQUIDNOX | ALCONOX INC. |
| METHANOL | EM SCIENCE |
| METHYLENE CHLORIDE | J.T. BAKER |
| NITRIC ACID 69-71% | FISHER SCIENTIFIC |
| N-NITROSO DIPHENYLAMINE | ACCUSTANDARD |
| NUTRIENT BLEND, E.N.D. | O'NIELL INDUSTRY |
| NU-WELL, CLEANING COMPOUND | JOHNSON FILTRATION |
| OIL, MOTOR | SUN REFINING & MARKETING CO. |
| OIL, LUBRICATING | SHELL OIL COMPANY |

| Product Name | Manufacturer |
|---|---|
| PADS, RESPIRATOR WIPES | NORTH SAFETY CO. |
| PAINT ENAMEL | GLIDEN COATINGS & RESINS |
| PAINT, LATEX BLUE | BENJAMIN MOORE CO. |
| PAINT, LATEX, WALL | THE GLIDEN CO. |
| PAINT, SPRAY, MARKETING, ORANGE | LAWSON PRODUCTS |
| PAINT, SPRAY | MARTIN-SEMOUR CO. |
| PAINT, SPRAY, KRYLOW | BORDEN INC. |
| PAINT THINNER | DAMPNEY CO. |
| PENETONE 58 | PENETONE CO. |
| POLY TREAT "A" | LEA |
| POLYNUCLEOLYTE | ENSOTECH INC. |
| POLYPROPYLENE PLASTIC | NORTON CO. |
| PRIMER, PVC, WELD-ON | I.P.S. CORPORATION |
| RAID INSPECT KILLER | S.C. JOHNSON & SON |
| SAND, JESSE MORIE | THE MORIE CO. |
| SEALER, RADIATOR | RADIATOR SPECIALTY CO. |
| SILICONE SPRAY | FIRST BRANDS |
| SOLUTION, PN 4 | ANALTICAL MEASUREMENTS |
| SOLUTION PN7 | ANALITICAL MEASUREMENTS |
| SOAP, ANTIMICROBIAL | D-CON |
| SOAP, SOFT-SUDS | TURBO-TECK ENTERPRISES |
| SODIUM ACID PYROPHOSPHATE | MONSANTO |
| SODIUM CHLORIDE | HACH CO. |
| SODIUM HEXAMETA PHOSPHATE | GEORGE MANN & CO. |
| SODIUM HYDROXIDE, 25% | E&F KING |
| SODIUM HYDROXIDE, 50% | E&F KING |
| SODIUM THIOSULFATE CRYSTALS | E&M SCIENCE |
| STAIN, CUPRINOL, WOOD, PERSU. | DARWORTH CO. |
| TETRACHLOROETHYLENE | EASTMAN KODAK CO. |
| TRICHLOROETHANE | FISHER SCIENTIFIC |

# EXHIBIT E

## EXAMPLES OF HAZARD COMMUNICATION DOCUMENTATION SHEETS

# GROUNDWATER TECHNOLOGY
# **TRAINING DOCUMENT**

Name_____Date_____

SS#_____-_____-_____Emp.#_____Job Title_____

Training/Seminar Title: Hazard Communication Training_____Code:_____

Training Description_____

_____

Training Sponsor Agency:_____

Length of training session_____(Hours)

**I certify that I have been trained in the above subject matter and have had the opportunity to ask questions and that those questions have been answered to my satisfaction.**

_____
Employee Signature

_____
Instructor Signature

*Please forward a readable copy of this document along with a copy of the* ***Training Course Log*** *to:*

*Corporate Health & Safety Training*
*Groundwater Technology*
*100 River Ridge Drive*
*Norwood, MA 02062*

**GROUNDWATER TECHNOLOGY, INC.**
**HAZARD COMMUNICATION PROGRAM PART I**
**EMPLOYEE TRAINING**

Employee Name:_____ Date:_____

Job Title:_____SSN #: _____

Location: _____ Region:_____

I have received instruction in the following topics as part of my Groundwater Technology, Inc. Hazard Communication Training Program.

Employee Signature_____Date_____

Instructor Signature_____Date_____

General Program Topics:

1. Elements of the OSHA Hazard Communication Standard.

2. Elements of Groundwater Technology, Inc. written Hazard Communication Program.

3. Review of the Chemical Inventory for this work site.

4. Review of the MSDS sheets for hazardous chemicals located at this work site, and identify the location for copies of these MSDS sheets.

5. Discussed the Company work processes with potential risks for exposure that utilize hazardous chemicals, and explain action of proper standard operating procedures to be used in each process.

6. Discussed the potential environmental and personal risks for an accidental release or spill of hazardous chemical, the emergency procedures to be followed and protection to wear in the event of a spill.

7. Review of contingency and evacuation plans for fires, medical emergencies or other emergency incidents.

8. Explanation of health risks associated with hazardous chemicals and discuss the routes of entry into the body.

9. Discussed the warning signs and symptoms of exposure to hazardous chemicals.

10. Outlines of the physical, biological and chemical hazards present at the work site, and the proper personal protective equipment to wear for minimizing these hazard risks.

11. Explanation of other environmental risks on site such as noise, heat, cold, or lighting and procedures or guidelines to minimize these hazards.

12. Show the hazard labels and signs utilized at the work site for identification of hazardous materials or hazardous areas.

**GROUNDWATER TECHNOLOGY, INC.**
**HAZARD COMMUNICATION PROGRAM Part II: Site Specific Program**
**EMPLOYEE TRAINING**

Employee Name:_____ Date:_____

Job Title:_____SSN #: _____

Location: _____ Region:_____

I have received instruction in the following topics as Part II of the GT Hazard Communication Program and completion of the 29 CFR 1910.120- standard training requirement: (3 days on site training)

a. Review of MSDS for each potential chemical hazard on site.

b. Review of specific work practices and personal protective equipment required to protect employees from potential hazards on site.

c. Explanation of emergency procedures for spills, leaks, fires, medical emergencies, vapor releases, confined space problems, etc.

d. Review of proper methods of personal protective equipment selection and use.

e. Explanation of possible environmental risks to site personnel such as heat, cold, noise, and lighting.

Site Specific Safety Orientation Training:

Description:_____

_____

_____

_____

Employee signature:_____Date:_____

Supervisor's Name:_____Hours of Training:_____

# EXHIBIT F

## EXAMPLES OF ELECTRICAL SAFETY LABELING

## LOCKOUT/TAGOUT LABELING

## AND

## SOURCES OF LABELS

## HAZARD COMMUNICATION LABELS

## SOURCES FOR ORDERING:

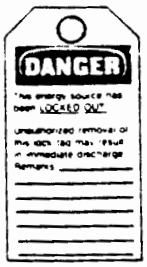
| | |
|---|---|
| Seton Identification Products<br>P. O. Box JB-1331<br>New Haven, CT 06505 | 1(800)243-6624 |
| Emed Graphic Communications<br>P. O. Box 369<br>Buffalo, NY 14240-0369 | 1(800)442-3633 |
| D & C Sign and Label<br>P. O. Box KA-157<br>Northford, CT 06472 | 1(800)356-9269 |
| Brady Sign Mark Division<br>727 W. Glendale Ave<br>P. O. Box 571<br>Milwaukee, WI 53201 | 1(800)635-7557 |

Rev. Side #1 - 65502
Rev. Side #2 - 65535
Rev. Side #3 - 65670

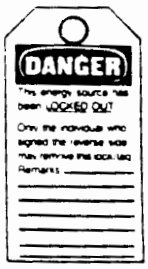
Rev. Side #1 - 65503
Rev. Side #2 - 65521

Rev. Side #1 - 65504
Rev. Side #2 - 65522

Rev. Side #1 - 65505
Rev. Side #2 - 65523




Reverse Side #1




Reverse Side #2

Reverse Side #3

Rev. Side #1 - 65506
Rev. Side #2 - 65534

Rev. Side #1 - 65515
Rev. Side #2 - 65524

Rev. Side #1 - 65520
Rev. Side #2 - 65525
Rev. Side #3 - 65671

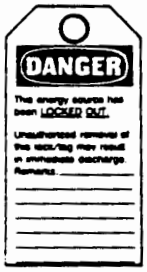
Rev. Side #1 - 65526
Rev. Side #2 - 65527

OSHA requires that all lockout and tagout devices shall indicate the identity of the employee applying the device. Tags are designed for repeated use. Simply assign a set of tags to each employee.

- Brass Grommet for added strength. Large enough to accept most locks (7/16" inside diameter).
- Polyester laminate protects graphics, wipes clean and stands up against water, grease and extreme temperatures.
- Write-on matte finish allows workers to personalize tags with pen, pencil or marker.
- Heavy duty construction prevents accidental removal. Withstands over 80 lbs. of pulling pressure.
- 8" Nylon ties – 50 lbs. unlocking strength (Cat. No. 91166) and permanent Markers (Cat. No. 87052) available for attaching and signing tags.
- Standard Package: 25 identical 5-1/2" x 3" tags.
- Custom tags available, call your local distributor for more information.

# Photo Identification Tags

Catalog No. 65500



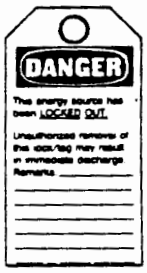

Reverse Side

Standard Package:
25 – 5-1/4" x 2-3/4" paper tags.
25 – 5-1/2" x 3" overlaminate pouches.
**Catalog No. 65500**

## Heavy Duty Laminated Tags

Photo Identification tags make it easy to identify individuals working on equipment. Photographs can be taken with most photo I.D. cameras. These tags provide long lasting protection. To use, simply sign tag, place photo in designated area, insert tag into overlaminate pouch and run through heat laminator (Catalog No. 23320). Tag has chamfered corners and 7/16" hole.

Catalog No. 65501

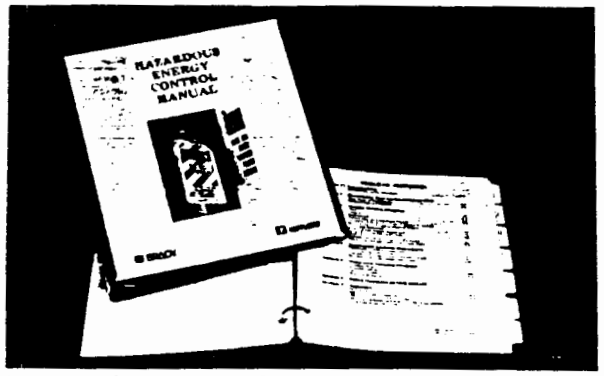



Reverse Side

Standard Package:
25 identical 5-3/4" x 3" tags.
**Catalog No. 65501**

## Self Sealing Laminated Tags

Make it easy to identify individuals working on equipment. These tags are rigid vinyl with polyester overlaminate. To use, employee signs tag, places photo on tag and applies self-sticking laminate to front of tag. Tag has chamfered corners and heavy-duty 7/16" brass grommet.




## Lockout Compliance Manual

This two volume compliance set contains samples that highlight what OSHA is looking for and demonstrates what you must do to comply with lockout/tagout regulations.

### Hazardous Energy Control Manual (Volume I)

85 page manual includes:

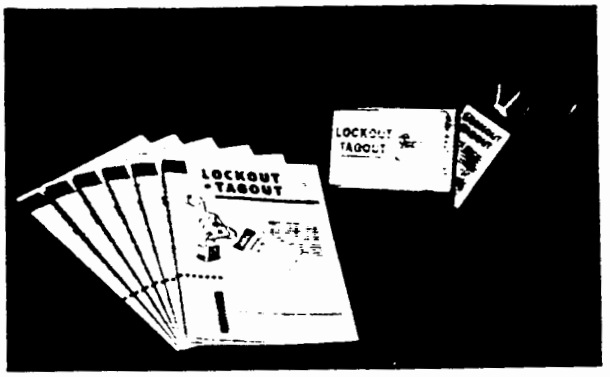
- Step-by-step instructions for developing your lockout/tagout compliance program.
- Suggested training program including outlines, training notes and handout materials.
- Forms and checklists for developing your hazardous energy control procedures.
- Sample programs and procedures.
- Copy of OSHA Standard 29 CFR 1910.147.

### Hazardous Energy Control Procedures (Volume II)

Includes sample programs and forms for completing your inventory listing, equipment procedures and employee training log. Three ring binder designed to contain your written program and related information.

**Catalog No. 65558**
Two Volume Set

**Catalog No. 65557**
Additional Procedure Binder




## Lockout Video and Training Booklets

This two-part program explains OSHA's Lockout/Tagout Standard and details correct procedures for locking and tagging. The video and training booklets are comprehensive and easy-to-understand. They also convincingly demonstrate why following the rules can be a life or death matter.

### Part I (The Regulation):

- Hazards of Uncontrolled Energy
- Importance of Lockout/Tagout
- When Should You Lock or Tag?
- Four E's of Safety

### Part II (How To Comply):

- Applying Energy Controls
- Equipment Shutdown and Isolation
- Applying Lockout/Tagout Devices
- Control of Stored Energy
- Verification of Isolation

**Length:** 27 minutes. Spanish version: 66153.

**Video** Standard Package: 1
**Catalog No. 65554**

**Training Booklets** Standard Package: 10 **Catalog No. 65555**

# Lockout Signs and Labels

LOCK OUT FOR SAFETY

Self-sticking Vinyl (B-946)
65580 – 2-1/4" x 4-1/2"

LOCK OUT BEFORE SERVICING

Self-sticking Vinyl (B-946)
65581 – 2-1/4" x 4-1/2"

LOCK OUT HERE

Self-sticking Vinyl (B-946)
65582 – 2-1/4" x 4-1/2"

REMOVE ALL DOUBT LOCK IT OUT

Self-sticking Vinyl (B-946)
65583 – 2-1/4" x 4-1/2"

CAUTION
THIS MACHINE MUST BE LOCKED OUT PRIOR TO SERVICING

Fiberglass (B-120)
65516 – 14" x 10"
65517 – 10" x 7"
Self-sticking Vinyl (B-946)
65518 – 10" x 7"
65510 – 7" x 5"
65509 – 5" x 3-1/2"

CAUTION
WHEN THROWING SWITCH USE LEFT HAND AND TURN FACE AWAY

Fiberglass (B-120)
65575 – 14" x 10"
65576 – 10" x 7"
Self-sticking Vinyl (B-946)
65577 – 10" x 7"
65578 – 7" x 5"
65579 – 5" x 3-1/2"

THIS DISCONNECT DOES NOT REMOVE ALL POWER FROM PANEL

Self-sticking Vinyl (B-946)
65584 – 2-1/4" x 4-1/2"

CAUTION
LOCK OUT FOR SAFETY

Fiberglass (B-120)
65570 – 14" x 10"
65571 – 10" x 7"
Self-sticking Vinyl (B-946)
65572 – 10" x 7"
65573 – 7" x 5"
65574 – 5" x 3-1/2"

?
DID YOU REMEMBER TO REMOVE YOUR LOCKS AND TAGS

Fiberglass (B-120)
65681 – 14" x 10"
65682 – 10" x 7"
Self-sticking Vinyl (B-946)
65683 – 10" x 7"
65684 – 7" x 5"
65685 – 5" x 3-1/2"

**Brady Lock Labels** are an easy way to identify employee's locks. Employees sign the label, attach it to their lock and cover the label with a polyester over-laminate (sold separately).

Self-sticking Vinyl (B-826)
65507 – 3/4" x 5"

Clear Overlaminate (B-674)
65508 – 1" x 6"

NOTICE

Fiberglass (B-120)
65511 – 20" x 14"

DANGER
DO NOT OPERATE
NAME _____
DEPT. _____

Self-sticking Vinyl Cloth (B-500)
65519 – 5" x 3-1/2"

Temporarily tag out equipment not designed to be locked out. This label has a removable adhesive.

**WARRANTY**

"Brady products are sold with the understanding that the buyer will test them in actual use and determine for himself their adaptability to his intended uses. Brady warrants to the buyer that its products are free from defects in material and workmanship, but limits its obligation under the warranty to replacement of the product shown to Brady's satisfaction to have been defective at the time Brady sold it. This warranty does not extend to any persons obtaining the product from the buyer. THIS WARRANTY IS IN LIEU OF ANY OTHER WARRANTY EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND OF ANY OTHER OBLIGATIONS OR LIABILITY ON BRADY'S PART. UNDER NO CIRCUMSTANCES WILL BRADY BE LIABLE FOR ANY LOSS, DAMAGE, EXPENSE OR CONSEQUENTIAL DAMAGES OF ANY KIND ARISING IN CONNECTION WITH THE USE, OR INABILITY TO USE, BRADY'S PRODUCT."

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**Signmark® Division**
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Toll-Free (800) 635-7557 • In Wisconsin (414) 961-2233
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| SWEDEN | BRADY A.B. • Phone 0760-94125 |
| U.S.A. | W.H. BRADY Co. • Phone (414) 332-8100 |
| WEST GERMANY | W.H. BRADY GmbH • Phone (06074) 9103-0 |


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# EXHIBIT G

## HAZARD COMMUNICATION AUDIT FORM

GROUNDWATER TECHNOLOGY, INC.

Hazard Communication Audit Checklist

- ☐ Written hazard communication program in office
- ☐ Employee hazard communication training completed
- ☐ Right-to-know station erected/signs
- ☐ Hazard caution signs posted
- ☐ Hazardous materials storage areas marked, posted and barricaded
- ☐ Electrical cabinets marked properly, lockout/tagout labels/locks
- ☐ Chemical inventory completed
- ☐ Material safety data sheets for all chemicals
- ☐ Hazard containers labeled, hazard chemicals labeled
- ☐ Compressed waste gas cylinders properly marked and stored
- ☐ Pipes for hazardous materials marked and labeled
- ☐ Personal protective equipment worn in hazard areas
- ☐ First aid and emergency equipment posted near hazard areas
- ☐ Site safety plans contain hazard information
- ☐ Emergency equipment and fire fighting equipment properly marked and signage

## 15.2 Site Emergency Forms and Maps (To Be Posted On-Site!)

**Contaminants of Concern: Petroleum Hydrocarbons/JP-4, Sulfuric Acid and Metals**
**Minimum Level of Protection: Modified Level D**

**Do not endanger your life. Survey the situation before taking any action.**

Groundwater Technology Office Telephone: (505) 242-3113

Groundwater Technology Office Address: 2501 Yale Blvd. SE, Suite 204
Albuquerque, NM 87106
Fax: (505) 242-1103

Telephone Located at: Phone On-site

**IN THE EVENT OF ANY EMERGENCY, CONTACT PROJECT MANAGER OR SSHO**

## EMERGENCY PHONE NUMBERS

| | | | | |
|---|---|---|---|---|
| Ambulance (Base): | 9-911 | Project Manager: | Sara Brothers | (505) 242-3113 |
| | | | (home) | (505) 345-3252 |
| Fire Dept. (Base): | 7228 | Site Manager: | TBA | |
| Base Hospital: | 7171 | CIH: | S. Venuti | (617) 769-7600 |
| | | | (home) | (617) 665-8603 |
| Poison Control: | (800) 432-6866 | DO Manager: | Ron Versaw | (303) 980-2202 |
| EPA (info Line): | (800) 424-9346 | Technical Mgr: | Mark Mercier | (402) 221-7666 |
| Nat. Response Center: | (800) 424-8802 | Base POC: | Warren Neff | (505) 479-3931 |
| Chemtrec: | (800) 424-9300 | Foster Wheeler On-Site Rep: | Dan Holmquist | (505) 479-2668 |

State Agency: N/A

| | | |
|---|---|---|
| Base Hospital: | 833rd Medical Group Hospital: | (505) 479-7171 |
| Civilian Hospital: | Gerald Champion Memorial Hospital: | (505) 439-2100 |

Groundwater Technology Emergency Phone Number (24 hours): (800) 876-0647

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lead | SL | Pond B | B2-6 | SW7421 | > | 285 | 0.47 | mg/kg | | . | . |
| Lead | SL | Pond B | B2-5 | SW7421 | > | 190 | 0.72 | mg/kg | R | . | . |
| Lead | SL | Pond B | B2-8 | SW7421 | > | 210 | 0.55 | mg/kg | | . | . |
| Mercury | SL | Pond B | B2-10 | SW7471 | > | 4.2 | 0.5 | mg/kg | R | . | . |
| Mercury | SL | Pond B | B2-5 | SW7471 | > | 4.4 | 0.5 | mg/kg | | . | . |
| Mercury | SL | Pond B | B1-23 | SW7471 | > | 4.3 | 0.38 | mg/kg | | . | . |
| Mercury | SL | Pond B | B2-8 | SW7471 | > | 3.9 | 0.41 | mg/kg | | . | . |
| Mercury | SL | Pond B | B2-6 | SW7471 | > | 6.35 | 0.32 | mg/kg | | . | . |
| Mercury | SL | Pond B | B2-9 | SW7471 | > | 6.3 | 0.56 | mg/kg | | . | . |
| Nickel | SL | Pond B | B2-5 | SW6010 | > | 27 | 12 | mg/kg | @ | . | . |
| Nickel | SL | Pond B | B2-6 | SW6010 | > | 32.5 | 7.5 | mg/kg | | . | . |
| Nickel | SL | Pond B | B2-10 | SW6010 | > | 19 | 11 | mg/kg | @ | . | . |
| Nickel | SL | Pond B | B2-8 | SW6010 | > | 28 | 9.6 | mg/kg | @ | . | . |
| Nickel | SL | Pond B | B2-9 | SW6010 | > | 26 | 13 | mg/kg | @ | . | . |
| Nickel | SL | Pond B | B1-23 | SW6010 | > | 26 | 8.5 | mg/kg | @ | . | . |
| PCB-1254 | SL | Pond B | B3-6 | SW8080 | > | 14 | 5.4 | mg/kg | @ | . | . |
| PCB-1254 | SL | Pond B | B4-1 | SW8080 | > | 1.9 | 0.51 | mg/kg | @ | . | . |
| PCB-1254 | SL | Pond B | B3-5 | SW8080 | > | 3.3 | 0.49 | mg/kg | | . | . |
| PCB-1254 | SL | Pond B | B3-8 | SW8080 | ND | 1.8 | 3.6 | mg/kg | | . | . |
| PCB-1254 | SL | Pond B | B4-4 | SW8080 | > | 1.8 | 0.47 | mg/kg | @ | . | . |
| PCB-1254 | SL | Pond B | B3-7 | SW8080 | > | 4.1 | 2.2 | mg/kg | @ | . | . |
| PCB-1254 | SL | Pond B | B4-3 | SW8080 | ND | 2.6 | 5.2 | mg/kg | | . | . |
| PCB-1254 | SL | Pond B | B4-2 | SW8080 | ND | 2.3 | 4.6 | mg/kg | | . | . |
| PCB-1254 | SL | Pond B | B1-13 | SW8080 | > | 8 | 2.2 | mg/kg | @ | . | . |
| PCB-1254 | SL | Pond B | B2-6 | SW8080 | ND | 1.35 | 2.8 | mg/kg | | . | . |
| PCB-1254 | SL | Pond B | B2-10 | SW8080 | ND | 2.4 | 4.8 | mg/kg | | . | . |
| PCB-1254 | SL | Pond B | B2-9 | SW8080 | ND | 2.4 | 4.8 | mg/kg | | . | . |
| PCB-1254 | SL | Pond B | B1-14 | SW8080 | > | 10 | 3.5 | mg/kg | @ | . | . |
| PCB-1254 | SL | Pond B | B1-12 | SW8080 | > | 16 | 2.5 | mg/kg | | . | . |
| PCB-1254 | SL | Pond B | B-S3-SA | SW8080 | > | 9.1 | . | mg/kg | C@ | 0 | . |
| PCB-1254 | SL | Pond B | B1-6 | SW8080 | > | 7.8 | 2.4 | mg/kg | @ | . | . |
| PCB-1254 | SL | Pond B | B1-3 | SW8080 | > | 7.8 | 2.5 | mg/kg | @ | . | . |
| PCB-1254 | SL | Pond B | B1-23 | SW8080 | > | 15 | 3.6 | mg/kg | @ | . | . |
| PCB-1254 | SL | Pond B | B1-22 | SW8080 | > | 9.4 | 1.4 | mg/kg | | . | . |
| PCB-1254 | SL | Pond B | B1-18 | SW8080 | < | 2.8 | 3 | mg/kg | J | . | . |
| PCB-1254 | SL | Pond B | B1-8 | SW8080 | > | 1.8 | 1.7 | mg/kg | @ | . | . |
| PCB-1254 | SL | Pond B | B3-4 | SW8080 | ND | 1.7 | 3.4 | mg/kg | | . | . |
| PCB-1254 | SL | Pond B | B2-5 | SW8080 | ND | 2.4 | 4.8 | mg/kg | | . | . |
| PCB-1254 | SL | Pond B | B1-17 | SW8080 | > | 4 | 1 | mg/kg | @ | . | . |
| PCB-1254 | SL | Pond B | B2-8 | SW8080 | > | 5.2 | 3.4 | mg/kg | @ | . | . |
| PCB-1254 | SL | Pond B | B1-16 | SW8080 | > | 5.5 | 1.7 | mg/kg | @ | . | . |
| PCB-1254 | SL | Pond B | B3-1 | SW8080 | > | 4.3 | 2.8 | mg/kg | @ | . | . |
| PCB-1254 | SL | Pond B | B3-2 | SW8080 | ND | 2.8 | 5.6 | mg/kg | | . | . |
| PCB-1254 | SL | Pond B | B3-3 | SW8080 | > | 7.6 | 4.6 | mg/kg | @ | . | . |
| PCB-1254 | SL | Pond B | B-S2-SA | SW8080 | > | 13 | . | mg/kg | C@ | 0 | . |
| PCB-1254 | SL | Pond B | B-S1-SA | SW8080 | > | 13 | . | mg/kg | C@ | 0 | . |
| PCB-1260 | SL | Pond B | B4-4 | SW8080 | ND | 0.235 | 0.47 | mg/kg | | . | . |
| PCB-1260 | SL | Pond B | B4-3 | SW8080 | ND | 2.6 | 5.2 | mg/kg | | . | . |
| PCB-1260 | SL | Pond B | B4-2 | SW8080 | ND | 2.3 | 4.6 | mg/kg | | . | . |
| PCB-1260 | SL | Pond B | B4-1 | SW8080 | ND | 0.255 | 0.51 | mg/kg | | . | . |
| PCB-1260 | SL | Pond B | B1-18 | SW8080 | ND | 1.5 | 3 | mg/kg | | . | . |
| PCB-1260 | SL | Pond B | B2-9 | SW8080 | ND | 2.4 | 4.8 | mg/kg | | . | . |
| PCB-1260 | SL | Pond B | B1-17 | SW8080 | ND | 0.5 | 1 | mg/kg | | . | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PCB-1260 | SL | Pond B | B3-2 | SW8080 | ND | 2.8 | 5.6 | mg/kg | | . | . |
| PCB-1260 | SL | Pond B | B3-4 | SW8080 | ND | 1.7 | 3.4 | mg/kg | | . | . |
| PCB-1260 | SL | Pond B | B1-22 | SW8080 | > | 3 | 1.4 | mg/kg | @ | . | . |
| PCB-1260 | SL | Pond B | B1-16 | SW8080 | ND | 0.85 | 1.7 | mg/kg | @ | . | . |
| PCB-1260 | SL | Pond B | B2-6 | SW8080 | ND | 1.35 | 2.8 | mg/kg | | . | . |
| PCB-1260 | SL | Pond B | B2-10 | SW8080 | ND | 2.4 | 4.8 | mg/kg | | . | . |
| PCB-1260 | SL | Pond B | B1-14 | SW8080 | ND | 1.75 | 3.5 | mg/kg | | . | . |
| PCB-1260 | SL | Pond B | B1-8 | SW8080 | ND | 0.85 | 1.7 | mg/kg | | . | . |
| PCB-1260 | SL | Pond B | B2-5 | SW8080 | ND | 2.4 | 4.8 | mg/kg | | . | . |
| PCB-1260 | SL | Pond B | B1-6 | SW8080 | ND | 1.2 | 2.4 | mg/kg | | . | . |
| PCB-1260 | SL | Pond B | B2-8 | SW8080 | ND | 1.7 | 3.4 | mg/kg | | . | . |
| PCB-1260 | SL | Pond B | B3-8 | SW8080 | ND | 1.8 | 3.6 | mg/kg | | . | . |
| PCB-1260 | SL | Pond B | B3-1 | SW8080 | ND | 1.4 | 2.8 | mg/kg | | . | . |
| PCB-1260 | SL | Pond B | B1-3 | SW8080 | ND | 1.25 | 2.5 | mg/kg | | . | . |
| PCB-1260 | SL | Pond B | B3-3 | SW8080 | ND | 2.3 | 4.6 | mg/kg | | . | . |
| PCB-1260 | SL | Pond B | B1-23 | SW8080 | ND | 1.8 | 3.6 | mg/kg | | . | . |
| PCB-1260 | SL | Pond B | B3-5 | SW8080 | ND | 0.245 | 0.49 | mg/kg | | . | . |
| PCB-1260 | SL | Pond B | B3-6 | SW8080 | ND | 2.7 | 5.4 | mg/kg | | . | . |
| PCB-1260 | SL | Pond B | B3-7 | SW8080 | ND | 1.1 | 2.2 | mg/kg | | . | . |
| PCB-1260 | SL | Pond B | B1-13 | SW8080 | ND | 1.1 | 2.2 | mg/kg | | . | . |
| PCB-1260 | SL | Pond B | B1-12 | SW8080 | ND | 1.25 | 2.5 | mg/kg | | . | . |
| Phenanthrene | SL | Pond B | B2-10 | SW8270 | ND | 2.25 | 4.5 | mg/kg | | . | . |
| Phenanthrene | SL | Pond B | B2-6 | SW8270 | ND | 1.0533333 | 2.6 | mg/kg | | . | . |
| Phenanthrene | SL | Pond B | B3-2 | SW8270 | ND | 2.55 | 5.1 | mg/kg | | . | . |
| Phenanthrene | SL | Pond B | B3-8 | SW8270 | ND | 1.8 | 3.6 | mg/kg | | . | . |
| Phenanthrene | SL | Pond B | B3-4 | SW8270 | ND | 1.4 | 2.8 | mg/kg | | . | . |
| Phenanthrene | SL | Pond B | B3-6 | SW8270 | < | 0.95 | 5.1 | mg/kg | J | . | . |
| Phenanthrene | SL | Pond B | B1-23 | SW8270 | < | 3 | 3.6 | mg/kg | J | . | . |
| Phenanthrene | SL | Pond B | B4-2 | SW8270 | ND | 2.25 | 4.5 | mg/kg | | . | . |
| Phenanthrene | SL | Pond B | B2-9 | SW8270 | ND | 2.25 | 4.5 | mg/kg | | . | . |
| Phenanthrene | SL | Pond B | B4-3 | SW8270 | ND | 2.55 | 5.1 | mg/kg | | . | . |
| Phenanthrene | SL | Pond B | B2-8 | SW8270 | ND | 1.65 | 3.3 | mg/kg | | . | . |
| Phenanthrene | SL | Pond B | B2-5 | SW8270 | ND | 2.25 | 4.5 | mg/kg | | . | . |
| Pyrene | SL | Pond B | B1-23 | SW8270 | > | 2.2 | 1.3 | mg/kg | # | . | . |
| Pyrene | SL | Pond B | B4-3 | SW8270 | ND | 0.9 | 1.8 | mg/kg | | . | . |
| Pyrene | SL | Pond B | B3-4 | SW8270 | ND | 0.485 | 0.97 | mg/kg | | . | . |
| Pyrene | SL | Pond B | B4-2 | SW8270 | ND | 0.8 | 1.6 | mg/kg | | . | . |
| Pyrene | SL | Pond B | B3-8 | SW8270 | ND | 0.65 | 1.3 | mg/kg | | . | . |
| Pyrene | SL | Pond B | B3-6 | SW8270 | < | 1.6 | 1.8 | mg/kg | J | . | . |
| Pyrene | SL | Pond B | B3-2 | SW8270 | ND | 0.9 | 1.8 | mg/kg | | . | . |
| Pyrene | SL | Pond B | B2-9 | SW8270 | ND | 0.8 | 1.6 | mg/kg | | . | . |
| Pyrene | SL | Pond B | B2-8 | SW8270 | ND | 0.55 | 1.1 | mg/kg | | . | . |
| Pyrene | SL | Pond B | B2-6 | SW8270 | ND | 0.57 | 0.9 | mg/kg | | . | . |
| Pyrene | SL | Pond B | B2-5 | SW8270 | < | 0.88 | 1.6 | mg/kg | J | . | . |
| Pyrene | SL | Pond B | B2-10 | SW8270 | ND | 0.8 | 1.6 | mg/kg | | . | . |
| Selenium | SL | Pond B | B2-5 | SW7740 | ND | 0.7 | 1.4 | mg/kg | | . | . |
| Selenium | SL | Pond B | B2-10 | SW7740 | ND | 0.65 | 1.3 | mg/kg | | . | . |
| Selenium | SL | Pond B | B2-6 | SW7740 | ND | 0.425 | 0.9 | mg/kg | | . | . |
| Selenium | SL | Pond B | B1-23 | SW7740 | ND | 0.485 | 0.97 | mg/kg | | . | . |
| Selenium | SL | Pond B | B2-8 | SW7740 | ND | 0.5 | 1 | mg/kg | | . | . |
| Selenium | SL | Pond B | B2-9 | SW7740 | > | 2 | 1.5 | mg/kg | @ | . | . |
| Silver | SL | Pond B | B2-8 | SW6010 | > | 240 | 14 | mg/kg | | . | . |
| Silver | SL | Pond B | B1-23 | SW6010 | > | 340 | 13 | mg/kg | | . | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Silver | SL | Pond B | B2-6 | SW6010 | > | 365 | 11 | mg/kg | | . | . |
| Silver | SL | Pond B | B2-5 | SW6010 | > | 360 | 17 | mg/kg | ^ | . | . |
| Silver | SL | Pond B | B2-9 | SW6010 | > | 470 | 20 | mg/kg | | . | . |
| Silver | SL | Pond B | B2-10 | SW6010 | > | 440 | 17 | mg/kg | | . | . |
| Zinc | SL | Pond B | B2-9 | SW6010 | > | 1200 | 13 | mg/kg | | . | . |
| Zinc | SL | Pond B | B2-6 | SW6010 | > | 1300 | 7.5 | mg/kg | | . | . |
| Zinc | SL | Pond B | B1-23 | SW6010 | > | 990 | 8.5 | mg/kg | | . | . |
| Zinc | SL | Pond B | B2-5 | SW6010 | > | 960 | 12 | mg/kg | | . | . |
| Zinc | SL | Pond B | B2-10 | SW6010 | > | 990 | 11 | mg/kg | | . | . |
| Zinc | SL | Pond B | B2-8 | SW6010 | > | 840 | 9.6 | mg/kg | | . | . |
| Acetone | SO | Pond B | B-6 | SW8240 | > | 0.019 | . | mg/kg | @ | 0.5 | 2.5 |
| Acetone | SO | Pond B | B-5 | SW8240 | > | 0.039 | . | mg/kg | B@ | 0.5 | 2.5 |
| Acetone | SO | Pond B | B-1 | SW8240 | ND | 0.007 | 0.014 | mg/kg | | 0.5 | 2.5 |
| Acetone | SO | Pond B | B-2 | SW8240 | ND | 0.0065 | 0.013 | mg/kg | | 0.5 | 2.5 |
| Acetone | SO | Pond B | B-4 | SW8240 | > | 0.011 | . | mg/kg | JB | 0.5 | 2.5 |
| Acetone | SO | Pond B | B-3 | SW8240 | > | 0.02 | . | mg/kg | @ | 0.5 | 2.5 |
| Aluminum | SO | Pond B | B-2 | SW6010 | > | 11000 | . | mg/kg | | 0.5 | 2.5 |
| Aluminum | SO | Pond B | B-4 | SW6010 | > | 18000 | . | mg/kg | | 0.5 | 2.5 |
| Aluminum | SO | Pond B | B-1 | SW6010 | > | 7800 | . | mg/kg | | 0.5 | 2.5 |
| Aluminum | SO | Pond B | B-5 | SW6010 | > | 13000 | . | mg/kg | | 0.5 | 2.5 |
| Aluminum | SO | Pond B | B-3 | SW6010 | > | 9000 | . | mg/kg | | 0.5 | 2.5 |
| Aluminum | SO | Pond B | B-6 | SW6010 | > | 12000 | . | mg/kg | | 0.5 | 2.5 |
| Arsenic | SO | Pond B | B-1 | SW7060 | > | 3.5 | . | mg/kg | @ | 0.5 | 2.5 |
| Arsenic | SO | Pond B | B-4 | SW7060 | ND | 1.05 | 2.1 | mg/kg | | 0.5 | 2.5 |
| Arsenic | SO | Pond B | B-5 | SW7060 | > | 2.5 | . | mg/kg | @ | 0.5 | 2.5 |
| Arsenic | SO | Pond B | B-6 | SW7060 | > | 6.6 | . | mg/kg | | 0.5 | 2.5 |
| Arsenic | SO | Pond B | B-3 | SW7060 | > | 3.4 | . | mg/kg | @ | 0.5 | 2.5 |
| Arsenic | SO | Pond B | B-2 | SW7060 | > | 3.8 | . | mg/kg | @ | 0.5 | 2.5 |
| Barium | SO | Pond B | B-3 | SW6010 | > | 46 | . | mg/kg | | 0.5 | 2.5 |
| Barium | SO | Pond B | B-2 | SW6010 | > | 47 | . | mg/kg | | 0.5 | 2.5 |
| Barium | SO | Pond B | B-1 | SW6010 | > | 45 | . | mg/kg | | 0.5 | 2.5 |
| Barium | SO | Pond B | B-6 | SW6010 | > | 15 | . | mg/kg | | 0.5 | 2.5 |
| Barium | SO | Pond B | B-5 | SW6010 | > | 86 | . | mg/kg | | 0.5 | 2.5 |
| Barium | SO | Pond B | B-4 | SW6010 | > | 78 | . | mg/kg | | 0.5 | 2.5 |
| Beryllium | SO | Pond B | B-6 | SW6010 | > | 0.59 | . | mg/kg | @ | 0.5 | 2.5 |
| Beryllium | SO | Pond B | B-1 | SW6010 | > | 0.29 | . | mg/kg | @ | 0.5 | 2.5 |
| Beryllium | SO | Pond B | B-5 | SW6010 | > | 0.54 | . | mg/kg | @ | 0.5 | 2.5 |
| Beryllium | SO | Pond B | B-4 | SW6010 | > | 0.78 | . | mg/kg | @ | 0.5 | 2.5 |
| Beryllium | SO | Pond B | B-3 | SW6010 | > | 0.4 | . | mg/kg | @ | 0.5 | 2.5 |
| Beryllium | SO | Pond B | B-2 | SW6010 | > | 0.65 | . | mg/kg | @ | 0.5 | 2.5 |
| bis(2-Ethylhexyl)phthalate | SO | Pond B | B-5 | SW8270 | > | 0.17 | . | mg/kg | J | 0.5 | 2.5 |
| Calcium | SO | Pond B | B-4 | SW6010 | > | 98000 | . | mg/kg | | 0.5 | 2.5 |
| Calcium | SO | Pond B | B-5 | SW6010 | > | 59000 | . | mg/kg | | 0.5 | 2.5 |
| Calcium | SO | Pond B | B-2 | SW6010 | > | 82000 | . | mg/kg | | 0.5 | 2.5 |
| Calcium | SO | Pond B | B-3 | SW6010 | > | 53000 | . | mg/kg | | 0.5 | 2.5 |
| Calcium | SO | Pond B | B-1 | SW6010 | > | 91000 | . | mg/kg | | 0.5 | 2.5 |
| Calcium | SO | Pond B | B-6 | SW6010 | > | 86000 | . | mg/kg | | 0.5 | 2.5 |
| Carbon disulfide | SO | Pond B | B-6 | SW8240 | > | 0.0043 | . | mg/kg | J | 0.5 | 2.5 |
| Carbon disulfide | SO | Pond B | B-5 | SW8240 | ND | 0.00335 | 0.0067 | mg/kg | | 0.5 | 2.5 |
| Carbon disulfide | SO | Pond B | B-4 | SW8240 | ND | 0.00325 | 0.0065 | mg/kg | | 0.5 | 2.5 |
| Carbon disulfide | SO | Pond B | B-3 | SW8240 | ND | 0.00345 | 0.0069 | mg/kg | | 0.5 | 2.5 |
| Carbon disulfide | SO | Pond B | B-2 | SW8240 | ND | 0.0032 | 0.0064 | mg/kg | | 0.5 | 2.5 |
| Carbon disulfide | SO | Pond B | B-1 | SW8240 | ND | 0.00355 | 0.0071 | mg/kg | | 0.5 | 2.5 |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Chromium | SO | Pond B | B-3 | SW6010 | > | 8.4 | . | mg/kg | | 0.5 | 2.5 |
| Chromium | SO | Pond B | B-2 | SW6010 | > | 10 | . | mg/kg | | 0.5 | 2.5 |
| Chromium | SO | Pond B | B-6 | SW6010 | > | 11 | . | mg/kg | | 0.5 | 2.5 |
| Chromium | SO | Pond B | B-1 | SW6010 | > | 7 | . | mg/kg | | 0.5 | 2.5 |
| Chromium | SO | Pond B | B-4 | SW6010 | > | 16 | . | mg/kg | | 0.5 | 2.5 |
| Chromium | SO | Pond B | B-5 | SW6010 | > | 12 | . | mg/kg | | 0.5 | 2.5 |
| Cobalt | SO | Pond B | B-5 | SW6010 | > | 4.4 | . | mg/kg | @ | 0.5 | 2.5 |
| Cobalt | SO | Pond B | B-4 | SW6010 | > | 5.7 | . | mg/kg | @ | 0.5 | 2.5 |
| Cobalt | SO | Pond B | B-3 | SW6010 | > | 3.2 | . | mg/kg | @ | 0.5 | 2.5 |
| Cobalt | SO | Pond B | B-2 | SW6010 | > | 4 | . | mg/kg | @ | 0.5 | 2.5 |
| Cobalt | SO | Pond B | B-6 | SW6010 | > | 4 | . | mg/kg | @ | 0.5 | 2.5 |
| Cobalt | SO | Pond B | B-1 | SW6010 | > | 2.9 | . | mg/kg | @ | 0.5 | 2.5 |
| Copper | SO | Pond B | B-4 | SW6010 | > | 9.1 | . | mg/kg | @ | 0.5 | 2.5 |
| Copper | SO | Pond B | B-5 | SW6010 | > | 8.2 | . | mg/kg | @ | 0.5 | 2.5 |
| Copper | SO | Pond B | B-2 | SW6010 | > | 5.5 | . | mg/kg | @ | 0.5 | 2.5 |
| Copper | SO | Pond B | B-3 | SW6010 | > | 6.4 | . | mg/kg | @ | 0.5 | 2.5 |
| Copper | SO | Pond B | B-1 | SW6010 | > | 6.4 | . | mg/kg | @ | 0.5 | 2.5 |
| Copper | SO | Pond B | B-6 | SW6010 | > | 5.4 | . | mg/kg | @ | 0.5 | 2.5 |
| Dibutylphthalate | SO | Pond B | B-1 | SW8270 | ND | 0.11 | 0.22 | mg/kg | | 0.5 | 2.5 |
| Dibutylphthalate | SO | Pond B | B-6 | SW8270 | > | 0.17 | . | mg/kg | J | 0.5 | 2.5 |
| Dibutylphthalate | SO | Pond B | B-2 | SW8270 | ND | 0.11 | 0.22 | mg/kg | | 0.5 | 2.5 |
| Dibutylphthalate | SO | Pond B | B-5 | SW8270 | ND | 0.105 | 0.21 | mg/kg | | 0.5 | 2.5 |
| Dibutylphthalate | SO | Pond B | B-4 | SW8270 | ND | 0.105 | 0.21 | mg/kg | | 0.5 | 2.5 |
| Dibutylphthalate | SO | Pond B | B-3 | SW8270 | ND | 0.11 | 0.22 | mg/kg | | 0.5 | 2.5 |
| Endosulfan I | SO | Pond B | B-3 | SW8080 | ND | 0.0007 | 0.0014 | mg/kg | | 0.5 | 2.5 |
| Endosulfan I | SO | Pond B | B-2 | SW8080 | > | 0.00194 | . | mg/kg | X@ | 0.5 | 2.5 |
| Endosulfan I | SO | Pond B | B-4 | SW8080 | ND | 0.00065 | 0.0013 | mg/kg | | 0.5 | 2.5 |
| Endosulfan I | SO | Pond B | B-I | SW8080 | ND | 0.0007 | 0.0014 | mg/kg | | 0.5 | 2.5 |
| Endosulfan I | SO | Pond B | B-5 | SW8080 | ND | 0.0013 | 0.0026 | mg/kg | | 0.5 | 2.5 |
| Endosulfan I | SO | Pond B | B-6 | SW8080 | ND | 0.0007 | 0.0014 | mg/kg | | 0.5 | 2.5 |
| Iron | SO | Pond B | B-6 | SW6010 | > | 7800 | . | mg/kg | | 0.5 | 2.5 |
| Iron | SO | Pond B | B-1 | SW6010 | > | 5000 | . | mg/kg | | 0.5 | 2.5 |
| Iron | SO | Pond B | B-3 | SW6010 | > | 6200 | . | mg/kg | | 0.5 | 2.5 |
| Iron | SO | Pond B | B-4 | SW6010 | > | 13000 | . | mg/kg | | 0.5 | 2.5 |
| Iron | SO | Pond B | B-2 | SW6010 | > | 7900 | . | mg/kg | | 0.5 | 2.5 |
| Iron | SO | Pond B | B-5 | SW6010 | > | 9200 | . | mg/kg | | 0.5 | 2.5 |
| Lead | SO | Pond B | B-4 | SW7421 | > | 7.4 | . | mg/kg | | 0.5 | 2.5 |
| Lead | SO | Pond B | B-5 | SW7421 | > | 4.3 | . | mg/kg | | 0.5 | 2.5 |
| Lead | SO | Pond B | B-1 | SW7421 | > | 3.2 | . | mg/kg | | 0.5 | 2.5 |
| Lead | SO | Pond B | B-3 | SW7421 | > | 2.8 | . | mg/kg | | 0.5 | 2.5 |
| Lead | SO | Pond B | B-2 | SW7421 | > | 2.6 | . | mg/kg | | 0.5 | 2.5 |
| Lead | SO | Pond B | B-6 | SW7421 | > | 3.2 | . | mg/kg | | 0.5 | 2.5 |
| Magnesium | SO | Pond B | B-2 | SW6010 | > | 22000 | . | mg/kg | | 0.5 | 2.5 |
| Magnesium | SO | Pond B | B-1 | SW6010 | > | 18000 | . | mg/kg | | 0.5 | 2.5 |
| Magnesium | SO | Pond B | B-6 | SW6010 | > | 12000 | . | mg/kg | | 0.5 | 2.5 |
| Magnesium | SO | Pond B | B-5 | SW6010 | > | 18000 | . | mg/kg | | 0.5 | 2.5 |
| Magnesium | SO | Pond B | B-4 | SW6010 | > | 12000 | . | mg/kg | | 0.5 | 2.5 |
| Magnesium | SO | Pond B | B-3 | SW6010 | > | 18000 | . | mg/kg | | 0.5 | 2.5 |
| Manganese | SO | Pond B | B-1 | SW6010 | > | 81 | . | mg/kg | | 0.5 | 2.5 |
| Manganese | SO | Pond B | B-6 | SW6010 | > | 99 | . | mg/kg | | 0.5 | 2.5 |
| Manganese | SO | Pond B | B-5 | SW6010 | > | 130 | . | mg/kg | | 0.5 | 2.5 |
| Manganese | SO | Pond B | B-4 | SW6010 | > | 250 | . | mg/kg | | 0.5 | 2.5 |
| Manganese | SO | Pond B | B-3 | SW6010 | > | 64 | . | mg/kg | | 0.5 | 2.5 |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Manganese | SO | Pond B | B-2 | SW6010 | > | 89 | . | mg/kg | | 0.5 | 2.5 |
| Methylene chloride | SO | Pond B | B-4 | SW8240 | > | 0.0029 | . | mg/kg | JB | 0.5 | 2.5 |
| Methylene chloride | SO | Pond B | B-3 | SW8240 | > | 0.0026 | . | mg/kg | JB | 0.5 | 2.5 |
| Methylene chloride | SO | Pond B | B-5 | SW8240 | > | 0.0024 | . | mg/kg | JB | 0.5 | 2.5 |
| Nickel | SO | Pond B | B-2 | SW6010 | > | 7.2 | . | mg/kg | @ | 0.5 | 2.5 |
| Nickel | SO | Pond B | B-3 | SW6010 | > | 6.8 | . | mg/kg | @ | 0.5 | 2.5 |
| Nickel | SO | Pond B | B-1 | SW6010 | > | 5.1 | . | mg/kg | @ | 0.5 | 2.5 |
| Nickel | SO | Pond B | B-4 | SW6010 | > | 10 | . | mg/kg | @ | 0.5 | 2.5 |
| Nickel | SO | Pond B | B-6 | SW6010 | > | 9 | . | mg/kg | @ | 0.5 | 2.5 |
| Nickel | SO | Pond B | B-5 | SW6010 | > | 7.9 | . | mg/kg | @ | 0.5 | 2.5 |
| Potassium | SO | Pond B | B-5 | SW6010 | > | 3500 | . | mg/kg | | 0.5 | 2.5 |
| Potassium | SO | Pond B | B-4 | SW6010 | > | 5200 | . | mg/kg | | 0.5 | 2.5 |
| Potassium | SO | Pond B | B-2 | SW6010 | > | 2300 | . | mg/kg | | 0.5 | 2.5 |
| Potassium | SO | Pond B | B-3 | SW6010 | > | 2000 | . | mg/kg | | 0.5 | 2.5 |
| Potassium | SO | Pond B | B-6 | SW6010 | > | 2700 | . | mg/kg | | 0.5 | 2.5 |
| Potassium | SO | Pond B | B-1 | SW6010 | > | 1700 | . | mg/kg | @ | 0.5 | 2.5 |
| Silicon | SO | Pond B | B-6 | SW6010 | > | 6000 | . | mg/kg | | 0.5 | 2.5 |
| Silicon | SO | Pond B | B-5 | SW6010 | > | 460 | . | mg/kg | @ | 0.5 | 2.5 |
| Silicon | SO | Pond B | B-4 | SW6010 | > | 420 | . | mg/kg | @ | 0.5 | 2.5 |
| Silicon | SO | Pond B | B-3 | SW6010 | > | 520 | . | mg/kg | @ | 0.5 | 2.5 |
| Silicon | SO | Pond B | B-1 | SW6010 | > | 2100 | . | mg/kg | | 0.5 | 2.5 |
| Silicon | SO | Pond B | B-2 | SW6010 | > | 3100 | . | mg/kg | | 0.5 | 2.5 |
| Sodium | SO | Pond B | B-5 | SW6010 | > | 520 | . | mg/kg | @ | 0.5 | 2.5 |
| Sodium | SO | Pond B | B-2 | SW6010 | > | 520 | . | mg/kg | @ | 0.5 | 2.5 |
| Sodium | SO | Pond B | B-6 | SW6010 | > | 430 | . | mg/kg | @ | 0.5 | 2.5 |
| Sodium | SO | Pond B | B-1 | SW6010 | > | 770 | . | mg/kg | | 0.5 | 2.5 |
| Sodium | SO | Pond B | B-4 | SW6010 | > | 760 | . | mg/kg | | 0.5 | 2.5 |
| Sodium | SO | Pond B | B-3 | SW6010 | > | 420 | . | mg/kg | @ | 0.5 | 2.5 |
| Vanadium | SO | Pond B | B-1 | SW6010 | > | 20 | . | mg/kg | | 0.5 | 2.5 |
| Vanadium | SO | Pond B | B-3 | SW6010 | > | 25 | . | mg/kg | | 0.5 | 2.5 |
| Vanadium | SO | Pond B | B-6 | SW6010 | > | 34 | . | mg/kg | | 0.5 | 2.5 |
| Vanadium | SO | Pond B | B-5 | SW6010 | > | 33 | . | mg/kg | | 0.5 | 2.5 |
| Vanadium | SO | Pond B | B-4 | SW6010 | > | 29 | . | mg/kg | | 0.5 | 2.5 |
| Vanadium | SO | Pond B | B-2 | SW6010 | > | 37 | . | mg/kg | | 0.5 | 2.5 |
| Zinc | SO | Pond B | B-4 | SW6010 | > | 40 | . | mg/kg | | 0.5 | 2.5 |
| Zinc | SO | Pond B | B-3 | SW6010 | > | 19 | . | mg/kg | | 0.5 | 2.5 |
| Zinc | SO | Pond B | B-2 | SW6010 | > | 24 | . | mg/kg | | 0.5 | 2.5 |
| Zinc | SO | Pond B | B-5 | SW6010 | > | 32 | . | mg/kg | | 0.5 | 2.5 |
| Zinc | SO | Pond B | B-1 | SW6010 | > | 16 | . | mg/kg | | 0.5 | 2.5 |
| Zinc | SO | Pond B | B-6 | SW6010 | > | 22 | . | mg/kg | | 0.5 | 2.5 |
| 4,4'-DDD | WS | Pond B | B-01 | SW8080 | > | 0.000043 | 9.50E-06 | mg/L | X@ | . | . |
| 4,4'-DDE | WS | Pond B | B-2 | SW8080 | ND | 0.0003 | 0.0006 | mg/L | | . | . |
| 4,4'-DDE | WS | Pond B | B-01 | SW8080 | > | 0.000015 | 9.50E-06 | mg/L | X@ | . | . |
| 4,4'-DDE | WS | Pond B | B-1 | SW8080 | > | 0.0004 | . | mg/L | J | . | . |
| 4,4'-DDT | WS | Pond B | B-01 | SW8080 | < | 0.000018 | 0.000019 | mg/L | JX | . | . |
| alpha-BHC | WS | Pond B | B-01 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| alpha-BHC | WS | Pond B | B-3 | SW8080 | > | 0.00004 | . | mg/L | J | . | . |
| alpha-Chlordane | WS | Pond B | B-01 | SW8080 | < | 3.40E-06 | 9.50E-06 | mg/L | JX | . | . |
| Aluminum | WS | Pond B | B-6 | SW6010 | > | 0.029 | . | mg/L | @ | . | . |
| Aluminum | WS | Pond B | B-5 | SW6010 | > | 0.032 | . | mg/L | @ | . | . |
| Aluminum | WS | Pond B | B-4 | SW6010 | ND | 0.012 | 0.024 | mg/L | | . | . |
| Aluminum | WS | Pond B | B-3 | SW6010 | ND | 0.012 | 0.024 | mg/L | | . | . |
| Aluminum | WS | Pond B | B-2 | SW6010 | ND | 0.012 | 0.024 | mg/L | | . | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Aluminum | WS | Pond B | B-1 | SW6010 | ND | 0.012 | 0.024 | mg/L | | . | . |
| Aluminum | WS | Pond B | HW-1 | SW6010 | > | 0.11 | . | mg/L | @ | . | . |
| Aluminum | WS | Pond B | HW-2 | SW6010 | > | 0.09 | . | mg/L | @ | . | . |
| Antimony | WS | Pond B | HW-2 | SW6010 | ND | 0.014 | 0.028 | mg/L | | . | . |
| Antimony | WS | Pond B | HW-1 | SW6010 | ND | 0.014 | 0.028 | mg/L | | . | . |
| Antimony | WS | Pond B | B-6 | SW6010 | ND | 0.014 | 0.028 | mg/L | | . | . |
| Antimony | WS | Pond B | B-5 | SW6010 | > | 0.078 | . | mg/L | @ | . | . |
| Antimony | WS | Pond B | B-4 | SW6010 | ND | 0.014 | 0.028 | mg/L | | . | . |
| Antimony | WS | Pond B | B-3 | SW6010 | ND | 0.014 | 0.028 | mg/L | | . | . |
| Antimony | WS | Pond B | B-2 | SW6010 | ND | 0.014 | 0.028 | mg/L | | . | . |
| Antimony | WS | Pond B | B-1 | SW6010 | ND | 0.014 | 0.028 | mg/L | | . | . |
| Arsenic | WS | Pond B | HW-1 | SW7060 | ND | 0.003 | 0.006 | mg/L | | . | . |
| Arsenic | WS | Pond B | B-6 | SW7060 | > | 0.0038 | . | mg/L | @ | . | . |
| Arsenic | WS | Pond B | B-5 | SW7060 | > | 0.0037 | . | mg/L | @ | . | . |
| Arsenic | WS | Pond B | B-4 | SW7060 | ND | 0.003 | 0.006 | mg/L | | . | . |
| Arsenic | WS | Pond B | B-3 | SW7060 | ND | 0.003 | 0.006 | mg/L | | . | . |
| Arsenic | WS | Pond B | B-2 | SW7060 | ND | 0.003 | 0.006 | mg/L | | . | . |
| Arsenic | WS | Pond B | B-1 | SW7060 | ND | 0.003 | 0.006 | mg/L | | . | . |
| Arsenic | WS | Pond B | HW-2 | SW7060 | ND | 0.003 | 0.006 | mg/L | | . | . |
| Barium | WS | Pond B | B-1 | SW6010 | > | 0.035 | . | mg/L | @ | . | . |
| Barium | WS | Pond B | B-2 | SW6010 | > | 0.028 | . | mg/L | @ | . | . |
| Barium | WS | Pond B | HW-1 | SW6010 | > | 0.027 | . | mg/L | @ | . | . |
| Barium | WS | Pond B | B-5 | SW6010 | > | 0.037 | . | mg/L | @ | . | . |
| Barium | WS | Pond B | B-4 | SW6010 | > | 0.037 | . | mg/L | @ | . | . |
| Barium | WS | Pond B | B-3 | SW6010 | > | 0.03 | . | mg/L | @ | . | . |
| Barium | WS | Pond B | HW-2 | SW6010 | ND | 0.013 | 0.026 | mg/L | | . | . |
| Barium | WS | Pond B | B-6 | SW6010 | > | 0.04 | . | mg/L | | . | . |
| Benzoic acid | WS | Pond B | B-1 | SW8270 | > | 0.005 | . | mg/L | J | . | . |
| bis(2-Ethylhexyl)phthalate | WS | Pond B | B-5 | SW8270 | > | 0.014 | . | mg/L | @ | . | . |
| bis(2-Ethylhexyl)phthalate | WS | Pond B | B-4 | SW8270 | > | 0.004 | . | mg/L | JB | . | . |
| bis(2-Ethylhexyl)phthalate | WS | Pond B | B-3 | SW8270 | > | 0.008 | . | mg/L | JB | . | . |
| bis(2-Ethylhexyl)phthalate | WS | Pond B | B-2 | SW8270 | > | 0.015 | . | mg/L | JB | . | . |
| bis(2-Ethylhexyl)phthalate | WS | Pond B | B-6 | SW8270 | ND | 0.01 | 0.02 | mg/L | B | . | . |
| bis(2-Ethylhexyl)phthalate | WS | Pond B | HW-1 | SW8270 | > | 0.003 | . | mg/L | JB | . | . |
| bis(2-Ethylhexyl)phthalate | WS | Pond B | B-1 | SW8270 | > | 0.007 | . | mg/L | JB | . | . |
| bis(2-Ethylhexyl)phthalate | WS | Pond B | HW-2 | SW8270 | > | 0.007 | . | mg/L | JB | . | . |
| Boron | WS | Pond B | HW-1 | SW6010 | > | 0.58 | . | mg/L | | . | . |
| Boron | WS | Pond B | B-4 | SW6010 | > | 0.31 | . | mg/L | @ | . | . |
| Boron | WS | Pond B | B-2 | SW6010 | > | 0.24 | . | mg/L | @ | . | . |
| Boron | WS | Pond B | B-3 | SW6010 | > | 0.3 | . | mg/L | @ | . | . |
| Boron | WS | Pond B | B-6 | SW6010 | > | 0.33 | . | mg/L | @ | . | . |
| Boron | WS | Pond B | B-1 | SW6010 | > | 0.35 | . | mg/L | @ | . | . |
| Boron | WS | Pond B | HW-2 | SW6010 | > | 0.74 | . | mg/L | | . | . |
| Boron | WS | Pond B | B-5 | SW6010 | > | 0.27 | . | mg/L | @ | . | . |
| Calcium | WS | Pond B | HW-2 | SW6010 | > | 27 | . | mg/L | | . | . |
| Calcium | WS | Pond B | B-1 | SW6010 | > | 390 | . | mg/L | | . | . |
| Calcium | WS | Pond B | B-6 | SW6010 | > | 410 | . | mg/L | | . | . |
| Calcium | WS | Pond B | B-5 | SW6010 | > | 380 | . | mg/L | | . | . |
| Calcium | WS | Pond B | B-4 | SW6010 | > | 380 | . | mg/L | | . | . |
| Calcium | WS | Pond B | HW-1 | SW6010 | > | 340 | . | mg/L | | . | . |
| Calcium | WS | Pond B | B-3 | SW6010 | > | 340 | . | mg/L | | . | . |
| Calcium | WS | Pond B | B-2 | SW6010 | > | 310 | . | mg/L | | . | . |
| Chlordane | WS | Pond B | B-1 | SW8080 | > | 0.0002 | . | mg/L | J | . | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Chlordane | WS | Pond B | B-6 | SW8080 | > | 0.00005 | . | mg/L | J | . | . |
| Chlordane | WS | Pond B | B-4 | SW8080 | > | 0.00005 | . | mg/L | J | . | . |
| Chlordane | WS | Pond B | B-5 | SW8080 | > | 0.00005 | . | mg/L | J | . | . |
| Chromium | WS | Pond B | B-3 | SW6010 | ND | 0.002 | 0.004 | mg/L | | . | . |
| Chromium | WS | Pond B | B-2 | SW6010 | ND | 0.002 | 0.004 | mg/L | | . | . |
| Chromium | WS | Pond B | B-4 | SW6010 | ND | 0.002 | 0.004 | mg/L | | . | . |
| Chromium | WS | Pond B | B-1 | SW6010 | ND | 0.002 | 0.004 | mg/L | | . | . |
| Chromium | WS | Pond B | B-6 | SW6010 | ND | 0.002 | 0.004 | mg/L | | . | . |
| Chromium | WS | Pond B | B-5 | SW6010 | > | 0.0046 | . | mg/L | @ | . | . |
| Chromium | WS | Pond B | HW-1 | SW6010 | ND | 0.002 | 0.004 | mg/L | | . | . |
| Chromium | WS | Pond B | HW-2 | SW6010 | ND | 0.002 | 0.004 | mg/L | | . | . |
| Chromium VI | WS | Pond B | B-6 | SW7196 | ND | 0.0001 | 0.0002 | mg/L | | . | . |
| Chromium VI | WS | Pond B | B-5 | SW7196 | ND | 0.0001 | 0.0002 | mg/L | | . | . |
| Chromium VI | WS | Pond B | B-4 | SW7196 | > | 0.0004 | . | mg/L | @ | . | . |
| Copper | WS | Pond B | B-4 | SW6010 | > | 0.0052 | . | mg/L | @ | . | . |
| Copper | WS | Pond B | B-6 | SW6010 | ND | 0.0025 | 0.005 | mg/L | | . | . |
| Copper | WS | Pond B | B-5 | SW6010 | ND | 0.0025 | 0.005 | mg/L | | . | . |
| Copper | WS | Pond B | HW-1 | SW6010 | > | 0.0075 | . | mg/L | @ | . | . |
| Copper | WS | Pond B | B-3 | SW6010 | ND | 0.0025 | 0.005 | mg/L | | . | . |
| Copper | WS | Pond B | HW-2 | SW6010 | ND | 0.0025 | 0.005 | mg/L | | . | . |
| Copper | WS | Pond B | B-1 | SW6010 | ND | 0.0025 | 0.005 | mg/L | | . | . |
| Copper | WS | Pond B | B-2 | SW6010 | ND | 0.0025 | 0.005 | mg/L | | . | . |
| delta-BHC | WS | Pond B | B-01 | SW8080 | > | 0.000017 | 9.50E-06 | mg/L | X@ | . | . |
| Dieldrin | WS | Pond B | B-01 | SW8080 | > | 0.000022 | 9.50E-06 | mg/L | X@ | . | . |
| Endosulfan sulfate | WS | Pond B | B-01 | SW8080 | < | 0.000012 | 0.000048 | mg/L | JB | . | . |
| gamma-BHC | WS | Pond B | B-6 | SW8080 | > | 0.00001 | . | mg/L | J | . | . |
| gamma-BHC | WS | Pond B | B-5 | SW8080 | > | 0.00001 | . | mg/L | J | . | . |
| gamma-BHC | WS | Pond B | B-4 | SW8080 | > | 0.00001 | . | mg/L | J | . | . |
| gamma-BHC | WS | Pond B | B-01 | SW8080 | > | 0.00001 | 9.50E-06 | mg/L | @ | . | . |
| Hardness, as CaC03 | WS | Pond B | B-01 | E130.2 | > | 1600 | 62 | mg/L | | . | . |
| Heptachlor epoxide | WS | Pond B | B-01 | SW8080 | > | 0.00001 | 9.50E-06 | mg/L | G@ | . | . |
| Iron | WS | Pond B | B-1 | SW6010 | > | 0.11 | . | mg/L | | . | . |
| Iron | WS | Pond B | B-5 | SW6010 | > | 0.085 | . | mg/L | | . | . |
| Iron | WS | Pond B | HW-2 | SW6010 | > | 0.14 | . | mg/L | | . | . |
| Iron | WS | Pond B | HW-1 | SW6010 | > | 0.19 | . | mg/L | | . | . |
| Iron | WS | Pond B | B-6 | SW6010 | > | 0.095 | . | mg/L | | . | . |
| Iron | WS | Pond B | B-4 | SW6010 | > | 0.072 | . | mg/L | | . | . |
| Iron | WS | Pond B | B-3 | SW6010 | > | 0.084 | . | mg/L | | . | . |
| Iron | WS | Pond B | B-2 | SW6010 | > | 0.077 | . | mg/L | | . | . |
| Lead | WS | Pond B | B-4 | SW7421 | > | 0.0074 | . | mg/L | @ | . | . |
| Lead | WS | Pond B | B-3 | SW7421 | ND | 0.001 | 0.002 | mg/L | | . | . |
| Lead | WS | Pond B | B-2 | SW7421 | ND | 0.001 | 0.002 | mg/L | | . | . |
| Lead | WS | Pond B | B-5 | SW7421 | > | 0.0041 | . | mg/L | @ | . | . |
| Lead | WS | Pond B | B-1 | SW7421 | ND | 0.005 | 0.01 | mg/L | | . | . |
| Lead | WS | Pond B | HW-2 | SW7421 | > | 0.0029 | . | mg/L | @ | . | . |
| Lead | WS | Pond B | HW-1 | SW7421 | > | 0.004 | . | mg/L | @ | . | . |
| Lead | WS | Pond B | B-6 | SW7421 | > | 0.0057 | . | mg/L | @ | . | . |
| Lead (organic) | WS | Pond B | B-1 | E239.1 | > | 0.11 | . | mg/L | @ | . | . |
| Lead (organic) | WS | Pond B | HW-1 | E239.1 | > | 0.1 | . | mg/L | @ | . | . |
| Lead (organic) | WS | Pond B | HW-2 | E239.1 | ND | 0.05 | 0.1 | mg/L | | . | . |
| Lead (organic) | WS | Pond B | B-5 | E239.1 | ND | 0.05 | 0.1 | mg/L | | . | . |
| Lead (organic) | WS | Pond B | B-6 | E239.1 | ND | 0.05 | 0.1 | mg/L | | . | . |
| Lead (organic) | WS | Pond B | B-2 | E239.1 | > | 0.13 | . | mg/L | @ | . | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lead (organic) | WS | Pond B | B-3 | E239.1 | > | 0.12 | . | mg/L | @ | . | . |
| Lead (organic) | WS | Pond B | B-4 | E239.1 | ND | 0.05 | 0.1 | mg/L | | . | . |
| Magnesium | WS | Pond B | B-4 | SW6010 | > | 190 | . | mg/L | | . | . |
| Magnesium | WS | Pond B | B-2 | SW6010 | > | 160 | . | mg/L | | . | . |
| Magnesium | WS | Pond B | B-1 | SW6010 | > | 200 | . | mg/L | | . | . |
| Magnesium | WS | Pond B | B-5 | SW6010 | > | 190 | . | mg/L | | . | . |
| Magnesium | WS | Pond B | B-3 | SW6010 | > | 170 | . | mg/L | | . | . |
| Magnesium | WS | Pond B | HW-2 | SW6010 | > | 13 | . | mg/L | | . | . |
| Magnesium | WS | Pond B | HW-1 | SW6010 | > | 170 | . | mg/L | | . | . |
| Magnesium | WS | Pond B | B-6 | SW6010 | > | 200 | . | mg/L | | . | . |
| Manganese | WS | Pond B | B-1 | SW6010 | > | 0.055 | . | mg/L | | . | . |
| Manganese | WS | Pond B | B-5 | SW6010 | > | 0.086 | . | mg/L | | . | . |
| Manganese | WS | Pond B | HW-2 | SW6010 | > | 0.03 | . | mg/L | @ | . | . |
| Manganese | WS | Pond B | HW-1 | SW6010 | > | 0.044 | . | mg/L | | . | . |
| Manganese | WS | Pond B | B-6 | SW6010 | > | 0.092 | . | mg/L | | . | . |
| Manganese | WS | Pond B | B-4 | SW6010 | > | 0.086 | . | mg/L | | . | . |
| Manganese | WS | Pond B | B-3 | SW6010 | > | 0.044 | . | mg/L | | . | . |
| Manganese | WS | Pond B | B-2 | SW6010 | > | 0.038 | . | mg/L | @ | . | . |
| Mercury | WS | Pond B | B-4 | SW7470 | ND | 0.0001 | 0.0002 | mg/L | | . | . |
| Mercury | WS | Pond B | B-3 | SW7470 | > | 0.00062 | . | mg/L | @ | . | . |
| Mercury | WS | Pond B | B-2 | SW7470 | > | 0.0004 | . | mg/L | @ | . | . |
| Mercury | WS | Pond B | B-5 | SW7470 | ND | 0.0001 | 0.0002 | mg/L | | . | . |
| Mercury | WS | Pond B | B-1 | SW7470 | > | 0.00062 | . | mg/L | @ | . | . |
| Mercury | WS | Pond B | HW-2 | SW7470 | > | 0.00041 | . | mg/L | @ | . | . |
| Mercury | WS | Pond B | HW-1 | SW7470 | > | 0.00051 | . | mg/L | @ | . | . |
| Mercury | WS | Pond B | B-6 | SW7470 | ND | 0.0001 | 0.0002 | mg/L | | . | . |
| Potassium | WS | Pond B | B-1 | SW6010 | > | 13 | . | mg/L | | . | . |
| Potassium | WS | Pond B | HW-1 | SW6010 | > | 10 | . | mg/L | | . | . |
| Potassium | WS | Pond B | HW-2 | SW6010 | > | 8.3 | . | mg/L | | . | . |
| Potassium | WS | Pond B | B-5 | SW6010 | > | 12 | . | mg/L | | . | . |
| Potassium | WS | Pond B | B-6 | SW6010 | > | 13 | . | mg/L | | . | . |
| Potassium | WS | Pond B | B-2 | SW6010 | > | 10 | . | mg/L | | . | . |
| Potassium | WS | Pond B | B-3 | SW6010 | > | 11 | . | mg/L | | . | . |
| Potassium | WS | Pond B | B-4 | SW6010 | > | 12 | . | mg/L | | . | . |
| Selenium | WS | Pond B | B-4 | SW7740 | ND | 0.002 | 0.004 | mg/L | | . | . |
| Selenium | WS | Pond B | B-2 | SW7740 | > | 0.0038 | . | mg/L | @ | . | . |
| Selenium | WS | Pond B | B-1 | SW7740 | ND | 0.001 | 0.002 | mg/L | | . | . |
| Selenium | WS | Pond B | B-5 | SW7740 | ND | 0.001 | 0.002 | mg/L | | . | . |
| Selenium | WS | Pond B | B-3 | SW7740 | > | 0.0032 | . | mg/L | @ | . | . |
| Selenium | WS | Pond B | HW-2 | SW7740 | > | 0.0026 | . | mg/L | @ | . | . |
| Selenium | WS | Pond B | HW-1 | SW7740 | > | 0.0027 | . | mg/L | @ | . | . |
| Selenium | WS | Pond B | B-6 | SW7740 | ND | 0.001 | 0.002 | mg/L | | . | . |
| Silicon | WS | Pond B | B-1 | SW6010 | > | 17 | . | mg/L | | . | . |
| Silicon | WS | Pond B | B-5 | SW6010 | > | 16 | . | mg/L | | . | . |
| Silicon | WS | Pond B | HW-2 | SW6010 | > | 9.1 | . | mg/L | | . | . |
| Silicon | WS | Pond B | HW-1 | SW6010 | > | 12 | . | mg/L | | . | . |
| Silicon | WS | Pond B | B-6 | SW6010 | > | 17 | . | mg/L | | . | . |
| Silicon | WS | Pond B | B-4 | SW6010 | > | 16 | . | mg/L | | . | . |
| Silicon | WS | Pond B | B-3 | SW6010 | > | 13 | . | mg/L | | . | . |
| Silicon | WS | Pond B | B-2 | SW6010 | > | 12 | . | mg/L | | . | . |
| Silver | WS | Pond B | HW-2 | SW6010 | > | 0.0075 | . | mg/L | @ | . | . |
| Silver | WS | Pond B | HW-1 | SW6010 | > | 0.026 | . | mg/L | | . | . |
| Sodium | WS | Pond B | B-2 | SW6010 | > | 450 | . | mg/L | | . | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sodium | WS | Pond B | B-3 | SW6010 | > | 50 | . | mg/L | | . | . |
| Sodium | WS | Pond B | B-1 | SW6010 | > | 580 | . | mg/L | | . | . |
| Sodium | WS | Pond B | B-4 | SW6010 | > | 570 | . | mg/L | | . | . |
| Sodium | WS | Pond B | HW-1 | SW6010 | > | 510 | . | mg/L | | . | . |
| Sodium | WS | Pond B | B-5 | SW6010 | > | 570 | . | mg/L | | . | . |
| Sodium | WS | Pond B | B-6 | SW6010 | > | 580 | . | mg/L | | . | . |
| Sodium | WS | Pond B | HW-2 | SW6010 | > | 390 | . | mg/L | | . | . |
| Total dissolved solids | WS | Pond B | B-01 | E160.1 | > | 3800 | 10 | mg/L | | . | . |
| Vanadium | WS | Pond B | HW-2 | SW6010 | > | 0.0074 | . | mg/L | @ | . | . |
| Vanadium | WS | Pond B | B-1 | SW6010 | > | 0.0084 | . | mg/L | @ | . | . |
| Vanadium | WS | Pond B | HW-1 | SW6010 | > | 0.011 | . | mg/L | @ | . | . |
| Vanadium | WS | Pond B | B-5 | SW6010 | > | 0.0096 | . | mg/L | @ | . | . |
| Vanadium | WS | Pond B | B-4 | SW6010 | > | 0.0092 | . | mg/L | @ | . | . |
| Vanadium | WS | Pond B | B-3 | SW6010 | > | 0.0079 | . | mg/L | @ | . | . |
| Vanadium | WS | Pond B | B-2 | SW6010 | > | 0.0059 | . | mg/L | @ | . | . |
| Vanadium | WS | Pond B | B-6 | SW6010 | > | 0.01 | . | mg/L | @ | . | . |
| Zinc | WS | Pond B | B-6 | SW6010 | > | 0.025 | . | mg/L | | . | . |
| Zinc | WS | Pond B | HW-1 | SW6010 | > | 0.033 | . | mg/L | | . | . |
| Zinc | WS | Pond B | B-2 | SW6010 | > | 0.0055 | . | mg/L | @ | . | . |
| Zinc | WS | Pond B | B-5 | SW6010 | > | 0.018 | . | mg/L | | . | . |
| Zinc | WS | Pond B | B-4 | SW6010 | > | 0.0042 | . | mg/L | @ | . | . |
| Zinc | WS | Pond B | B-3 | SW6010 | > | 0.011 | . | mg/L | @ | . | . |
| Zinc | WS | Pond B | B-1 | SW6010 | > | 0.013 | . | mg/L | @ | . | . |
| Zinc | WS | Pond B | HW-2 | SW6010 | > | 0.018 | . | mg/L | | . | . |
| 2,4,5-T | SL | Pond C | C-03 | SW8150 | < | 0.15 | 0.15 | mg/kg | | . | . |
| 2,4,5-T | SL | Pond C | C-01 | SW8150 | < | 0.22 | 0.22 | mg/kg | | . | . |
| 2,4,5-T | SL | Pond C | C-06 | SW8150 | < | 0.11 | 0.11 | mg/kg | | . | . |
| 2,4,5-T | SL | Pond C | C-04 | SW8150 | < | 0.17 | 0.17 | mg/kg | | . | . |
| 2,4,5-T | SL | Pond C | C-5 | SW8150 | ND | 0.032 | 0.064 | mg/kg | | 0 | . |
| 2,4,5-T | SL | Pond C | C-02 | SW8150 | < | 0.15 | 0.15 | mg/kg | | . | . |
| 2,4,5-T | SL | Pond C | C-2 | SW8150 | ND | 0.012 | 0.024 | mg/kg | | 0 | . |
| 2,4,5-T | SL | Pond C | C-3 | SW8150 | ND | 0.015 | 0.03 | mg/kg | | 0 | . |
| 2,4,5-T | SL | Pond C | C-05 | SW8150 | > | 0.3 | 0.25 | mg/kg | X@ | . | . |
| 2,4,5-T | SL | Pond C | C-4 | SW8150 | ND | 0.015 | 0.03 | mg/kg | | 0 | . |
| 2,4,5-T | SL | Pond C | C-1 | SW8150 | ND | 0.016 | 0.032 | mg/kg | | 0 | . |
| 2,4,5-T | SL | Pond C | C-6 | SW8150 | ND | 0.014 | 0.028 | mg/kg | | 0 | . |
| 2-Methylnaphthalene | SL | Pond C | C-4 | SW8270 | ND | 0.2 | 0.4 | mg/kg | | 0 | . |
| 2-Methylnaphthalene | SL | Pond C | C-5 | SW8270 | > | 14 | . | mg/kg | @ | 0 | . |
| 2-Methylnaphthalene | SL | Pond C | C-2 | SW8270 | ND | 0.18 | 0.36 | mg/kg | | 0 | . |
| 2-Methylnaphthalene | SL | Pond C | C-1 | SW8270 | > | 1.1 | . | mg/kg | @ | 0 | . |
| 2-Methylnaphthalene | SL | Pond C | C-06 | SW8270 | ND | 2.7 | 5.4 | mg/kg | | . | . |
| 2-Methylnaphthalene | SL | Pond C | C-04 | SW8270 | ND | 4.3 | 8.6 | mg/kg | | . | . |
| 2-Methylnaphthalene | SL | Pond C | C-03 | SW8270 | ND | 3.7 | 7.4 | mg/kg | | . | . |
| 2-Methylnaphthalene | SL | Pond C | C-02 | SW8270 | ND | 3.75 | 7.5 | mg/kg | | . | . |
| 2-Methylnaphthalene | SL | Pond C | C-01 | SW8270 | ND | 0.65 | 1.3 | mg/kg | | . | . |
| 2-Methylnaphthalene | SL | Pond C | C-05 | SW8270 | ND | 6 | 12 | mg/kg | | . | . |
| 2-Methylnaphthalene | SL | Pond C | C-6 | SW8270 | ND | 0.19 | 0.38 | mg/kg | | 0 | . |
| 2-Methylnaphthalene | SL | Pond C | C-3 | SW8270 | ND | 0.21 | 0.42 | mg/kg | | 0 | . |
| 4,4'-DDD | SL | Pond C | C-03 | SW8080 | > | 0.31 | 0.077 | mg/kg | C@ | . | . |
| 4,4'-DDD | SL | Pond C | C-2 | SW8080 | > | 0.08 | . | mg/kg | C@ | 0 | . |
| 4,4'-DDD | SL | Pond C | C-6 | SW8080 | > | 0.18 | . | mg/kg | C | 0 | . |
| 4,4'-DDD | SL | Pond C | C-06 | SW8080 | > | 1.6 | 0.054 | mg/kg | C | . | . |
| 4,4'-DDD | SL | Pond C | C-3 | SW8080 | > | 1.9 | . | mg/kg | C | 0 | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4,4'-DDD | SL | Pond C | C-05 | SW8080 | > | 0.42 | 0.12 | mg/kg | C@ | . | . |
| 4,4'-DDD | SL | Pond C | C-4 | SW8080 | > | 0.43 | . | mg/kg | C | 0 | . |
| 4,4'-DDD | SL | Pond C | C-04 | SW8080 | > | 0.58 | 0.086 | mg/kg | C | . | . |
| 4,4'-DDD | SL | Pond C | C-1 | SW8080 | > | 6 | . | mg/kg | C | 0 | . |
| 4,4'-DDD | SL | Pond C | C-5 | SW8080 | > | 16 | . | mg/kg | C | 0 | . |
| 4,4'-DDD | SL | Pond C | C-01 | SW8080 | < | 0.013 | 0.013 | mg/kg | | . | . |
| 4,4'-DDD | SL | Pond C | C-02 | SW8080 | > | 0.36 | 0.075 | mg/kg | C@ | . | . |
| 4,4'-DDE | SL | Pond C | C-05 | SW8080 | > | 0.29 | 0.12 | mg/kg | C@ | . | . |
| 4,4'-DDE | SL | Pond C | C-04 | SW8080 | > | 0.46 | 0.086 | mg/kg | C | . | . |
| 4,4'-DDE | SL | Pond C | C-03 | SW8080 | > | 0.32 | 0.077 | mg/kg | C@ | . | . |
| 4,4'-DDE | SL | Pond C | C-02 | SW8080 | > | 0.57 | 0.075 | mg/kg | C | . | . |
| 4,4'-DDE | SL | Pond C | C-4 | SW8080 | > | 0.095 | . | mg/kg | C@ | 0 | . |
| 4,4'-DDE | SL | Pond C | C-5 | SW8080 | > | 8.1 | . | mg/kg | CG | 0 | . |
| 4,4'-DDE | SL | Pond C | C-06 | SW8080 | > | 1.3 | 0.054 | mg/kg | C | . | . |
| 4,4'-DDE | SL | Pond C | C-3 | SW8080 | > | 0.4 | . | mg/kg | XG | 0 | . |
| 4,4'-DDE | SL | Pond C | C-2 | SW8080 | ND | 0.0345 | 0.069 | mg/kg | | 0 | . |
| 4,4'-DDE | SL | Pond C | C-1 | SW8080 | > | 0.24 | . | mg/kg | C@ | 0 | . |
| 4,4'-DDE | SL | Pond C | C-01 | SW8080 | > | 0.049 | 0.013 | mg/kg | X@ | . | . |
| 4,4'-DDE | SL | Pond C | C-6 | SW8080 | > | 0.057 | . | mg/kg | C@ | 0 | . |
| 4,4'-DDT | SL | Pond C | C-01 | SW8080 | < | 0.023 | 0.026 | mg/kg | JC | . | . |
| 4,4'-DDT | SL | Pond C | C-06 | SW8080 | > | 0.14 | 0.11 | mg/kg | C@ | . | . |
| 4,4'-DDT | SL | Pond C | C-02 | SW8080 | < | 0.13 | 0.15 | mg/kg | JC | . | . |
| 4,4'-DDT | SL | Pond C | C-05 | SW8080 | > | 0.36 | 0.24 | mg/kg | X@ | . | . |
| 4,4'-DDT | SL | Pond C | C-04 | SW8080 | > | 0.21 | 0.17 | mg/kg | X@ | . | . |
| 4,4'-DDT | SL | Pond C | C-03 | SW8080 | < | 0.15 | 0.15 | mg/kg | | . | . |
| Acetone | SL | Pond C | C-03 | SW8240 | > | 2.3 | 0.76 | mg/kg | @ | . | . |
| Acetone | SL | Pond C | C-02 | SW8240 | > | 1.5 | 0.76 | mg/kg | @ | . | . |
| Acetone | SL | Pond C | C-04 | SW8240 | < | 0.56 | 0.87 | mg/kg | J | . | . |
| Acetone | SL | Pond C | C-01 | SW8240 | > | 0.31 | 0.13 | mg/kg | @ | . | . |
| Acetone | SL | Pond C | C-6 | SW8240 | > | 0.0045 | . | mg/kg | JB | 0 | . |
| Acetone | SL | Pond C | C-2 | SW8240 | ND | 0.007 | 0.014 | mg/kg | | 0 | . |
| Acetone | SL | Pond C | C-4 | SW8240 | > | 0.009 | . | mg/kg | J | 0 | . |
| Acetone | SL | Pond C | C-5 | SW8240 | > | 0.032 | . | mg/kg | J | 0 | . |
| Acetone | SL | Pond C | C-1 | SW8240 | > | 0.045 | . | mg/kg | B@ | 0 | . |
| Acetone | SL | Pond C | C-05 | SW8240 | > | 1.9 | 1.2 | mg/kg | @ | . | . |
| Acetone | SL | Pond C | C-3 | SW8240 | > | 0.021 | . | mg/kg | B@ | 0 | . |
| Acetone | SL | Pond C | C-06 | SW8240 | > | 0.72 | 0.55 | mg/kg | @ | . | . |
| Acetophenone | SL | Pond C | C-05 | SW8270 | < | 12 | 12 | mg/kg | | . | . |
| Acetophenone | SL | Pond C | C-01 | SW8270 | < | 0.1 | 1.3 | mg/kg | J | . | . |
| Acetophenone | SL | Pond C | C-04 | SW8270 | < | 3.2 | 8.6 | mg/kg | J | . | . |
| Acetophenone | SL | Pond C | C-06 | SW8270 | < | 5.4 | 5.4 | mg/kg | | . | . |
| Acetophenone | SL | Pond C | C-03 | SW8270 | < | 7.4 | 7.4 | mg/kg | | . | . |
| Acetophenone | SL | Pond C | C-02 | SW8270 | < | 7.5 | 7.5 | mg/kg | | . | . |
| alpha-Chlordane | SL | Pond C | C-06 | SW8080 | < | 0.054 | 0.054 | mg/kg | | . | . |
| alpha-Chlordane | SL | Pond C | C-03 | SW8080 | < | 0.066 | 0.077 | mg/kg | JC | . | . |
| alpha-Chlordane | SL | Pond C | C-04 | SW8080 | < | 0.086 | 0.086 | mg/kg | | . | . |
| alpha-Chlordane | SL | Pond C | C-01 | SW8080 | < | 0.013 | 0.013 | mg/kg | | . | . |
| alpha-Chlordane | SL | Pond C | C-02 | SW8080 | < | 0.075 | 0.075 | mg/kg | | . | . |
| alpha-Chlordane | SL | Pond C | C-05 | SW8080 | < | 0.12 | 0.12 | mg/kg | | . | . |
| Aluminum | SL | Pond C | C-2 | SW6010 | > | 8900 | . | mg/kg | | 0 | . |
| Aluminum | SL | Pond C | C-1 | SW6010 | > | 11000 | . | mg/kg | | 0 | . |
| Aluminum | SL | Pond C | C-6 | SW6010 | > | 10000 | . | mg/kg | | 0 | . |
| Aluminum | SL | Pond C | C-5 | SW6010 | > | 9500 | . | mg/kg | | 0 | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Aluminum | SL | Pond C | C-4 | SW6010 | > | 6800 | . | mg/kg | | 0 | . |
| Aluminum | SL | Pond C | C-3 | SW6010 | > | 13000 | . | mg/kg | | 0 | . |
| Arsenic | SL | Pond C | C-4 | SW7060 | ND | 0.35 | 0.7 | mg/kg | | 0 | . |
| Arsenic | SL | Pond C | C-3 | SW7060 | ND | 0.75 | 1.5 | mg/kg | | 0 | . |
| Arsenic | SL | Pond C | C-2 | SW7060 | > | 1.5 | . | mg/kg | @ | 0 | . |
| Arsenic | SL | Pond C | C-1 | SW7060 | ND | 0.8 | 1.6 | mg/kg | | 0 | . |
| Arsenic | SL | Pond C | C-06 | SW7060 | > | 3.5 | 1.7 | mg/kg | @ | . | . |
| Arsenic | SL | Pond C | C-05 | SW7060 | ND | 2.85 | 3.8 | mg/kg | | . | . |
| Arsenic | SL | Pond C | C-04 | SW7060 | ND | 1.875 | 2.5 | mg/kg | | . | . |
| Arsenic | SL | Pond C | C-03 | SW7060 | ND | 1.875 | 2.5 | mg/kg | | . | . |
| Arsenic | SL | Pond C | C-6 | SW7060 | > | 1.2 | . | mg/kg | @ | 0 | . |
| Arsenic | SL | Pond C | C-5 | SW7060 | ND | 0.6 | 1.2 | mg/kg | | 0 | . |
| Arsenic | SL | Pond C | C-02 | SW7060 | ND | 1.95 | 2.6 | mg/kg | | . | . |
| Arsenic | SL | Pond C | C-01 | SW7060 | ND | 2.55 | 3.4 | mg/kg | | . | . |
| Barium | SL | Pond C | C-02 | SW6010 | > | 110 | 5.9 | mg/kg | | . | . |
| Barium | SL | Pond C | C-1 | SW6010 | > | 93 | . | mg/kg | | 0 | . |
| Barium | SL | Pond C | C-3 | SW6010 | > | 92 | . | mg/kg | | 0 | . |
| Barium | SL | Pond C | C-04 | SW6010 | > | 80 | 7.1 | mg/kg | | . | . |
| Barium | SL | Pond C | C-4 | SW6010 | > | 69 | . | mg/kg | | 0 | . |
| Barium | SL | Pond C | C-01 | SW6010 | > | 130 | 9.2 | mg/kg | | . | . |
| Barium | SL | Pond C | C-2 | SW6010 | > | 74 | . | mg/kg | | 0 | . |
| Barium | SL | Pond C | C-06 | SW6010 | > | 85 | 4 | mg/kg | | . | . |
| Barium | SL | Pond C | C-6 | SW6010 | > | 92 | . | mg/kg | | 0 | . |
| Barium | SL | Pond C | C-03 | SW6010 | > | 61 | 5.6 | mg/kg | | . | . |
| Barium | SL | Pond C | C-05 | SW6010 | > | 100 | 10 | mg/kg | | . | . |
| Barium | SL | Pond C | C-5 | SW6010 | > | 100 | . | mg/kg | | 0 | . |
| Benzene | SL | Pond C | C-03 | SW8240 | < | 0.038 | 0.038 | mg/kg | | . | . |
| Benzene | SL | Pond C | C-02 | SW8240 | < | 0.038 | 0.038 | mg/kg | | . | . |
| Benzene | SL | Pond C | C-01 | SW8240 | < | 0.0065 | 0.0065 | mg/kg | | . | . |
| Benzene | SL | Pond C | C-06 | SW8240 | < | 0.001 | 0.027 | mg/kg | J | . | . |
| Benzene | SL | Pond C | C-05 | SW8240 | < | 0.06 | 0.06 | mg/kg | | . | . |
| Benzene | SL | Pond C | C-04 | SW8240 | < | 0.043 | 0.043 | mg/kg | | . | . |
| Beryllium | SL | Pond C | C-5 | SW6010 | ND | 0.26 | 0.52 | mg/kg | | 0 | . |
| Beryllium | SL | Pond C | C-06 | SW6010 | ND | 0.4 | 0.8 | mg/kg | | . | . |
| Beryllium | SL | Pond C | C-6 | SW6010 | > | 0.38 | . | mg/kg | @ | 0 | . |
| Beryllium | SL | Pond C | C-4 | SW6010 | ND | 0.17 | 0.34 | mg/kg | | 0 | . |
| Beryllium | SL | Pond C | C-3 | SW6010 | > | 0.43 | . | mg/kg | @ | 0 | . |
| Beryllium | SL | Pond C | C-2 | SW6010 | ND | 0.135 | 0.27 | mg/kg | | 0 | . |
| Beryllium | SL | Pond C | C-1 | SW6010 | > | 0.46 | . | mg/kg | @ | 0 | . |
| bis(2-Ethylhexyl)phthalate | SL | Pond C | C-01 | SW8270 | > | 11 | 1.3 | mg/kg | B | . | . |
| bis(2-Ethylhexyl)phthalate | SL | Pond C | C-3 | SW8270 | > | 0.65 | . | mg/kg | @ | 0 | . |
| bis(2-Ethylhexyl)phthalate | SL | Pond C | C-6 | SW8270 | ND | 0.24 | 0.48 | mg/kg | | 0 | . |
| bis(2-Ethylhexyl)phthalate | SL | Pond C | C-5 | SW8270 | > | 6.2 | . | mg/kg | J | 0 | . |
| bis(2-Ethylhexyl)phthalate | SL | Pond C | C-4 | SW8270 | > | 0.91 | . | mg/kg | @ | 0 | . |
| bis(2-Ethylhexyl)phthalate | SL | Pond C | C-2 | SW8270 | > | 0.75 | . | mg/kg | @ | 0 | . |
| bis(2-Ethylhexyl)phthalate | SL | Pond C | C-1 | SW8270 | > | 1.2 | . | mg/kg | @ | 0 | . |
| bis(2-Ethylhexyl)phthalate | SL | Pond C | C-06 | SW8270 | > | 6.3 | 5.4 | mg/kg | B@ | . | . |
| bis(2-Ethylhexyl)phthalate | SL | Pond C | C-05 | SW8270 | > | 21 | 12 | mg/kg | B@ | . | . |
| bis(2-Ethylhexyl)phthalate | SL | Pond C | C-04 | SW8270 | ND | 6.45 | 8.6 | mg/kg | | . | . |
| bis(2-Ethylhexyl)phthalate | SL | Pond C | C-03 | SW8270 | > | 25 | 7.4 | mg/kg | B@ | . | . |
| bis(2-Ethylhexyl)phthalate | SL | Pond C | C-02 | SW8270 | > | 36 | 7.5 | mg/kg | B@ | . | . |
| Cadmium | SL | Pond C | C-05 | SW6010 | > | 6 | 5 | mg/kg | @ | . | . |
| Cadmium | SL | Pond C | C-04 | SW6010 | > | 4.2 | 3.6 | mg/kg | @ | . | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cadmium | SL | Pond C | C-03 | SW6010 | > | 4 | 2.8 | mg/kg | @ | . | . |
| Cadmium | SL | Pond C | C-02 | SW6010 | > | 4.2 | 2.9 | mg/kg | @ | . | . |
| Cadmium | SL | Pond C | C-06 | SW6010 | ND | 1.5 | 2 | mg/kg | | . | . |
| Cadmium | SL | Pond C | C-01 | SW6010 | ND | 3.45 | 4.6 | mg/kg | | . | . |
| Calcium | SL | Pond C | C-1 | SW6010 | > | 110000 | . | mg/kg | | 0 | . |
| Calcium | SL | Pond C | C-2 | SW6010 | > | 74000 | . | mg/kg | | 0 | . |
| Calcium | SL | Pond C | C-3 | SW6010 | > | 120000 | . | mg/kg | | 0 | . |
| Calcium | SL | Pond C | C-6 | SW6010 | > | 110000 | . | mg/kg | | 0 | . |
| Calcium | SL | Pond C | C-4 | SW6010 | > | 110000 | . | mg/kg | | 0 | . |
| Calcium | SL | Pond C | C-5 | SW6010 | > | 120000 | . | mg/kg | | 0 | . |
| Carbon disulfide | SL | Pond C | C-05 | SW8240 | > | 0.11 | 0.06 | mg/kg | @ | . | . |
| Carbon disulfide | SL | Pond C | C-3 | SW8240 | ND | 0.004 | 0.008 | mg/kg | | 0 | . |
| Carbon disulfide | SL | Pond C | C-04 | SW8240 | > | 0.05 | 0.043 | mg/kg | @ | . | . |
| Carbon disulfide | SL | Pond C | C-06 | SW8240 | > | 0.071 | 0.027 | mg/kg | @ | . | . |
| Carbon disulfide | SL | Pond C | C-4 | SW8240 | > | 0.014 | . | mg/kg | @ | 0 | . |
| Carbon disulfide | SL | Pond C | C-02 | SW8240 | < | 0.024 | 0.038 | mg/kg | J | . | . |
| Carbon disulfide | SL | Pond C | C-2 | SW8240 | > | 0.0071 | . | mg/kg | @ | 0 | . |
| Carbon disulfide | SL | Pond C | C-03 | SW8240 | > | 0.047 | 0.038 | mg/kg | @ | . | . |
| Carbon disulfide | SL | Pond C | C-6 | SW8240 | ND | 0.00365 | 0.0073 | mg/kg | | 0 | . |
| Carbon disulfide | SL | Pond C | C-5 | SW8240 | > | 0.014 | . | mg/kg | J | 0 | . |
| Carbon disulfide | SL | Pond C | C-01 | SW8240 | < | 0.0065 | 0.0065 | mg/kg | | . | . |
| Carbon disulfide | SL | Pond C | C-1 | SW8240 | ND | 0.0044 | 0.0088 | mg/kg | | 0 | . |
| Chromium | SL | Pond C | C-1 | SW6010 | > | 34 | . | mg/kg | | 0 | . |
| Chromium | SL | Pond C | C-6 | SW6010 | > | 9.3 | . | mg/kg | | 0 | . |
| Chromium | SL | Pond C | C-01 | SW6010 | > | 120 | 9.2 | mg/kg | | . | . |
| Chromium | SL | Pond C | C-3 | SW6010 | > | 27 | . | mg/kg | | 0 | . |
| Chromium | SL | Pond C | C-2 | SW6010 | > | 18 | . | mg/kg | | 0 | . |
| Chromium | SL | Pond C | C-5 | SW6010 | > | 25 | . | mg/kg | | 0 | . |
| Chromium | SL | Pond C | C-06 | SW6010 | > | 63 | 4 | mg/kg | | . | . |
| Chromium | SL | Pond C | C-05 | SW6010 | > | 76 | 10 | mg/kg | | . | . |
| Chromium | SL | Pond C | C-4 | SW6010 | > | 7.9 | . | mg/kg | @ | 0 | . |
| Chromium | SL | Pond C | C-04 | SW6010 | > | 91 | 7.1 | mg/kg | | . | . |
| Chromium | SL | Pond C | C-03 | SW6010 | > | 46 | 5.6 | mg/kg | | . | . |
| Chromium | SL | Pond C | C-02 | SW6010 | > | 86 | 5.9 | mg/kg | | . | . |
| Cobalt | SL | Pond C | C-02 | SW6010 | < | 5.9 | 5.9 | mg/kg | | . | . |
| Cobalt | SL | Pond C | C-03 | SW6010 | < | 5.6 | 5.6 | mg/kg | | . | . |
| Cobalt | SL | Pond C | C-01 | SW6010 | < | 9.2 | 9.2 | mg/kg | | . | . |
| Cobalt | SL | Pond C | C-5 | SW6010 | > | 3.6 | . | mg/kg | @ | 0 | . |
| Cobalt | SL | Pond C | C-6 | SW6010 | > | 3.3 | . | mg/kg | @ | 0 | . |
| Cobalt | SL | Pond C | C-2 | SW6010 | > | 3.3 | . | mg/kg | @ | 0 | . |
| Cobalt | SL | Pond C | C-1 | SW6010 | > | 3.8 | . | mg/kg | @ | 0 | . |
| Cobalt | SL | Pond C | C-3 | SW6010 | > | 4.2 | . | mg/kg | @ | 0 | . |
| Cobalt | SL | Pond C | C-06 | SW6010 | > | 4.3 | 4 | mg/kg | @ | . | . |
| Cobalt | SL | Pond C | C-4 | SW6010 | > | 2.7 | . | mg/kg | @ | 0 | . |
| Cobalt | SL | Pond C | C-04 | SW6010 | < | 7.1 | 7.1 | mg/kg | | . | . |
| Cobalt | SL | Pond C | C-05 | SW6010 | < | 10 | 10 | mg/kg | | . | . |
| Copper | SL | Pond C | C-06 | SW6010 | > | 67 | 8 | mg/kg | | . | . |
| Copper | SL | Pond C | C-05 | SW6010 | > | 260 | 20 | mg/kg | | . | . |
| Copper | SL | Pond C | C-04 | SW6010 | > | 130 | 14 | mg/kg | | . | . |
| Copper | SL | Pond C | C-03 | SW6010 | > | 250 | 11 | mg/kg | | . | . |
| Copper | SL | Pond C | C-5 | SW6010 | > | 44 | . | mg/kg | | 0 | . |
| Copper | SL | Pond C | C-02 | SW6010 | > | 190 | 12 | mg/kg | | . | . |
| Copper | SL | Pond C | C-6 | SW6010 | > | 7.4 | . | mg/kg | @ | 0 | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Copper | SL | Pond C | C-01 | SW6010 | > | 220 | 18 | mg/kg | | . | . |
| Copper | SL | Pond C | C-4 | SW6010 | > | 15 | . | mg/kg | @ | 0 | . |
| Copper | SL | Pond C | C-3 | SW6010 | > | 31 | . | mg/kg | | 0 | . |
| Copper | SL | Pond C | C-2 | SW6010 | > | 16 | . | mg/kg | | 0 | . |
| Copper | SL | Pond C | C-1 | SW6010 | > | 28 | . | mg/kg | | 0 | . |
| Cyanide | SL | Pond C | C-01 | SW9012 | > | 330 | 13 | mg/kg | | . | . |
| Cyanide | SL | Pond C | C-03 | SW9012 | > | 6.5 | 1.6 | mg/kg | @ | . | . |
| Cyanide | SL | Pond C | C-06 | SW9012 | < | 1.1 | 1.1 | mg/kg | | . | . |
| Cyanide | SL | Pond C | C-05 | SW9012 | < | 2.6 | 2.6 | mg/kg | | . | . |
| Cyanide | SL | Pond C | C-04 | SW9012 | < | 1.7 | 1.7 | mg/kg | | . | . |
| Cyanide | SL | Pond C | C-02 | SW9012 | < | 1.6 | 1.6 | mg/kg | | . | . |
| delta-BHC | SL | Pond C | C-06 | SW8080 | > | 1.6 | 0.054 | mg/kg | X | . | . |
| delta-BHC | SL | Pond C | C-04 | SW8080 | > | 1.6 | 0.086 | mg/kg | X | . | . |
| delta-BHC | SL | Pond C | C-03 | SW8080 | < | 0.077 | 0.077 | mg/kg | | . | . |
| delta-BHC | SL | Pond C | C-02 | SW8080 | = | 0.75 | 0.75 | mg/kg | D | . | . |
| delta-BHC | SL | Pond C | C-05 | SW8080 | > | 5 | 0.12 | mg/kg | X | . | . |
| delta-BHC | SL | Pond C | C-01 | SW8080 | < | 0.013 | 0.013 | mg/kg | | . | . |
| Dibenzofuran | SL | Pond C | C-4 | SW8270 | ND | 0.1 | 0.2 | mg/kg | | 0 | . |
| Dibenzofuran | SL | Pond C | C-3 | SW8270 | ND | 0.105 | 0.21 | mg/kg | | 0 | . |
| Dibenzofuran | SL | Pond C | C-2 | SW8270 | ND | 0.09 | 0.18 | mg/kg | | 0 | . |
| Dibenzofuran | SL | Pond C | C-6 | SW8270 | ND | 0.095 | 0.19 | mg/kg | | 0 | . |
| Dibenzofuran | SL | Pond C | C-1 | SW8270 | > | 0.31 | . | mg/kg | @ | 0 | . |
| Dibutylphthalate | SL | Pond C | C-04 | SW8270 | ND | 6.45 | 8.6 | mg/kg | | . | . |
| Dibutylphthalate | SL | Pond C | C-6 | SW8270 | ND | 0.12 | 0.24 | mg/kg | | 0 | . |
| Dibutylphthalate | SL | Pond C | C-05 | SW8270 | ND | 9 | 12 | mg/kg | | . | . |
| Dibutylphthalate | SL | Pond C | C-3 | SW8270 | ND | 0.13 | 0.26 | mg/kg | | 0 | . |
| Dibutylphthalate | SL | Pond C | C-02 | SW8270 | < | 0.35 | 7.5 | mg/kg | J | . | . |
| Dibutylphthalate | SL | Pond C | C-03 | SW8270 | ND | 5.55 | 7.4 | mg/kg | | . | . |
| Dibutylphthalate | SL | Pond C | C-2 | SW8270 | ND | 0.11 | 0.22 | mg/kg | | 0 | . |
| Dibutylphthalate | SL | Pond C | C-5 | SW8270 | ND | 3.9 | 7.8 | mg/kg | | 0 | . |
| Dibutylphthalate | SL | Pond C | C-4 | SW8270 | ND | 0.125 | 0.25 | mg/kg | | 0 | . |
| Dibutylphthalate | SL | Pond C | C-1 | SW8270 | ND | 0.145 | 0.29 | mg/kg | | 0 | . |
| Dibutylphthalate | SL | Pond C | C-06 | SW8270 | ND | 4.05 | 5.4 | mg/kg | | . | . |
| Dibutylphthalate | SL | Pond C | C-01 | SW8270 | < | 0.046 | 1.3 | mg/kg | J | . | . |
| Endosulfan I | SL | Pond C | C-03 | SW8080 | < | 0.077 | 0.077 | mg/kg | | . | . |
| Endosulfan I | SL | Pond C | C-02 | SW8080 | < | 0.075 | 0.075 | mg/kg | | . | . |
| Endosulfan I | SL | Pond C | C-4 | SW8080 | > | 0.85 | . | mg/kg | X | 0 | . |
| Endosulfan I | SL | Pond C | C-04 | SW8080 | < | 0.086 | 0.086 | mg/kg | | . | . |
| Endosulfan I | SL | Pond C | C-5 | SW8080 | > | 4.4 | . | mg/kg | X | 0 | . |
| Endosulfan I | SL | Pond C | C-01 | SW8080 | < | 0.013 | 0.013 | mg/kg | | . | . |
| Endosulfan I | SL | Pond C | C-2 | SW8080 | > | 1.5 | . | mg/kg | X | 0 | . |
| Endosulfan I | SL | Pond C | C-06 | SW8080 | < | 0.054 | 0.054 | mg/kg | | . | . |
| Endosulfan I | SL | Pond C | C-05 | SW8080 | > | 0.38 | 0.12 | mg/kg | X@ | . | . |
| Ethyl benzene | SL | Pond C | C-01 | SW8240 | < | 0.0039 | 0.0065 | mg/kg | J | . | . |
| Ethyl benzene | SL | Pond C | C-03 | SW8240 | < | 0.016 | 0.038 | mg/kg | J | . | . |
| Ethyl benzene | SL | Pond C | C-06 | SW8240 | < | 0.025 | 0.027 | mg/kg | J | . | . |
| Ethyl benzene | SL | Pond C | C-05 | SW8240 | < | 0.02 | 0.06 | mg/kg | J | . | . |
| Ethyl benzene | SL | Pond C | C-04 | SW8240 | = | 0.043 | 0.043 | mg/kg | @ | . | . |
| Ethyl benzene | SL | Pond C | C-02 | SW8240 | < | 0.015 | 0.038 | mg/kg | J | . | . |
| Fluoranthene | SL | Pond C | C-06 | SW8270 | ND | 4.05 | 5.4 | mg/kg | | . | . |
| Fluoranthene | SL | Pond C | C-04 | SW8270 | ND | 6.45 | 8.6 | mg/kg | | . | . |
| Fluoranthene | SL | Pond C | C-03 | SW8270 | ND | 5.55 | 7.4 | mg/kg | | . | . |
| Fluoranthene | SL | Pond C | C-02 | SW8270 | < | 0.34 | 7.5 | mg/kg | J | . | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fluoranthene | SL | Pond C | C-05 | SW8270 | ND | 9 | 12 | mg/kg | | . | . |
| Fluoranthene | SL | Pond C | C-01 | SW8270 | < | 0.085 | 1.3 | mg/kg | J | . | . |
| gamma-Chlordane | SL | Pond C | C-06 | SW8080 | < | 0.051 | 0.054 | mg/kg | JX | . | . |
| gamma-Chlordane | SL | Pond C | C-05 | SW8080 | > | 0.21 | 0.12 | mg/kg | C@ | . | . |
| gamma-Chlordane | SL | Pond C | C-02 | SW8080 | < | 0.075 | 0.075 | mg/kg | | . | . |
| gamma-Chlordane | SL | Pond C | C-04 | SW8080 | > | 0.15 | 0.086 | mg/kg | C@ | . | . |
| gamma-Chlordane | SL | Pond C | C-03 | SW8080 | > | 0.14 | 0.077 | mg/kg | C@ | . | . |
| gamma-Chlordane | SL | Pond C | C-01 | SW8080 | < | 0.013 | 0.013 | mg/kg | | . | . |
| Iron | SL | Pond C | C-1 | SW6010 | > | 8500 | . | mg/kg | | 0 | . |
| Iron | SL | Pond C | C-6 | SW6010 | > | 6900 | . | mg/kg | | 0 | . |
| Iron | SL | Pond C | C-4 | SW6010 | > | 4900 | . | mg/kg | | 0 | . |
| Iron | SL | Pond C | C-2 | SW6010 | > | 6400 | . | mg/kg | | 0 | . |
| Iron | SL | Pond C | C-3 | SW6010 | > | 9000 | . | mg/kg | | 0 | . |
| Iron | SL | Pond C | C-5 | SW6010 | > | 7200 | . | mg/kg | | 0 | . |
| Kepone (Mirex) | SL | Pond C | C-5 | SW8080 | > | 95.7 | 0.68 | mg/kg | C | . | . |
| Kepone (Mirex) | SL | Pond C | C-05 | SW8080 | ND | 0.06 | 0.12 | mg/kg | | . | . |
| Kepone (Mirex) | SL | Pond C | C-04 | SW8080 | ND | 0.043 | 0.086 | mg/kg | | . | . |
| Kepone (Mirex) | SL | Pond C | C-03 | SW8080 | ND | 0.0385 | 0.077 | mg/kg | | . | . |
| Kepone (Mirex) | SL | Pond C | C-06 | SW8080 | ND | 0.027 | 0.054 | mg/kg | | . | . |
| Kepone (Mirex) | SL | Pond C | C-01 | SW8080 | ND | 0.0065 | 0.013 | mg/kg | | . | . |
| Kepone (Mirex) | SL | Pond C | C-02 | SW8080 | ND | 0.0375 | 0.075 | mg/kg | | . | . |
| Kepone (Mirex) | SL | Pond C | C-4 | SW8080 | > | 5.79 | 0.078 | mg/kg | C | . | . |
| Lead | SL | Pond C | C-01 | SW7421 | > | 48 | 2.6 | mg/kg | Z | . | . |
| Lead | SL | Pond C | C-3 | SW7421 | > | 17 | . | mg/kg | | 0 | . |
| Lead | SL | Pond C | C-6 | SW7421 | > | 5.6 | . | mg/kg | | 0 | . |
| Lead | SL | Pond C | C-5 | SW7421 | > | 12 | . | mg/kg | | 0 | . |
| Lead | SL | Pond C | C-4 | SW7421 | > | 4.7 | . | mg/kg | | 0 | . |
| Lead | SL | Pond C | C-2 | SW7421 | > | 6.4 | . | mg/kg | | 0 | . |
| Lead | SL | Pond C | C-1 | SW7421 | > | 12 | . | mg/kg | | 0 | . |
| Lead | SL | Pond C | C-06 | SW7421 | > | 13 | 1.3 | mg/kg | | . | . |
| Lead | SL | Pond C | C-05 | SW7421 | > | 64 | 11 | mg/kg | | . | . |
| Lead | SL | Pond C | C-04 | SW7421 | > | 22 | 1.9 | mg/kg | | . | . |
| Lead | SL | Pond C | C-03 | SW7421 | > | 27 | 1.9 | mg/kg | | . | . |
| Lead | SL | Pond C | C-02 | SW7421 | > | 36 | 1.9 | mg/kg | | . | . |
| Magnesium | SL | Pond C | C-6 | SW6010 | > | 8200 | . | mg/kg | | 0 | . |
| Magnesium | SL | Pond C | C-4 | SW6010 | > | 7200 | . | mg/kg | | 0 | . |
| Magnesium | SL | Pond C | C-3 | SW6010 | > | 13000 | . | mg/kg | | 0 | . |
| Magnesium | SL | Pond C | C-2 | SW6010 | > | 10000 | . | mg/kg | | 0 | . |
| Magnesium | SL | Pond C | C-5 | SW6010 | > | 11000 | . | mg/kg | | 0 | . |
| Magnesium | SL | Pond C | C-1 | SW6010 | > | 13000 | . | mg/kg | | 0 | . |
| Manganese | SL | Pond C | C-2 | SW6010 | > | 120 | . | mg/kg | | 0 | . |
| Manganese | SL | Pond C | C-6 | SW6010 | > | 110 | . | mg/kg | | 0 | . |
| Manganese | SL | Pond C | C-4 | SW6010 | > | 92 | . | mg/kg | | 0 | . |
| Manganese | SL | Pond C | C-3 | SW6010 | > | 180 | . | mg/kg | | 0 | . |
| Manganese | SL | Pond C | C-1 | SW6010 | > | 210 | . | mg/kg | | 0 | . |
| Manganese | SL | Pond C | C-5 | SW6010 | > | 170 | . | mg/kg | | 0 | . |
| Mercury | SL | Pond C | C-05 | SW7471 | > | 1 | 0.56 | mg/kg | @ | . | . |
| Mercury | SL | Pond C | C-01 | SW7471 | > | 1.6 | 0.5 | mg/kg | @ | . | . |
| Mercury | SL | Pond C | C-03 | SW7471 | > | 0.84 | 0.35 | mg/kg | @ | . | . |
| Mercury | SL | Pond C | C-04 | SW7471 | > | 0.94 | 0.37 | mg/kg | @ | . | . |
| Mercury | SL | Pond C | C-06 | SW7471 | > | 0.54 | 0.25 | mg/kg | @ | . | . |
| Mercury | SL | Pond C | C-02 | SW7471 | > | 0.83 | 0.35 | mg/kg | @ | . | . |
| Methyl ethyl ketone | SL | Pond C | C-02 | SW8240 | < | 0.19 | 0.76 | mg/kg | J | . | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Methyl ethyl ketone | SL | Pond C | C-6 | SW8240 | ND | 0.0075 | 0.015 | mg/kg | | 0 | . |
| Methyl ethyl ketone | SL | Pond C | C-01 | SW8240 | < | 0.043 | 0.13 | mg/kg | J | . | . |
| Methyl ethyl ketone | SL | Pond C | C-5 | SW8240 | > | 0.016 | . | mg/kg | J | 0 | . |
| Methyl ethyl ketone | SL | Pond C | C-3 | SW8240 | ND | 0.008 | 0.016 | mg/kg | | 0 | . |
| Methyl ethyl ketone | SL | Pond C | C-2 | SW8240 | ND | 0.007 | 0.014 | mg/kg | | 0 | . |
| Methyl ethyl ketone | SL | Pond C | C-1 | SW8240 | ND | 0.009 | 0.018 | mg/kg | | 0 | . |
| Methyl ethyl ketone | SL | Pond C | C-06 | SW8240 | < | 0.13 | 0.55 | mg/kg | J | . | . |
| Methyl ethyl ketone | SL | Pond C | C-4 | SW8240 | ND | 0.008 | 0.016 | mg/kg | | 0 | . |
| Methyl ethyl ketone | SL | Pond C | C-05 | SW8240 | < | 0.31 | 1.2 | mg/kg | J | . | . |
| Methyl ethyl ketone | SL | Pond C | C-04 | SW8240 | < | 0.072 | 0.87 | mg/kg | J | . | . |
| Methyl ethyl ketone | SL | Pond C | C-03 | SW8240 | < | 0.29 | 0.76 | mg/kg | J | . | . |
| Methylene chloride | SL | Pond C | C-4 | SW8240 | ND | 0.0039 | 0.0078 | mg/kg | | 0 | . |
| Methylene chloride | SL | Pond C | C-3 | SW8240 | > | 0.0022 | . | mg/kg | JB | 0 | . |
| Methylene chloride | SL | Pond C | C-2 | SW8240 | > | 0.0019 | . | mg/kg | J | 0 | . |
| Methylene chloride | SL | Pond C | C-1 | SW8240 | > | 0.0045 | . | mg/kg | JB | 0 | . |
| Methylene chloride | SL | Pond C | C-5 | SW8240 | > | 0.0073 | . | mg/kg | J | 0 | . |
| Methylene chloride | SL | Pond C | C-6 | SW8240 | > | 0.0027 | . | mg/kg | JB | 0 | . |
| Methylene chloride | SL | Pond C | C-01 | SW8240 | ND | 0.00325 | 0.0065 | mg/kg | | . | . |
| Nickel | SL | Pond C | C-3 | SW6010 | > | 9.1 | . | mg/kg | @ | 0 | . |
| Nickel | SL | Pond C | C-02 | SW6010 | > | 15 | 12 | mg/kg | @ | . | . |
| Nickel | SL | Pond C | C-5 | SW6010 | > | 7.9 | . | mg/kg | @ | 0 | . |
| Nickel | SL | Pond C | C-03 | SW6010 | ND | 8.25 | 11 | mg/kg | | . | . |
| Nickel | SL | Pond C | C-04 | SW6010 | ND | 10.5 | 14 | mg/kg | | . | . |
| Nickel | SL | Pond C | C-1 | SW6010 | > | 7.5 | . | mg/kg | @ | 0 | . |
| Nickel | SL | Pond C | C-2 | SW6010 | > | 6.2 | . | mg/kg | @ | 0 | . |
| Nickel | SL | Pond C | C-6 | SW6010 | > | 6 | . | mg/kg | @ | 0 | . |
| Nickel | SL | Pond C | C-05 | SW6010 | ND | 15 | 20 | mg/kg | | . | . |
| Nickel | SL | Pond C | C-4 | SW6010 | > | 4.4 | . | mg/kg | @ | 0 | . |
| Nickel | SL | Pond C | C-01 | SW6010 | ND | 13.5 | 18 | mg/kg | | . | . |
| Nickel | SL | Pond C | C-06 | SW6010 | > | 12 | 8 | mg/kg | @ | . | . |
| Phenanthrene | SL | Pond C | C-03 | SW8270 | < | 0.74 | 7.4 | mg/kg | J | . | . |
| Phenanthrene | SL | Pond C | C-02 | SW8270 | < | 1 | 7.5 | mg/kg | J | . | . |
| Phenanthrene | SL | Pond C | C-01 | SW8270 | < | 0.097 | 1.3 | mg/kg | J | . | . |
| Phenanthrene | SL | Pond C | C-6 | SW8270 | ND | 0.26 | 0.52 | mg/kg | | 0 | . |
| Phenanthrene | SL | Pond C | C-4 | SW8270 | ND | 0.27 | 0.54 | mg/kg | | 0 | . |
| Phenanthrene | SL | Pond C | C-3 | SW8270 | > | 0.3 | . | mg/kg | J | 0 | . |
| Phenanthrene | SL | Pond C | C-2 | SW8270 | ND | 0.24 | 0.48 | mg/kg | | 0 | . |
| Phenanthrene | SL | Pond C | C-1 | SW8270 | > | 1.8 | . | mg/kg | @ | 0 | . |
| Phenanthrene | SL | Pond C | C-06 | SW8270 | < | 1.3 | 5.4 | mg/kg | J | . | . |
| Phenanthrene | SL | Pond C | C-5 | SW8270 | > | 11 | . | mg/kg | @ | 0 | . |
| Phenanthrene | SL | Pond C | C-05 | SW8270 | < | 0.76 | 12 | mg/kg | J | . | . |
| Phenanthrene | SL | Pond C | C-04 | SW8270 | < | 1.1 | 8.6 | mg/kg | J | . | . |
| Phenol | SL | Pond C | C-2 | SW8270 | ND | 0.115 | 0.23 | mg/kg | | 0 | . |
| Phenol | SL | Pond C | C-6 | SW8270 | > | 0.15 | . | mg/kg | J | 0 | . |
| Phenol | SL | Pond C | C-1 | SW8270 | ND | 0.15 | 0.3 | mg/kg | | 0 | . |
| Phenol | SL | Pond C | C-3 | SW8270 | ND | 0.135 | 0.27 | mg/kg | | 0 | . |
| Phenol | SL | Pond C | C-4 | SW8270 | ND | 0.13 | 0.26 | mg/kg | | 0 | . |
| Potassium | SL | Pond C | C-5 | SW6010 | > | 1700 | . | mg/kg | @ | 0 | . |
| Potassium | SL | Pond C | C-6 | SW6010 | > | 2600 | . | mg/kg | | 0 | . |
| Potassium | SL | Pond C | C-4 | SW6010 | > | 1500 | . | mg/kg | @ | 0 | . |
| Potassium | SL | Pond C | C-2 | SW6010 | > | 2100 | . | mg/kg | | 0 | . |
| Potassium | SL | Pond C | C-3 | SW6010 | > | 2700 | . | mg/kg | | 0 | . |
| Potassium | SL | Pond C | C-1 | SW6010 | > | 2700 | . | mg/kg | @ | 0 | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pyrene | SL | Pond C | C-03 | SW8270 | ND | 5.55 | 7.4 | mg/kg | | . | . |
| Pyrene | SL | Pond C | C-1 | SW8270 | ND | 0.12 | 0.24 | mg/kg | | 0 | . |
| Pyrene | SL | Pond C | C-06 | SW8270 | ND | 4.05 | 5.4 | mg/kg | | . | . |
| Pyrene | SL | Pond C | C-3 | SW8270 | ND | 0.11 | 0.22 | mg/kg | | 0 | . |
| Pyrene | SL | Pond C | C-5 | SW8270 | ND | 3.3 | 6.6 | mg/kg | | 0 | . |
| Pyrene | SL | Pond C | C-4 | SW8270 | ND | 0.105 | 0.21 | mg/kg | | 0 | . |
| Pyrene | SL | Pond C | C-2 | SW8270 | ND | 0.095 | 0.19 | mg/kg | | 0 | . |
| Pyrene | SL | Pond C | C-05 | SW8270 | ND | 9 | 12 | mg/kg | | . | . |
| Pyrene | SL | Pond C | C-02 | SW8270 | < | 0.57 | 7.5 | mg/kg | J | . | . |
| Pyrene | SL | Pond C | C-6 | SW8270 | > | 0.2 | . | mg/kg | @ | 0 | . |
| Pyrene | SL | Pond C | C-01 | SW8270 | < | 0.092 | 1.3 | mg/kg | J | . | . |
| Pyrene | SL | Pond C | C-04 | SW8270 | ND | 6.45 | 8.6 | mg/kg | | . | . |
| Selenium | SL | Pond C | C-01 | SW7740 | > | 6.3 | 4.3 | mg/kg | @ | . | . |
| Selenium | SL | Pond C | C-3 | SW7740 | ND | 0.47 | 0.94 | mg/kg | | 0 | . |
| Selenium | SL | Pond C | C-6 | SW7740 | ND | 0.38 | 0.76 | mg/kg | | 0 | . |
| Selenium | SL | Pond C | C-5 | SW7740 | ND | 0.75 | 1.5 | mg/kg | | 0 | . |
| Selenium | SL | Pond C | C-4 | SW7740 | ND | 0.44 | 0.88 | mg/kg | | 0 | . |
| Selenium | SL | Pond C | C-2 | SW7740 | ND | 0.37 | 0.74 | mg/kg | | 0 | . |
| Selenium | SL | Pond C | C-1 | SW7740 | ND | 0.49 | 0.98 | mg/kg | | 0 | . |
| Selenium | SL | Pond C | C-06 | SW7740 | > | 3 | 2.2 | mg/kg | @ | . | . |
| Selenium | SL | Pond C | C-05 | SW7740 | > | 6.3 | 4.7 | mg/kg | @ | . | . |
| Selenium | SL | Pond C | C-04 | SW7740 | ND | 2.4 | 3.2 | mg/kg | | . | . |
| Selenium | SL | Pond C | C-03 | SW7740 | ND | 2.4 | 3.2 | mg/kg | | . | . |
| Selenium | SL | Pond C | C-02 | SW7740 | > | 3.9 | 3.2 | mg/kg | @ | . | . |
| Silicon | SL | Pond C | C-4 | SW6010 | > | 3900 | . | mg/kg | | 0 | . |
| Silicon | SL | Pond C | C-3 | SW6010 | > | 820 | . | mg/kg | @ | 0 | . |
| Silicon | SL | Pond C | C-2 | SW6010 | > | 2400 | . | mg/kg | | 0 | . |
| Silicon | SL | Pond C | C-5 | SW6010 | > | 8200 | . | mg/kg | | 0 | . |
| Silicon | SL | Pond C | C-1 | SW6010 | > | 800 | . | mg/kg | @ | 0 | . |
| Silicon | SL | Pond C | C-6 | SW6010 | > | 500 | . | mg/kg | @ | 0 | . |
| Silver | SL | Pond C | C-01 | SW6010 | > | 320 | 9.2 | mg/kg | | . | . |
| Silver | SL | Pond C | C-03 | SW6010 | > | 190 | 5.6 | mg/kg | | . | . |
| Silver | SL | Pond C | C-1 | SW6010 | > | 4.9 | . | mg/kg | @ | 0 | . |
| Silver | SL | Pond C | C-04 | SW6010 | > | 170 | 7.1 | mg/kg | | . | . |
| Silver | SL | Pond C | C-06 | SW6010 | > | 95 | 4 | mg/kg | | . | . |
| Silver | SL | Pond C | C-5 | SW6010 | ND | 1.3 | 2.6 | mg/kg | | 0 | . |
| Silver | SL | Pond C | C-3 | SW6010 | ND | 0.9 | 1.8 | mg/kg | | 0 | . |
| Silver | SL | Pond C | C-05 | SW6010 | > | 160 | 10 | mg/kg | | . | . |
| Silver | SL | Pond C | C-2 | SW6010 | ND | 0.7 | 1.4 | mg/kg | | 0 | . |
| Silver | SL | Pond C | C-4 | SW6010 | > | 1.8 | . | mg/kg | @ | 0 | . |
| Silver | SL | Pond C | C-6 | SW6010 | ND | 0.7 | 1.4 | mg/kg | | 0 | . |
| Silver | SL | Pond C | C-02 | SW6010 | > | 200 | 5.9 | mg/kg | | . | . |
| Sodium | SL | Pond C | C-2 | SW6010 | > | 750 | . | mg/kg | | 0 | . |
| Sodium | SL | Pond C | C-1 | SW6010 | > | 1300 | . | mg/kg | | 0 | . |
| Sodium | SL | Pond C | C-3 | SW6010 | > | 1400 | . | mg/kg | | 0 | . |
| Sodium | SL | Pond C | C-6 | SW6010 | > | 640 | . | mg/kg | @ | 0 | . |
| Sodium | SL | Pond C | C-5 | SW6010 | > | 2300 | . | mg/kg | | 0 | . |
| Sodium | SL | Pond C | C-4 | SW6010 | > | 1000 | . | mg/kg | | 0 | . |
| Sulfide | SL | Pond C | C-05 | SW9030 | > | 2100 | 310 | mg/kg | | . | . |
| Sulfide | SL | Pond C | C-01 | SW9030 | > | 2800 | 250 | mg/kg | | . | . |
| Sulfide | SL | Pond C | C-06 | SW9030 | > | 1400 | 140 | mg/kg | | . | . |
| Sulfide | SL | Pond C | C-04 | SW9030 | > | 1600 | 210 | mg/kg | | . | . |
| Sulfide | SL | Pond C | C-03 | SW9030 | < | 190 | 190 | mg/kg | | . | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sulfide | SL | Pond C | C-02 | SW9030 | > | 1100 | 190 | mg/kg | | . | . |
| Tetrachloroethene | SL | Pond C | C-05 | SW8240 | < | 0.06 | 0.06 | mg/kg | | . | . |
| Tetrachloroethene | SL | Pond C | C-04 | SW8240 | < | 0.043 | 0.043 | mg/kg | | . | . |
| Tetrachloroethene | SL | Pond C | C-03 | SW8240 | < | 0.038 | 0.038 | mg/kg | | . | . |
| Tetrachloroethene | SL | Pond C | C-02 | SW8240 | < | 0.038 | 0.038 | mg/kg | | . | . |
| Tetrachloroethene | SL | Pond C | C-06 | SW8240 | < | 0.00081 | 0.027 | mg/kg | J | . | . |
| Tetrachloroethene | SL | Pond C | C-01 | SW8240 | < | 0.0065 | 0.0065 | mg/kg | | . | . |
| Toluene | SL | Pond C | C-01 | SW8240 | > | 0.0072 | 0.0065 | mg/kg | B@ | . | . |
| Toluene | SL | Pond C | C-02 | SW8240 | < | 0.0069 | 0.038 | mg/kg | JB | . | . |
| Toluene | SL | Pond C | C-03 | SW8240 | < | 0.0086 | 0.038 | mg/kg | JB | . | . |
| Toluene | SL | Pond C | C-06 | SW8240 | < | 0.015 | 0.027 | mg/kg | JB | . | . |
| Toluene | SL | Pond C | C-04 | SW8240 | < | 0.0065 | 0.043 | mg/kg | JB | . | . |
| Toluene | SL | Pond C | C-05 | SW8240 | < | 0.013 | 0.06 | mg/kg | JB | . | . |
| Vanadium | SL | Pond C | C-05 | SW6010 | > | 47 | 20 | mg/kg | @ | . | . |
| Vanadium | SL | Pond C | C-3 | SW6010 | > | 28 | . | mg/kg | | 0 | . |
| Vanadium | SL | Pond C | C-04 | SW6010 | > | 37 | 14 | mg/kg | @ | . | . |
| Vanadium | SL | Pond C | C-06 | SW6010 | > | 32 | 8 | mg/kg | @ | . | . |
| Vanadium | SL | Pond C | C-4 | SW6010 | > | 15 | . | mg/kg | @ | 0 | . |
| Vanadium | SL | Pond C | C-02 | SW6010 | > | 48 | 12 | mg/kg | @ | . | . |
| Vanadium | SL | Pond C | C-2 | SW6010 | > | 15 | . | mg/kg | | 0 | . |
| Vanadium | SL | Pond C | C-03 | SW6010 | > | 40 | 11 | mg/kg | @ | . | . |
| Vanadium | SL | Pond C | C-6 | SW6010 | > | 18 | . | mg/kg | | 0 | . |
| Vanadium | SL | Pond C | C-5 | SW6010 | > | 24 | . | mg/kg | @ | 0 | . |
| Vanadium | SL | Pond C | C-01 | SW6010 | > | 55 | 18 | mg/kg | @ | . | . |
| Vanadium | SL | Pond C | C-1 | SW6010 | > | 27 | . | mg/kg | | 0 | . |
| Xylenes | SL | Pond C | C-1 | SW8240 | > | 0.0024 | . | mg/kg | J | 0 | . |
| Xylenes | SL | Pond C | C-6 | SW8240 | ND | 0.00365 | 0.0073 | mg/kg | | 0 | . |
| Xylenes | SL | Pond C | C-01 | SW8240 | > | 0.017 | 0.0065 | mg/kg | @ | . | . |
| Xylenes | SL | Pond C | C-3 | SW8240 | > | 0.0026 | . | mg/kg | JB | 0 | . |
| Xylenes | SL | Pond C | C-2 | SW8240 | ND | 0.0035 | 0.007 | mg/kg | | 0 | . |
| Xylenes | SL | Pond C | C-5 | SW8240 | ND | 0.0085 | 0.017 | mg/kg | | 0 | . |
| Xylenes | SL | Pond C | C-06 | SW8240 | > | 0.045 | 0.027 | mg/kg | @ | . | . |
| Xylenes | SL | Pond C | C-05 | SW8240 | > | 0.13 | 0.06 | mg/kg | @ | . | . |
| Xylenes | SL | Pond C | C-4 | SW8240 | ND | 0.0039 | 0.0078 | mg/kg | | 0 | . |
| Xylenes | SL | Pond C | C-04 | SW8240 | > | 0.071 | 0.043 | mg/kg | @ | . | . |
| Xylenes | SL | Pond C | C-03 | SW8240 | > | 0.077 | 0.038 | mg/kg | @ | . | . |
| Xylenes | SL | Pond C | C-02 | SW8240 | > | 0.082 | 0.038 | mg/kg | @ | . | . |
| Zinc | SL | Pond C | C-02 | SW6010 | > | 240 | 12 | mg/kg | | . | . |
| Zinc | SL | Pond C | C-03 | SW6010 | > | 250 | 11 | mg/kg | | . | . |
| Zinc | SL | Pond C | C-01 | SW6010 | > | 330 | 18 | mg/kg | | . | . |
| Zinc | SL | Pond C | C-04 | SW6010 | > | 170 | 14 | mg/kg | | . | . |
| Zinc | SL | Pond C | C-3 | SW6010 | > | 65 | . | mg/kg | | 0 | . |
| Zinc | SL | Pond C | C-4 | SW6010 | > | 34 | . | mg/kg | | 0 | . |
| Zinc | SL | Pond C | C-6 | SW6010 | > | 25 | . | mg/kg | | 0 | . |
| Zinc | SL | Pond C | C-1 | SW6010 | > | 66 | . | mg/kg | | 0 | . |
| Zinc | SL | Pond C | C-2 | SW6010 | > | 37 | . | mg/kg | | 0 | . |
| Zinc | SL | Pond C | C-05 | SW6010 | > | 240 | 20 | mg/kg | | . | . |
| Zinc | SL | Pond C | C-5 | SW6010 | > | 130 | . | mg/kg | | 0 | . |
| Zinc | SL | Pond C | C-06 | SW6010 | > | 110 | 8 | mg/kg | | . | . |
| 4,4'-DDD | SO | Pond C | C-03 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 2 | 4 |
| 4,4'-DDD | SO | Pond C | C-01 | SW8080 | > | 0.061 | 0.021 | mg/kg | X@ | 0 | 2 |
| 4,4'-DDD | SO | Pond C | C-06 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 2 | 4 |
| 4,4'-DDD | SO | Pond C | C-1 | SW8080 | > | 0.16 | . | mg/kg | CG | 0.5 | 1.5 |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4,4'-DDD | SO | Pond C | C-5 | SW8080 | ND | 0.026 | 0.052 | mg/kg | | 0.5 | 1.5 |
| 4,4'-DDD | SO | Pond C | C-2 | SW8080 | > | 0.18 | . | mg/kg | C@ | 0.5 | 1.5 |
| 4,4'-DDD | SO | Pond C | C-05 | SW8080 | > | 0.0075 | 0.0014 | mg/kg | C | 0 | 2 |
| 4,4'-DDD | SO | Pond C | C-02 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| 4,4'-DDD | SO | Pond C | C-03 | SW8080 | > | 0.098 | 0.0027 | mg/kg | C | 0 | 2 |
| 4,4'-DDD | SO | Pond C | C-04 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| 4,4'-DDD | SO | Pond C | C-06 | SW8080 | > | 0.0023 | 0.0013 | mg/kg | C@ | 0 | 2 |
| 4,4'-DDD | SO | Pond C | C-6 | SW8080 | > | 0.074 | . | mg/kg | CG | 0.5 | 1.5 |
| 4,4'-DDD | SO | Pond C | C-4 | SW8080 | > | 0.078 | . | mg/kg | C | 0.5 | 1.5 |
| 4,4'-DDD | SO | Pond C | C-3 | SW8080 | > | 0.16 | . | mg/kg | CG | 0.5 | 1.5 |
| 4,4'-DDE | SO | Pond C | C-1 | SW8080 | > | 0.014 | . | mg/kg | C@ | 0.5 | 1.5 |
| 4,4'-DDE | SO | Pond C | C-06 | SW8080 | > | 0.0055 | 0.0013 | mg/kg | X@ | 0 | 2 |
| 4,4'-DDE | SO | Pond C | C-06 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 2 | 4 |
| 4,4'-DDE | SO | Pond C | C-04 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| 4,4'-DDE | SO | Pond C | C-03 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 2 | 4 |
| 4,4'-DDE | SO | Pond C | C-03 | SW8080 | > | 0.018 | 0.0027 | mg/kg | C | 0 | 2 |
| 4,4'-DDE | SO | Pond C | C-02 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| 4,4'-DDE | SO | Pond C | C-01 | SW8080 | > | 0.062 | 0.021 | mg/kg | C@ | 0 | 2 |
| 4,4'-DDE | SO | Pond C | C-3 | SW8080 | ND | 0.012 | 0.024 | mg/kg | | 0.5 | 1.5 |
| 4,4'-DDE | SO | Pond C | C-2 | SW8080 | > | 0.24 | . | mg/kg | C@ | 0.5 | 1.5 |
| 4,4'-DDE | SO | Pond C | C-05 | SW8080 | > | 0.014 | 0.0014 | mg/kg | X | 0 | 2 |
| 4,4'-DDE | SO | Pond C | C-6 | SW8080 | ND | 0.00255 | 0.0051 | mg/kg | | 0.5 | 1.5 |
| 4,4'-DDE | SO | Pond C | C-5 | SW8080 | ND | 0.026 | 0.052 | mg/kg | | 0.5 | 1.5 |
| 4,4'-DDE | SO | Pond C | C-4 | SW8080 | > | 0.021 | . | mg/kg | C@ | 0.5 | 1.5 |
| 4,4'-DDT | SO | Pond C | C-05 | SW8080 | < | 0.0027 | 0.0027 | mg/kg | | 0 | 2 |
| 4,4'-DDT | SO | Pond C | C-06 | SW8080 | < | 0.0025 | 0.0025 | mg/kg | | 2 | 4 |
| 4,4'-DDT | SO | Pond C | C-03 | SW8080 | < | 0.0026 | 0.0026 | mg/kg | | 2 | 4 |
| 4,4'-DDT | SO | Pond C | C-01 | SW8080 | < | 0.042 | 0.042 | mg/kg | | 0 | 2 |
| 4,4'-DDT | SO | Pond C | C-04 | SW8080 | < | 0.0027 | 0.0027 | mg/kg | | 0 | 2 |
| 4,4'-DDT | SO | Pond C | C-02 | SW8080 | < | 0.0027 | 0.0027 | mg/kg | | 0 | 2 |
| 4,4'-DDT | SO | Pond C | C-06 | SW8080 | < | 0.0024 | 0.0026 | mg/kg | JC | 0 | 2 |
| 4,4'-DDT | SO | Pond C | C-03 | SW8080 | > | 0.0057 | 0.0055 | mg/kg | X@ | 0 | 2 |
| Acetone | SO | Pond C | C-03 | SW8240 | < | 0.012 | 0.13 | mg/kg | J | 2 | 4 |
| Acetone | SO | Pond C | C-02 | SW8240 | < | 0.056 | 0.14 | mg/kg | J | 0 | 2 |
| Acetone | SO | Pond C | C-03 | SW8240 | < | 0.03 | 0.14 | mg/kg | J | 0 | 2 |
| Acetone | SO | Pond C | C-6 | SW8240 | > | 0.0091 | . | mg/kg | JB | 0.5 | 1.5 |
| Acetone | SO | Pond C | C-01 | SW8240 | < | 0.43 | 1.1 | mg/kg | J | 0 | 2 |
| Acetone | SO | Pond C | C-5 | SW8240 | > | 0.008 | . | mg/kg | J | 0.5 | 1.5 |
| Acetone | SO | Pond C | C-3 | SW8240 | > | 0.0078 | . | mg/kg | JB | 0.5 | 1.5 |
| Acetone | SO | Pond C | C-2 | SW8240 | > | 0.019 | . | mg/kg | @ | 0.5 | 1.5 |
| Acetone | SO | Pond C | C-1 | SW8240 | > | 0.0073 | . | mg/kg | JB | 0.5 | 1.5 |
| Acetone | SO | Pond C | C-06 | SW8240 | < | 0.031 | 0.13 | mg/kg | J | 2 | 4 |
| Acetone | SO | Pond C | C-4 | SW8240 | ND | 0.0075 | 0.015 | mg/kg | | 0.5 | 1.5 |
| Acetone | SO | Pond C | C-06 | SW8240 | < | 0.0084 | 0.13 | mg/kg | J | 0 | 2 |
| Acetone | SO | Pond C | C-05 | SW8240 | ND | 0.105 | 0.14 | mg/kg | | 0 | 2 |
| Acetone | SO | Pond C | C-04 | SW8240 | ND | 0.105 | 0.14 | mg/kg | | 0 | 2 |
| Aldrin | SO | Pond C | C-04 | SW8080 | > | 0.002 | 0.0014 | mg/kg | C@ | 0 | 2 |
| Aldrin | SO | Pond C | C-03 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 2 | 4 |
| Aldrin | SO | Pond C | C-03 | SW8080 | < | 0.0027 | 0.0027 | mg/kg | | 0 | 2 |
| Aldrin | SO | Pond C | C-02 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| Aldrin | SO | Pond C | C-05 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| Aldrin | SO | Pond C | C-06 | SW8080 | > | 0.0022 | 0.0013 | mg/kg | C@ | 0 | 2 |
| Aldrin | SO | Pond C | C-01 | SW8080 | < | 0.021 | 0.021 | mg/kg | | 0 | 2 |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Aldrin | SO | Pond C | C-06 | SW8080 | > | 0.0015 | 0.0013 | mg/kg | C@ | 2 | 4 |
| Aluminum | SO | Pond C | C-3 | SW6010 | > | 11000 | . | mg/kg | | 0.5 | 1.5 |
| Aluminum | SO | Pond C | C-1 | SW6010 | > | 10000 | . | mg/kg | | 0.5 | 1.5 |
| Aluminum | SO | Pond C | C-2 | SW6010 | > | 11000 | . | mg/kg | | 0.5 | 1.5 |
| Aluminum | SO | Pond C | C-6 | SW6010 | > | 9200 | . | mg/kg | | 0.5 | 1.5 |
| Aluminum | SO | Pond C | C-5 | SW6010 | > | 11000 | . | mg/kg | | 0.5 | 1.5 |
| Aluminum | SO | Pond C | C-4 | SW6010 | > | 9200 | . | mg/kg | | 0.5 | 1.5 |
| Arsenic | SO | Pond C | C-04 | SW7060 | > | 1.1 | 0.45 | mg/kg | @ | 0 | 2 |
| Arsenic | SO | Pond C | C-03 | SW7060 | > | 0.79 | 0.42 | mg/kg | @ | 0 | 2 |
| Arsenic | SO | Pond C | C-02 | SW7060 | > | 2.2 | 0.51 | mg/kg | @ | 0 | 2 |
| Arsenic | SO | Pond C | C-05 | SW7060 | > | 1 | 0.39 | mg/kg | @ | 0 | 2 |
| Arsenic | SO | Pond C | C-06 | SW7060 | > | 2.6 | 0.39 | mg/kg | | 0 | 2 |
| Arsenic | SO | Pond C | C-5 | SW7060 | ND | 0.55 | 1.1 | mg/kg | | 0.5 | 1.5 |
| Arsenic | SO | Pond C | C-01 | SW7060 | > | 2.4 | 0.38 | mg/kg | | 0 | 2 |
| Arsenic | SO | Pond C | C-3 | SW7060 | ND | 0.5 | 1 | mg/kg | | 0.5 | 1.5 |
| Arsenic | SO | Pond C | C-2 | SW7060 | ND | 0.6 | 1.2 | mg/kg | | 0.5 | 1.5 |
| Arsenic | SO | Pond C | C-1 | SW7060 | > | 1.7 | . | mg/kg | @ | 0.5 | 1.5 |
| Arsenic | SO | Pond C | C-4 | SW7060 | > | 1.1 | . | mg/kg | @ | 0.5 | 1.5 |
| Arsenic | SO | Pond C | C-06 | SW7060 | > | 2.4 | 0.42 | mg/kg | | 2 | 4 |
| Arsenic | SO | Pond C | C-6 | SW7060 | > | 1.2 | . | mg/kg | @ | 0.5 | 1.5 |
| Arsenic | SO | Pond C | C-03 | SW7060 | > | 1.3 | 0.36 | mg/kg | @ | 2 | 4 |
| Barium | SO | Pond C | C-5 | SW6010 | > | 96 | . | mg/kg | | 0.5 | 1.5 |
| Barium | SO | Pond C | C-6 | SW6010 | > | 160 | . | mg/kg | | 0.5 | 1.5 |
| Barium | SO | Pond C | C-4 | SW6010 | > | 94 | . | mg/kg | | 0.5 | 1.5 |
| Barium | SO | Pond C | C-1 | SW6010 | > | 84 | . | mg/kg | | 0.5 | 1.5 |
| Barium | SO | Pond C | C-06 | SW6010 | > | 88 | 4.2 | mg/kg | | 2 | 4 |
| Barium | SO | Pond C | C-06 | SW6010 | > | 59 | 4.4 | mg/kg | | 0 | 2 |
| Barium | SO | Pond C | C-05 | SW6010 | > | 64 | 4.2 | mg/kg | | 0 | 2 |
| Barium | SO | Pond C | C-04 | SW6010 | > | 44 | 4.2 | mg/kg | | 0 | 2 |
| Barium | SO | Pond C | C-03 | SW6010 | > | 61 | 4 | mg/kg | | 2 | 4 |
| Barium | SO | Pond C | C-03 | SW6010 | > | 54 | 4.4 | mg/kg | | 0 | 2 |
| Barium | SO | Pond C | C-3 | SW6010 | > | 160 | . | mg/kg | | 0.5 | 1.5 |
| Barium | SO | Pond C | C-2 | SW6010 | > | 110 | . | mg/kg | | 0.5 | 1.5 |
| Barium | SO | Pond C | C-02 | SW6010 | > | 63 | 3.9 | mg/kg | | 0 | 2 |
| Barium | SO | Pond C | C-01 | SW6010 | > | 110 | 3.8 | mg/kg | | 0 | 2 |
| Beryllium | SO | Pond C | C-4 | SW6010 | > | 0.3 | . | mg/kg | @ | 0.5 | 1.5 |
| Beryllium | SO | Pond C | C-03 | SW6010 | ND | 0.44 | 0.88 | mg/kg | | 0 | 2 |
| Beryllium | SO | Pond C | C-2 | SW6010 | > | 0.41 | . | mg/kg | @ | 0.5 | 1.5 |
| Beryllium | SO | Pond C | C-02 | SW6010 | ND | 0.39 | 0.78 | mg/kg | | 0 | 2 |
| Beryllium | SO | Pond C | C-01 | SW6010 | ND | 0.385 | 0.77 | mg/kg | | 0 | 2 |
| Beryllium | SO | Pond C | C-06 | SW6010 | ND | 0.42 | 0.84 | mg/kg | | 2 | 4 |
| Beryllium | SO | Pond C | C-04 | SW6010 | ND | 0.42 | 0.84 | mg/kg | | 0 | 2 |
| Beryllium | SO | Pond C | C-1 | SW6010 | > | 0.42 | . | mg/kg | @ | 0.5 | 1.5 |
| Beryllium | SO | Pond C | C-03 | SW6010 | ND | 0.405 | 0.81 | mg/kg | | 2 | 4 |
| Beryllium | SO | Pond C | C-5 | SW6010 | > | 0.38 | . | mg/kg | @ | 0.5 | 1.5 |
| Beryllium | SO | Pond C | C-3 | SW6010 | > | 0.44 | . | mg/kg | @ | 0.5 | 1.5 |
| Beryllium | SO | Pond C | C-05 | SW6010 | ND | 0.42 | 0.84 | mg/kg | | 0 | 2 |
| Beryllium | SO | Pond C | C-6 | SW6010 | > | 0.37 | . | mg/kg | @ | 0.5 | 1.5 |
| beta-BHC | SO | Pond C | C-04 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| beta-BHC | SO | Pond C | C-03 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 2 | 4 |
| beta-BHC | SO | Pond C | C-01 | SW8080 | > | 0.063 | 0.021 | mg/kg | X@ | 0 | 2 |
| beta-BHC | SO | Pond C | C-03 | SW8080 | < | 0.0027 | 0.0027 | mg/kg | | 0 | 2 |
| beta-BHC | SO | Pond C | C-05 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| beta-BHC | SO | Pond C | C-06 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 0 | 2 |
| beta-BHC | SO | Pond C | C-02 | SW8080 | > | 0.002 | 0.0014 | mg/kg | C@ | 0 | 2 |
| beta-BHC | SO | Pond C | C-06 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 2 | 4 |
| bis(2-Ethylhexyl)phthalate | SO | Pond C | C-02 | SW8270 | < | 0.16 | 1.4 | mg/kg | JB | 0 | 2 |
| bis(2-Ethylhexyl)phthalate | SO | Pond C | C-01 | SW8270 | < | 1.8 | 11 | mg/kg | JB | 0 | 2 |
| bis(2-Ethylhexyl)phthalate | SO | Pond C | C-03 | SW8270 | < | 0.38 | 1.3 | mg/kg | JB | 2 | 4 |
| bis(2-Ethylhexyl)phthalate | SO | Pond C | C-6 | SW8270 | ND | 0.21 | 0.42 | mg/kg | | 0.5 | 1.5 |
| bis(2-Ethylhexyl)phthalate | SO | Pond C | C-03 | SW8270 | < | 0.16 | 1.4 | mg/kg | JB | 0 | 2 |
| bis(2-Ethylhexyl)phthalate | SO | Pond C | C-04 | SW8270 | ND | 1.05 | 1.4 | mg/kg | | 0 | 2 |
| bis(2-Ethylhexyl)phthalate | SO | Pond C | C-4 | SW8270 | > | 0.21 | . | mg/kg | J | 0.5 | 1.5 |
| bis(2-Ethylhexyl)phthalate | SO | Pond C | C-3 | SW8270 | ND | 0.205 | 0.41 | mg/kg | | 0.5 | 1.5 |
| bis(2-Ethylhexyl)phthalate | SO | Pond C | C-2 | SW8270 | > | 0.5 | . | mg/kg | @ | 0.5 | 1.5 |
| bis(2-Ethylhexyl)phthalate | SO | Pond C | C-1 | SW8270 | ND | 0.215 | 0.43 | mg/kg | | 0.5 | 1.5 |
| bis(2-Ethylhexyl)phthalate | SO | Pond C | C-06 | SW8270 | < | 0.28 | 1.3 | mg/kg | JB | 2 | 4 |
| bis(2-Ethylhexyl)phthalate | SO | Pond C | C-5 | SW8270 | > | 0.14 | . | mg/kg | J | 0.5 | 1.5 |
| bis(2-Ethylhexyl)phthalate | SO | Pond C | C-06 | SW8270 | > | 7.9 | 1.3 | mg/kg | B | 0 | 2 |
| bis(2-Ethylhexyl)phthalate | SO | Pond C | C-05 | SW8270 | < | 0.18 | 1.4 | mg/kg | JB | 0 | 2 |
| Calcium | SO | Pond C | C-4 | SW6010 | > | 98000 | . | mg/kg | | 0.5 | 1.5 |
| Calcium | SO | Pond C | C-5 | SW6010 | > | 100000 | . | mg/kg | | 0.5 | 1.5 |
| Calcium | SO | Pond C | C-2 | SW6010 | > | 110000 | . | mg/kg | | 0.5 | 1.5 |
| Calcium | SO | Pond C | C-3 | SW6010 | > | 190000 | . | mg/kg | | 0.5 | 1.5 |
| Calcium | SO | Pond C | C-1 | SW6010 | > | 81000 | . | mg/kg | | 0.5 | 1.5 |
| Calcium | SO | Pond C | C-6 | SW6010 | > | 120000 | . | mg/kg | | 0.5 | 1.5 |
| Carbon disulfide | SO | Pond C | C-06 | SW8240 | ND | 0.0048 | 0.0064 | mg/kg | | 2 | 4 |
| Carbon disulfide | SO | Pond C | C-06 | SW8240 | ND | 0.005025 | 0.0067 | mg/kg | | 0 | 2 |
| Carbon disulfide | SO | Pond C | C-05 | SW8240 | < | 0.0016 | 0.0068 | mg/kg | J | 0 | 2 |
| Carbon disulfide | SO | Pond C | C-04 | SW8240 | < | 0.0067 | 0.0068 | mg/kg | J | 0 | 2 |
| Carbon disulfide | SO | Pond C | C-03 | SW8240 | < | 0.0029 | 0.0065 | mg/kg | J | 2 | 4 |
| Carbon disulfide | SO | Pond C | C-03 | SW8240 | > | 0.0085 | 0.007 | mg/kg | @ | 0 | 2 |
| Carbon disulfide | SO | Pond C | C-02 | SW8240 | > | 0.0076 | 0.0068 | mg/kg | @ | 0 | 2 |
| Carbon disulfide | SO | Pond C | C-1 | SW8240 | ND | 0.00335 | 0.0067 | mg/kg | | 0.5 | 1.5 |
| Carbon disulfide | SO | Pond C | C-2 | SW8240 | > | 0.027 | . | mg/kg | @ | 0.5 | 1.5 |
| Carbon disulfide | SO | Pond C | C-01 | SW8240 | ND | 0.03975 | 0.053 | mg/kg | | 0 | 2 |
| Carbon disulfide | SO | Pond C | C-6 | SW8240 | ND | 0.0032 | 0.0064 | mg/kg | | 0.5 | 1.5 |
| Carbon disulfide | SO | Pond C | C-3 | SW8240 | ND | 0.00315 | 0.0063 | mg/kg | | 0.5 | 1.5 |
| Carbon disulfide | SO | Pond C | C-4 | SW8240 | > | 0.019 | . | mg/kg | @ | 0.5 | 1.5 |
| Carbon disulfide | SO | Pond C | C-5 | SW8240 | > | 0.027 | . | mg/kg | @ | 0.5 | 1.5 |
| Chromium | SO | Pond C | C-06 | SW6010 | > | 6.7 | 4.2 | mg/kg | @ | 2 | 4 |
| Chromium | SO | Pond C | C-05 | SW6010 | ND | 3.15 | 4.2 | mg/kg | | 0 | 2 |
| Chromium | SO | Pond C | C-02 | SW6010 | > | 4.7 | 3.9 | mg/kg | @ | 0 | 2 |
| Chromium | SO | Pond C | C-01 | SW6010 | > | 4.4 | 3.8 | mg/kg | @ | 0 | 2 |
| Chromium | SO | Pond C | C-2 | SW6010 | > | 15 | . | mg/kg | | 0.5 | 1.5 |
| Chromium | SO | Pond C | C-03 | SW6010 | > | 5 | 4.4 | mg/kg | @ | 0 | 2 |
| Chromium | SO | Pond C | C-04 | SW6010 | ND | 3.15 | 4.2 | mg/kg | | 0 | 2 |
| Chromium | SO | Pond C | C-5 | SW6010 | > | 11 | . | mg/kg | | 0.5 | 1.5 |
| Chromium | SO | Pond C | C-3 | SW6010 | > | 10 | . | mg/kg | | 0.5 | 1.5 |
| Chromium | SO | Pond C | C-06 | SW6010 | > | 8.5 | 4.4 | mg/kg | @ | 0 | 2 |
| Chromium | SO | Pond C | C-4 | SW6010 | > | 8.2 | . | mg/kg | | 0.5 | 1.5 |
| Chromium | SO | Pond C | C-03 | SW6010 | > | 6.9 | 4 | mg/kg | @ | 2 | 4 |
| Chromium | SO | Pond C | C-1 | SW6010 | > | 9.6 | . | mg/kg | | 0.5 | 1.5 |
| Chromium | SO | Pond C | C-6 | SW6010 | > | 8.9 | . | mg/kg | | 0.5 | 1.5 |
| Cobalt | SO | Pond C | C-4 | SW6010 | > | 3 | . | mg/kg | @ | 0.5 | 1.5 |
| Cobalt | SO | Pond C | C-3 | SW6010 | > | 3.9 | . | mg/kg | @ | 0.5 | 1.5 |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cobalt | SO | Pond C | C-2 | SW6010 | > | 3.9 | . | mg/kg | @ | 0.5 | 1.5 |
| Cobalt | SO | Pond C | C-06 | SW6010 | ND | 2.1 | 4.2 | mg/kg | | 2 | 4 |
| Cobalt | SO | Pond C | C-06 | SW6010 | ND | 2.2 | 4.4 | mg/kg | | 0 | 2 |
| Cobalt | SO | Pond C | C-05 | SW6010 | ND | 2.1 | 4.2 | mg/kg | | 0 | 2 |
| Cobalt | SO | Pond C | C-04 | SW6010 | ND | 2.1 | 4.2 | mg/kg | | 0 | 2 |
| Cobalt | SO | Pond C | C-1 | SW6010 | > | 3.6 | . | mg/kg | @ | 0.5 | 1.5 |
| Cobalt | SO | Pond C | C-03 | SW6010 | ND | 2 | 4 | mg/kg | | 2 | 4 |
| Cobalt | SO | Pond C | C-03 | SW6010 | ND | 2.2 | 4.4 | mg/kg | | 0 | 2 |
| Cobalt | SO | Pond C | C-6 | SW6010 | > | 3.4 | . | mg/kg | @ | 0.5 | 1.5 |
| Cobalt | SO | Pond C | C-5 | SW6010 | > | 3.5 | . | mg/kg | @ | 0.5 | 1.5 |
| Cobalt | SO | Pond C | C-02 | SW6010 | ND | 1.95 | 3.9 | mg/kg | | 0 | 2 |
| Cobalt | SO | Pond C | C-01 | SW6010 | ND | 1.9 | 3.8 | mg/kg | | 0 | 2 |
| Copper | SO | Pond C | C-02 | SW6010 | ND | 3.9 | 7.8 | mg/kg | | 0 | 2 |
| Copper | SO | Pond C | C-4 | SW6010 | > | 6.6 | . | mg/kg | @ | 0.5 | 1.5 |
| Copper | SO | Pond C | C-2 | SW6010 | > | 18 | . | mg/kg | | 0.5 | 1.5 |
| Copper | SO | Pond C | C-03 | SW6010 | ND | 4.05 | 8.1 | mg/kg | | 2 | 4 |
| Copper | SO | Pond C | C-6 | SW6010 | > | 5.1 | . | mg/kg | @ | 0.5 | 1.5 |
| Copper | SO | Pond C | C-05 | SW6010 | ND | 4.2 | 8.4 | mg/kg | | 0 | 2 |
| Copper | SO | Pond C | C-06 | SW6010 | ND | 4.2 | 8.4 | mg/kg | | 2 | 4 |
| Copper | SO | Pond C | C-04 | SW6010 | ND | 4.2 | 8.4 | mg/kg | | 0 | 2 |
| Copper | SO | Pond C | C-3 | SW6010 | > | 7 | . | mg/kg | @ | 0.5 | 1.5 |
| Copper | SO | Pond C | C-1 | SW6010 | > | 7.6 | . | mg/kg | @ | 0.5 | 1.5 |
| Copper | SO | Pond C | C-01 | SW6010 | ND | 3.85 | 7.7 | mg/kg | | 0 | 2 |
| Copper | SO | Pond C | C-03 | SW6010 | ND | 4.4 | 8.8 | mg/kg | | 0 | 2 |
| Copper | SO | Pond C | C-06 | SW6010 | ND | 4.45 | 8.9 | mg/kg | | 0 | 2 |
| Copper | SO | Pond C | C-5 | SW6010 | > | 8.1 | . | mg/kg | @ | 0.5 | 1.5 |
| Cyanide | SO | Pond C | C-05 | SW9012 | < | 0.33 | 0.33 | mg/kg | | 0 | 2 |
| Cyanide | SO | Pond C | C-06 | SW9012 | < | 0.31 | 0.31 | mg/kg | | 0 | 2 |
| Cyanide | SO | Pond C | C-02 | SW9012 | > | 0.59 | 0.33 | mg/kg | @ | 0 | 2 |
| Cyanide | SO | Pond C | C-04 | SW9012 | < | 0.34 | 0.34 | mg/kg | | 0 | 2 |
| Cyanide | SO | Pond C | C-03 | SW9012 | > | 1.2 | 0.32 | mg/kg | @ | 2 | 4 |
| Cyanide | SO | Pond C | C-03 | SW9012 | > | 0.75 | 0.31 | mg/kg | @ | 0 | 2 |
| Cyanide | SO | Pond C | C-01 | SW9012 | > | 0.37 | 0.31 | mg/kg | @ | 0 | 2 |
| Cyanide | SO | Pond C | C-06 | SW9012 | < | 0.3 | 0.3 | mg/kg | | 2 | 4 |
| delta-BHC | SO | Pond C | C-05 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| delta-BHC | SO | Pond C | C-04 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| delta-BHC | SO | Pond C | C-03 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 2 | 4 |
| delta-BHC | SO | Pond C | C-03 | SW8080 | < | 0.0027 | 0.0027 | mg/kg | | 0 | 2 |
| delta-BHC | SO | Pond C | C-02 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| delta-BHC | SO | Pond C | C-06 | SW8080 | > | 0.0023 | 0.0013 | mg/kg | X@ | 0 | 2 |
| delta-BHC | SO | Pond C | C-06 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 2 | 4 |
| delta-BHC | SO | Pond C | C-01 | SW8080 | < | 0.021 | 0.021 | mg/kg | | 0 | 2 |
| Di-n-octylphthalate | SO | Pond C | C-05 | SW8270 | < | 1.4 | 1.4 | mg/kg | | 0 | 2 |
| Di-n-octylphthalate | SO | Pond C | C-06 | SW8270 | < | 1.3 | 1.3 | mg/kg | | 0 | 2 |
| Di-n-octylphthalate | SO | Pond C | C-02 | SW8270 | < | 0.22 | 1.4 | mg/kg | J | 0 | 2 |
| Di-n-octylphthalate | SO | Pond C | C-04 | SW8270 | < | 1.4 | 1.4 | mg/kg | | 0 | 2 |
| Di-n-octylphthalate | SO | Pond C | C-03 | SW8270 | < | 1.3 | 1.3 | mg/kg | | 2 | 4 |
| Di-n-octylphthalate | SO | Pond C | C-03 | SW8270 | < | 1.4 | 1.4 | mg/kg | | 0 | 2 |
| Di-n-octylphthalate | SO | Pond C | C-01 | SW8270 | < | 11 | 11 | mg/kg | | 0 | 2 |
| Di-n-octylphthalate | SO | Pond C | C-06 | SW8270 | < | 1.3 | 1.3 | mg/kg | | 2 | 4 |
| Dibutylphthalate | SO | Pond C | C-2 | SW8270 | ND | 0.12 | 0.24 | mg/kg | | 0.5 | 1.5 |
| Dibutylphthalate | SO | Pond C | C-1 | SW8270 | ND | 0.11 | 0.22 | mg/kg | | 0.5 | 1.5 |
| Dibutylphthalate | SO | Pond C | C-6 | SW8270 | ND | 0.105 | 0.21 | mg/kg | | 0.5 | 1.5 |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Dibutylphthalate | SO | Pond C | C-3 | SW8270 | ND | 0.1 | 0.2 | mg/kg | | 0.5 | 1.5 |
| Dibutylphthalate | SO | Pond C | C-5 | SW8270 | > | 0.21 | . | mg/kg | J | 0.5 | 1.5 |
| Dibutylphthalate | SO | Pond C | C-4 | SW8270 | > | 0.26 | . | mg/kg | @ | 0.5 | 1.5 |
| Dichloroprop | SO | Pond C | C-3 | SW8150 | ND | 0.0425 | 0.085 | mg/kg | | 0.5 | 1.5 |
| Dichloroprop | SO | Pond C | C-4 | SW8150 | ND | 0.0455 | 0.091 | mg/kg | | 0.5 | 1.5 |
| Dichloroprop | SO | Pond C | C-2 | SW8150 | > | 0.153 | . | mg/kg | C@ | 0.5 | 1.5 |
| Dichloroprop | SO | Pond C | C-5 | SW8150 | ND | 0.0425 | 0.085 | mg/kg | | 0.5 | 1.5 |
| Dichloroprop | SO | Pond C | C-1 | SW8150 | ND | 0.0425 | 0.085 | mg/kg | | 0.5 | 1.5 |
| Dichloroprop | SO | Pond C | C-6 | SW8150 | ND | 0.039 | 0.078 | mg/kg | | 0.5 | 1.5 |
| Endosulfan I | SO | Pond C | C-02 | SW8080 | ND | 0.0007 | 0.0014 | mg/kg | | 0 | 2 |
| Endosulfan I | SO | Pond C | C-01 | SW8080 | ND | 0.0105 | 0.021 | mg/kg | | 0 | 2 |
| Endosulfan I | SO | Pond C | C-03 | SW8080 | ND | 0.00065 | 0.0013 | mg/kg | | 2 | 4 |
| Endosulfan I | SO | Pond C | C-6 | SW8080 | ND | 0.00255 | 0.0051 | mg/kg | | 0.5 | 1.5 |
| Endosulfan I | SO | Pond C | C-03 | SW8080 | ND | 0.00135 | 0.0027 | mg/kg | | 0 | 2 |
| Endosulfan I | SO | Pond C | C-04 | SW8080 | ND | 0.0007 | 0.0014 | mg/kg | | 0 | 2 |
| Endosulfan I | SO | Pond C | C-4 | SW8080 | > | 0.17 | . | mg/kg | X | 0.5 | 1.5 |
| Endosulfan I | SO | Pond C | C-3 | SW8080 | ND | 0.012 | 0.024 | mg/kg | | 0.5 | 1.5 |
| Endosulfan I | SO | Pond C | C-2 | SW8080 | > | 0.44 | . | mg/kg | X | 0.5 | 1.5 |
| Endosulfan I | SO | Pond C | C-1 | SW8080 | ND | 0.0065 | 0.013 | mg/kg | | 0.5 | 1.5 |
| Endosulfan I | SO | Pond C | C-06 | SW8080 | ND | 0.00065 | 0.0013 | mg/kg | | 2 | 4 |
| Endosulfan I | SO | Pond C | C-5 | SW8080 | > | 0.44 | . | mg/kg | X | 0.5 | 1.5 |
| Endosulfan I | SO | Pond C | C-06 | SW8080 | ND | 0.00065 | 0.0013 | mg/kg | | 0 | 2 |
| Endosulfan I | SO | Pond C | C-05 | SW8080 | ND | 0.0007 | 0.0014 | mg/kg | | 0 | 2 |
| Endosulfan sulfate | SO | Pond C | C-05 | SW8080 | < | 0.0068 | 0.0068 | mg/kg | | 0 | 2 |
| Endosulfan sulfate | SO | Pond C | C-04 | SW8080 | < | 0.0068 | 0.0068 | mg/kg | | 0 | 2 |
| Endosulfan sulfate | SO | Pond C | C-03 | SW8080 | < | 0.00052 | 0.0065 | mg/kg | JX | 2 | 4 |
| Endosulfan sulfate | SO | Pond C | C-03 | SW8080 | < | 0.014 | 0.014 | mg/kg | | 0 | 2 |
| Endosulfan sulfate | SO | Pond C | C-02 | SW8080 | < | 0.0014 | 0.0068 | mg/kg | JC | 0 | 2 |
| Endosulfan sulfate | SO | Pond C | C-06 | SW8080 | < | 0.0065 | 0.0065 | mg/kg | | 0 | 2 |
| Endosulfan sulfate | SO | Pond C | C-06 | SW8080 | < | 0.0063 | 0.0063 | mg/kg | | 2 | 4 |
| Endosulfan sulfate | SO | Pond C | C-01 | SW8080 | < | 0.0011 | 0.11 | mg/kg | JX | 0 | 2 |
| Endrin aldehyde | SO | Pond C | C-03 | SW8080 | < | 0.0055 | 0.0055 | mg/kg | | 0 | 2 |
| Endrin aldehyde | SO | Pond C | C-05 | SW8080 | < | 0.0027 | 0.0027 | mg/kg | | 0 | 2 |
| Endrin aldehyde | SO | Pond C | C-06 | SW8080 | > | 0.0026 | 0.0025 | mg/kg | C@ | 2 | 4 |
| Endrin aldehyde | SO | Pond C | C-06 | SW8080 | < | 0.0026 | 0.0026 | mg/kg | | 0 | 2 |
| Endrin aldehyde | SO | Pond C | C-03 | SW8080 | < | 0.0026 | 0.0026 | mg/kg | | 2 | 4 |
| Endrin aldehyde | SO | Pond C | C-01 | SW8080 | < | 0.042 | 0.042 | mg/kg | | 0 | 2 |
| Endrin aldehyde | SO | Pond C | C-04 | SW8080 | < | 0.0027 | 0.0027 | mg/kg | | 0 | 2 |
| Endrin aldehyde | SO | Pond C | C-02 | SW8080 | < | 0.0027 | 0.0027 | mg/kg | | 0 | 2 |
| Ethyl benzene | SO | Pond C | C-06 | SW8240 | < | 0.0067 | 0.0067 | mg/kg | | 0 | 2 |
| Ethyl benzene | SO | Pond C | C-03 | SW8240 | < | 0.0065 | 0.0065 | mg/kg | | 2 | 4 |
| Ethyl benzene | SO | Pond C | C-02 | SW8240 | < | 0.0068 | 0.0068 | mg/kg | | 0 | 2 |
| Ethyl benzene | SO | Pond C | C-03 | SW8240 | < | 0.00066 | 0.007 | mg/kg | J | 0 | 2 |
| Ethyl benzene | SO | Pond C | C-05 | SW8240 | < | 0.0068 | 0.0068 | mg/kg | | 0 | 2 |
| Ethyl benzene | SO | Pond C | C-01 | SW8240 | < | 0.053 | 0.053 | mg/kg | | 0 | 2 |
| Ethyl benzene | SO | Pond C | C-06 | SW8240 | < | 0.0064 | 0.0064 | mg/kg | | 2 | 4 |
| Ethyl benzene | SO | Pond C | C-04 | SW8240 | < | 0.0068 | 0.0068 | mg/kg | | 0 | 2 |
| Heptachlor epoxide | SO | Pond C | C-06 | SW8080 | < | 0.00083 | 0.0013 | mg/kg | JX | 2 | 4 |
| Heptachlor epoxide | SO | Pond C | C-01 | SW8080 | < | 0.021 | 0.021 | mg/kg | | 0 | 2 |
| Heptachlor epoxide | SO | Pond C | C-05 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| Heptachlor epoxide | SO | Pond C | C-04 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| Heptachlor epoxide | SO | Pond C | C-03 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 2 | 4 |
| Heptachlor epoxide | SO | Pond C | C-06 | SW8080 | > | 0.0014 | 0.0013 | mg/kg | C@ | 0 | 2 |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Heptachlor epoxide | SO | Pond C | C-03 | SW8080 | < | 0.0027 | 0.0027 | mg/kg | | 0 | 2 |
| Heptachlor epoxide | SO | Pond C | C-02 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| Iron | SO | Pond C | C-4 | SW6010 | > | 6100 | . | mg/kg | | 0.5 | 1.5 |
| Iron | SO | Pond C | C-5 | SW6010 | > | 7000 | . | mg/kg | | 0.5 | 1.5 |
| Iron | SO | Pond C | C-2 | SW6010 | > | 8200 | . | mg/kg | | 0.5 | 1.5 |
| Iron | SO | Pond C | C-3 | SW6010 | > | 7500 | . | mg/kg | | 0.5 | 1.5 |
| Iron | SO | Pond C | C-1 | SW6010 | > | 7300 | . | mg/kg | | 0.5 | 1.5 |
| Iron | SO | Pond C | C-6 | SW6010 | > | 6500 | . | mg/kg | | 0.5 | 1.5 |
| Lead | SO | Pond C | C-6 | SW7421 | > | 4.4 | . | mg/kg | | 0.5 | 1.5 |
| Lead | SO | Pond C | C-2 | SW7421 | > | 5.3 | . | mg/kg | | 0.5 | 1.5 |
| Lead | SO | Pond C | C-4 | SW7421 | > | 3.5 | . | mg/kg | | 0.5 | 1.5 |
| Lead | SO | Pond C | C-5 | SW7421 | > | 3.2 | . | mg/kg | | 0.5 | 1.5 |
| Lead | SO | Pond C | C-1 | SW7421 | > | 3.9 | . | mg/kg | | 0.5 | 1.5 |
| Lead | SO | Pond C | C-06 | SW7421 | > | 2.3 | 0.29 | mg/kg | | 0 | 2 |
| Lead | SO | Pond C | C-3 | SW7421 | > | 4 | . | mg/kg | | 0.5 | 1.5 |
| Lead | SO | Pond C | C-06 | SW7421 | > | 3.3 | 0.31 | mg/kg | | 2 | 4 |
| Lead | SO | Pond C | C-05 | SW7421 | > | 0.51 | 0.29 | mg/kg | @ | 0 | 2 |
| Lead | SO | Pond C | C-04 | SW7421 | > | 1.6 | 0.34 | mg/kg | @ | 0 | 2 |
| Magnesium | SO | Pond C | C-5 | SW6010 | > | 25000 | . | mg/kg | | 0.5 | 1.5 |
| Magnesium | SO | Pond C | C-1 | SW6010 | > | 9700 | . | mg/kg | | 0.5 | 1.5 |
| Magnesium | SO | Pond C | C-4 | SW6010 | > | 8000 | . | mg/kg | | 0.5 | 1.5 |
| Magnesium | SO | Pond C | C-6 | SW6010 | > | 5400 | . | mg/kg | | 0.5 | 1.5 |
| Magnesium | SO | Pond C | C-3 | SW6010 | > | 7000 | . | mg/kg | | 0.5 | 1.5 |
| Magnesium | SO | Pond C | C-2 | SW6010 | > | 11000 | . | mg/kg | | 0.5 | 1.5 |
| Manganese | SO | Pond C | C-2 | SW6010 | > | 140 | . | mg/kg | | 0.5 | 1.5 |
| Manganese | SO | Pond C | C-1 | SW6010 | > | 150 | . | mg/kg | | 0.5 | 1.5 |
| Manganese | SO | Pond C | C-6 | SW6010 | > | 78 | . | mg/kg | | 0.5 | 1.5 |
| Manganese | SO | Pond C | C-5 | SW6010 | > | 88 | . | mg/kg | | 0.5 | 1.5 |
| Manganese | SO | Pond C | C-4 | SW6010 | > | 97 | . | mg/kg | | 0.5 | 1.5 |
| Manganese | SO | Pond C | C-3 | SW6010 | > | 77 | . | mg/kg | | 0.5 | 1.5 |
| Methylene chloride | SO | Pond C | C-2 | SW8240 | ND | 0.0037 | 0.0074 | mg/kg | | 0.5 | 1.5 |
| Methylene chloride | SO | Pond C | C-1 | SW8240 | > | 0.0049 | . | mg/kg | JB | 0.5 | 1.5 |
| Methylene chloride | SO | Pond C | C-06 | SW8240 | ND | 0.0048 | 0.0064 | mg/kg | | 2 | 4 |
| Methylene chloride | SO | Pond C | C-06 | SW8240 | < | 0.004 | 0.0067 | mg/kg | JB | 0 | 2 |
| Methylene chloride | SO | Pond C | C-05 | SW8240 | ND | 0.0051 | 0.0068 | mg/kg | | 0 | 2 |
| Methylene chloride | SO | Pond C | C-04 | SW8240 | ND | 0.0051 | 0.0068 | mg/kg | | 0 | 2 |
| Methylene chloride | SO | Pond C | C-03 | SW8240 | < | 0.00025 | 0.0065 | mg/kg | J | 2 | 4 |
| Methylene chloride | SO | Pond C | C-03 | SW8240 | ND | 0.00525 | 0.007 | mg/kg | | 0 | 2 |
| Methylene chloride | SO | Pond C | C-4 | SW8240 | > | 0.0017 | . | mg/kg | J | 0.5 | 1.5 |
| Methylene chloride | SO | Pond C | C-3 | SW8240 | > | 0.0033 | . | mg/kg | JB | 0.5 | 1.5 |
| Methylene chloride | SO | Pond C | C-02 | SW8240 | ND | 0.0051 | 0.0068 | mg/kg | | 0 | 2 |
| Methylene chloride | SO | Pond C | C-01 | SW8240 | ND | 0.03975 | 0.053 | mg/kg | | 0 | 2 |
| Methylene chloride | SO | Pond C | C-5 | SW8240 | > | 0.0015 | . | mg/kg | J | 0.5 | 1.5 |
| Methylene chloride | SO | Pond C | C-6 | SW8240 | > | 0.0048 | . | mg/kg | JB | 0.5 | 1.5 |
| Molybdenum | SO | Pond C | C-2 | SW6010 | > | 12 | . | mg/kg | @ | 0.5 | 1.5 |
| Molybdenum | SO | Pond C | C-4 | SW6010 | ND | 3.05 | 6.1 | mg/kg | | 0.5 | 1.5 |
| Molybdenum | SO | Pond C | C-6 | SW6010 | ND | 3.2 | 6.4 | mg/kg | | 0.5 | 1.5 |
| Molybdenum | SO | Pond C | C-5 | SW6010 | ND | 3.15 | 6.3 | mg/kg | | 0.5 | 1.5 |
| Molybdenum | SO | Pond C | C-1 | SW6010 | ND | 3 | 6 | mg/kg | | 0.5 | 1.5 |
| Molybdenum | SO | Pond C | C-3 | SW6010 | ND | 3.2 | 6.4 | mg/kg | | 0.5 | 1.5 |
| Nickel | SO | Pond C | C-06 | SW6010 | ND | 4.45 | 8.9 | mg/kg | | 0 | 2 |
| Nickel | SO | Pond C | C-04 | SW6010 | ND | 4.2 | 8.4 | mg/kg | | 0 | 2 |
| Nickel | SO | Pond C | C-03 | SW6010 | ND | 4.05 | 8.1 | mg/kg | | 2 | 4 |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nickel | SO | Pond C | C-05 | SW6010 | ND | 4.2 | 8.4 | mg/kg | | 0 | 2 |
| Nickel | SO | Pond C | C-03 | SW6010 | ND | 4.4 | 8.8 | mg/kg | | 0 | 2 |
| Nickel | SO | Pond C | C-4 | SW6010 | > | 5 | . | mg/kg | @ | 0.5 | 1.5 |
| Nickel | SO | Pond C | C-02 | SW6010 | ND | 3.9 | 7.8 | mg/kg | | 0 | 2 |
| Nickel | SO | Pond C | C-3 | SW6010 | > | 6.1 | . | mg/kg | @ | 0.5 | 1.5 |
| Nickel | SO | Pond C | C-2 | SW6010 | > | 8.3 | . | mg/kg | @ | 0.5 | 1.5 |
| Nickel | SO | Pond C | C-1 | SW6010 | > | 6.2 | . | mg/kg | @ | 0.5 | 1.5 |
| Nickel | SO | Pond C | C-06 | SW6010 | ND | 4.2 | 8.4 | mg/kg | | 2 | 4 |
| Nickel | SO | Pond C | C-5 | SW6010 | > | 5.8 | . | mg/kg | @ | 0.5 | 1.5 |
| Nickel | SO | Pond C | C-01 | SW6010 | ND | 3.85 | 7.7 | mg/kg | | 0 | 2 |
| Nickel | SO | Pond C | C-6 | SW6010 | > | 5.6 | . | mg/kg | @ | 0.5 | 1.5 |
| Phenanthrene | SO | Pond C | C-1 | SW8270 | ND | 0.235 | 0.47 | mg/kg | | 0.5 | 1.5 |
| Phenanthrene | SO | Pond C | C-6 | SW8270 | ND | 0.225 | 0.45 | mg/kg | | 0.5 | 1.5 |
| Phenanthrene | SO | Pond C | C-2 | SW8270 | > | 0.37 | . | mg/kg | J | 0.5 | 1.5 |
| Phenanthrene | SO | Pond C | C-5 | SW8270 | ND | 0.235 | 0.47 | mg/kg | | 0.5 | 1.5 |
| Phenanthrene | SO | Pond C | C-4 | SW8270 | ND | 0.265 | 0.53 | mg/kg | | 0.5 | 1.5 |
| Phenanthrene | SO | Pond C | C-3 | SW8270 | ND | 0.22 | 0.44 | mg/kg | | 0.5 | 1.5 |
| Potassium | SO | Pond C | C-5 | SW6010 | > | 2700 | . | mg/kg | | 0.5 | 1.5 |
| Potassium | SO | Pond C | C-6 | SW6010 | > | 2300 | . | mg/kg | | 0.5 | 1.5 |
| Potassium | SO | Pond C | C-3 | SW6010 | > | 2800 | . | mg/kg | | 0.5 | 1.5 |
| Potassium | SO | Pond C | C-2 | SW6010 | > | 2700 | . | mg/kg | | 0.5 | 1.5 |
| Potassium | SO | Pond C | C-4 | SW6010 | > | 2400 | . | mg/kg | | 0.5 | 1.5 |
| Potassium | SO | Pond C | C-1 | SW6010 | > | 2700 | . | mg/kg | | 0.5 | 1.5 |
| Pyrene | SO | Pond C | C-6 | SW8270 | > | 0.12 | . | mg/kg | J | 0.5 | 1.5 |
| Pyrene | SO | Pond C | C-4 | SW8270 | ND | 0.1 | 0.2 | mg/kg | | 0.5 | 1.5 |
| Pyrene | SO | Pond C | C-5 | SW8270 | ND | 0.09 | 0.18 | mg/kg | | 0.5 | 1.5 |
| Pyrene | SO | Pond C | C-1 | SW8270 | ND | 0.09 | 0.18 | mg/kg | | 0.5 | 1.5 |
| Pyrene | SO | Pond C | C-2 | SW8270 | ND | 0.1 | 0.2 | mg/kg | | 0.5 | 1.5 |
| Pyrene | SO | Pond C | C-3 | SW8270 | ND | 0.085 | 0.17 | mg/kg | | 0.5 | 1.5 |
| Silicon | SO | Pond C | C-5 | SW6010 | > | 1800 | . | mg/kg | | 0.5 | 1.5 |
| Silicon | SO | Pond C | C-1 | SW6010 | > | 460 | . | mg/kg | @ | 0.5 | 1.5 |
| Silicon | SO | Pond C | C-4 | SW6010 | > | 4000 | . | mg/kg | | 0.5 | 1.5 |
| Silicon | SO | Pond C | C-6 | SW6010 | > | 530 | . | mg/kg | @ | 0.5 | 1.5 |
| Silicon | SO | Pond C | C-3 | SW6010 | > | 490 | . | mg/kg | @ | 0.5 | 1.5 |
| Silicon | SO | Pond C | C-2 | SW6010 | > | 1700 | . | mg/kg | | 0.5 | 1.5 |
| Sodium | SO | Pond C | C-2 | SW6010 | > | 1000 | . | mg/kg | | 0.5 | 1.5 |
| Sodium | SO | Pond C | C-1 | SW6010 | > | 600 | . | mg/kg | | 0.5 | 1.5 |
| Sodium | SO | Pond C | C-6 | SW6010 | > | 380 | . | mg/kg | @ | 0.5 | 1.5 |
| Sodium | SO | Pond C | C-5 | SW6010 | > | 1200 | . | mg/kg | | 0.5 | 1.5 |
| Sodium | SO | Pond C | C-4 | SW6010 | > | 480 | . | mg/kg | @ | 0.5 | 1.5 |
| Sodium | SO | Pond C | C-3 | SW6010 | > | 740 | . | mg/kg | | 0.5 | 1.5 |
| Sulfide | SO | Pond C | C-01 | SW9030 | > | 130 | 31 | mg/kg | @ | 0 | 2 |
| Sulfide | SO | Pond C | C-06 | SW9030 | < | 32 | 32 | mg/kg | | 2 | 4 |
| Sulfide | SO | Pond C | C-03 | SW9030 | < | 31 | 31 | mg/kg | | 2 | 4 |
| Sulfide | SO | Pond C | C-06 | SW9030 | < | 33 | 33 | mg/kg | | 0 | 2 |
| Sulfide | SO | Pond C | C-05 | SW9030 | < | 34 | 34 | mg/kg | | 0 | 2 |
| Sulfide | SO | Pond C | C-04 | SW9030 | < | 34 | 34 | mg/kg | | 0 | 2 |
| Sulfide | SO | Pond C | C-03 | SW9030 | < | 34 | 34 | mg/kg | | 0 | 2 |
| Sulfide | SO | Pond C | C-02 | SW9030 | > | 60 | 34 | mg/kg | @ | 0 | 2 |
| Toluene | SO | Pond C | C-06 | SW8240 | < | 0.00049 | 0.0067 | mg/kg | J | 0 | 2 |
| Toluene | SO | Pond C | C-04 | SW8240 | < | 0.0017 | 0.0068 | mg/kg | JB | 0 | 2 |
| Toluene | SO | Pond C | C-06 | SW8240 | < | 0.00045 | 0.0064 | mg/kg | JB | 2 | 4 |
| Toluene | SO | Pond C | C-05 | SW8240 | < | 0.0068 | 0.0068 | mg/kg | | 0 | 2 |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Toluene | SO | Pond C | C-03 | SW8240 | < | 0.0005 | 0.007 | mg/kg | JB | 0 | 2 |
| Toluene | SO | Pond C | C-02 | SW8240 | < | 0.0013 | 0.0068 | mg/kg | JB | 0 | 2 |
| Toluene | SO | Pond C | C-03 | SW8240 | < | 0.00043 | 0.0065 | mg/kg | JB | 2 | 4 |
| Toluene | SO | Pond C | C-01 | SW8240 | < | 0.0023 | 0.053 | mg/kg | JB | 0 | 2 |
| Total organic carbon | SO | Pond C | C-06 | | > | 2000 | 1100 | mg/kg | @ | 0 | 2 |
| Total organic carbon | SO | Pond C | C-01 | | > | 3200 | 1100 | mg/kg | @ | 0 | 2 |
| Vanadium | SO | Pond C | C-02 | SW6010 | > | 16 | 7.8 | mg/kg | @ | 0 | 2 |
| Vanadium | SO | Pond C | C-05 | SW6010 | ND | 6.3 | 8.4 | mg/kg | | 0 | 2 |
| Vanadium | SO | Pond C | C-04 | SW6010 | ND | 6.3 | 8.4 | mg/kg | | 0 | 2 |
| Vanadium | SO | Pond C | C-01 | SW6010 | > | 19 | 7.7 | mg/kg | @ | 0 | 2 |
| Vanadium | SO | Pond C | C-06 | SW6010 | > | 20 | 8.9 | mg/kg | @ | 0 | 2 |
| Vanadium | SO | Pond C | C-03 | SW6010 | > | 12 | 8.1 | mg/kg | @ | 2 | 4 |
| Vanadium | SO | Pond C | C-1 | SW6010 | > | 20 | . | mg/kg | | 0.5 | 1.5 |
| Vanadium | SO | Pond C | C-4 | SW6010 | > | 18 | . | mg/kg | | 0.5 | 1.5 |
| Vanadium | SO | Pond C | C-3 | SW6010 | > | 30 | . | mg/kg | | 0.5 | 1.5 |
| Vanadium | SO | Pond C | C-2 | SW6010 | > | 23 | . | mg/kg | | 0.5 | 1.5 |
| Vanadium | SO | Pond C | C-03 | SW6010 | > | 11 | 8.8 | mg/kg | @ | 0 | 2 |
| Vanadium | SO | Pond C | C-5 | SW6010 | > | 25 | . | mg/kg | | 0.5 | 1.5 |
| Vanadium | SO | Pond C | C-06 | SW6010 | > | 14 | 8.4 | mg/kg | @ | 2 | 4 |
| Vanadium | SO | Pond C | C-6 | SW6010 | > | 20 | . | mg/kg | | 0.5 | 1.5 |
| Zinc | SO | Pond C | C-2 | SW6010 | > | 210 | . | mg/kg | | 0.5 | 1.5 |
| Zinc | SO | Pond C | C-1 | SW6010 | > | 26 | . | mg/kg | | 0.5 | 1.5 |
| Zinc | SO | Pond C | C-06 | SW6010 | > | 13 | 8.4 | mg/kg | @ | 2 | 4 |
| Zinc | SO | Pond C | C-06 | SW6010 | > | 17 | 8.9 | mg/kg | @ | 0 | 2 |
| Zinc | SO | Pond C | C-05 | SW6010 | ND | 6.3 | 8.4 | mg/kg | | 0 | 2 |
| Zinc | SO | Pond C | C-04 | SW6010 | ND | 6.3 | 8.4 | mg/kg | | 0 | 2 |
| Zinc | SO | Pond C | C-03 | SW6010 | > | 12 | 8.1 | mg/kg | @ | 2 | 4 |
| Zinc | SO | Pond C | C-03 | SW6010 | > | 11 | 8.8 | mg/kg | @ | 0 | 2 |
| Zinc | SO | Pond C | C-4 | SW6010 | > | 21 | . | mg/kg | | 0.5 | 1.5 |
| Zinc | SO | Pond C | C-3 | SW6010 | > | 24 | . | mg/kg | | 0.5 | 1.5 |
| Zinc | SO | Pond C | C-02 | SW6010 | > | 10 | 7.8 | mg/kg | @ | 0 | 2 |
| Zinc | SO | Pond C | C-01 | SW6010 | > | 14 | 7.7 | mg/kg | @ | 0 | 2 |
| Zinc | SO | Pond C | C-5 | SW6010 | > | 22 | . | mg/kg | | 0.5 | 1.5 |
| Zinc | SO | Pond C | C-6 | SW6010 | > | 20 | . | mg/kg | | 0.5 | 1.5 |
| 4,4'-DDE | WG | Pond C | MW-02 | SW8080 | ND | 4.80E-06 | 9.60E-06 | mg/L | | . | . |
| 4,4'-DDE | WG | Pond C | MW-02 | SW8080 | ND | 5.00E-06 | 0.00001 | mg/L | | . | . |
| 4,4'-DDE | WG | Pond C | MW-02 | SW8080 | > | 0.000016 | 9.60E-06 | mg/L | X@ | . | . |
| 4,4'-DDT | WG | Pond C | MW-02 | SW8080 | < | 0.000014 | 0.000019 | mg/L | J | . | . |
| 4,4'-DDT | WG | Pond C | MW-02 | SW8080 | ND | 0.00001 | 0.00002 | mg/L | | . | . |
| 4,4'-DDT | WG | Pond C | MW-02 | SW8080 | ND | 9.50E-06 | 0.000019 | mg/L | | . | . |
| Aldrin | WG | Pond C | MW-02 | SW8080 | ND | 4.80E-06 | 9.60E-06 | mg/L | | . | . |
| Aldrin | WG | Pond C | MW-02 | SW8080 | > | 0.000015 | 0.00001 | mg/L | X@ | . | . |
| Aldrin | WG | Pond C | MW-02 | SW8080 | ND | 4.80E-06 | 9.60E-06 | mg/L | | . | . |
| alpha-Chlordane | WG | Pond C | MW-02 | SW8080 | < | 8.30E-06 | 9.60E-06 | mg/L | JX | . | . |
| alpha-Chlordane | WG | Pond C | MW-02 | SW8080 | > | 0.000062 | 9.60E-06 | mg/L | X | . | . |
| delta-BHC | WG | Pond C | MW-02 | SW8080 | > | 0.000012 | 9.60E-06 | mg/L | G@ | . | . |
| delta-BHC | WG | Pond C | MW-02 | SW8080 | ND | 4.80E-06 | 9.60E-06 | mg/L | | . | . |
| delta-BHC | WG | Pond C | MW-02 | SW8080 | > | 0.00003 | 0.00001 | mg/L | C@ | . | . |
| Dieldrin | WG | Pond C | MW-02 | SW8080 | ND | 5.00E-06 | 0.00001 | mg/L | | . | . |
| Dieldrin | WG | Pond C | MW-02 | SW8080 | ND | 4.80E-06 | 9.60E-06 | mg/L | | . | . |
| Dieldrin | WG | Pond C | MW-02 | SW8080 | > | 0.000017 | 9.60E-06 | mg/L | @ | . | . |
| Endosulfan II | WG | Pond C | MW-02 | SW8080 | < | 9.80E-06 | 0.000029 | mg/L | JX | . | . |
| Endosulfan II | WG | Pond C | MW-02 | SW8080 | < | 0.000017 | 0.000029 | mg/L | J | . | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Endosulfan II | WG | Pond C | MW-02 | SW8080 | ND | 0.000015 | 0.00003 | mg/L | | . | . |
| Endosulfan sulfate | WG | Pond C | MW-02 | SW8080 | < | 5.10E-06 | 0.00005 | mg/L | JX | . | . |
| Endosulfan sulfate | WG | Pond C | MW-02 | SW8080 | < | 0.000018 | 0.000048 | mg/L | JX | . | . |
| Endosulfan sulfate | WG | Pond C | MW-02 | SW8080 | < | 0.000013 | 0.000048 | mg/L | J | . | . |
| Endrin | WG | Pond C | MW-02 | SW8080 | > | 0.000018 | 9.60E-06 | mg/L | @ | . | . |
| Endrin | WG | Pond C | MW-02 | SW8080 | ND | 4.80E-06 | 9.60E-06 | mg/L | | . | . |
| Endrin | WG | Pond C | MW-02 | SW8080 | ND | 5.00E-06 | 0.00001 | mg/L | | . | . |
| Endrin aldehyde | WG | Pond C | MW-02 | SW8080 | < | 4.40E-06 | 0.000019 | mg/L | JX | . | . |
| Endrin aldehyde | WG | Pond C | MW-02 | SW8080 | < | 3.50E-06 | 0.000019 | mg/L | JX | . | . |
| gamma-BHC | WG | Pond C | MW-02 | SW8080 | > | 0.000016 | 9.60E-06 | mg/L | X@ | . | . |
| gamma-BHC | WG | Pond C | MW-02 | SW8080 | ND | 5.00E-06 | 0.00001 | mg/L | | . | . |
| gamma-BHC | WG | Pond C | MW-02 | SW8080 | ND | 4.80E-06 | 9.60E-06 | mg/L | | . | . |
| gamma-Chlordane | WG | Pond C | MW-02 | SW8080 | > | 0.00074 | 9.60E-06 | mg/L | G | . | . |
| gamma-Chlordane | WG | Pond C | MW-02 | SW8080 | > | 0.000042 | 9.60E-06 | mg/L | X@ | . | . |
| Isodrin | WG | Pond C | MW-02 | SW8080 | < | 5.10E-06 | 9.60E-06 | mg/L | JX | . | . |
| Isodrin | WG | Pond C | MW-02 | SW8080 | ND | 4.80E-06 | 9.60E-06 | mg/L | | . | . |
| Aluminum | WS | Pond C | C-5 | SW6010 | ND | 0.012 | 0.024 | mg/L | | . | . |
| Aluminum | WS | Pond C | C-1 | SW6010 | ND | 0.012 | 0.024 | mg/L | | . | . |
| Aluminum | WS | Pond C | C-2 | SW6010 | > | 0.053 | . | mg/L | @ | . | . |
| Aluminum | WS | Pond C | C-4 | SW6010 | ND | 0.012 | 0.024 | mg/L | | . | . |
| Aluminum | WS | Pond C | C-3 | SW6010 | ND | 0.012 | 0.024 | mg/L | | . | . |
| Arsenic | WS | Pond C | C-3 | SW7060 | ND | 0.0015 | 0.003 | mg/L | | . | . |
| Arsenic | WS | Pond C | C-5 | SW7060 | > | 0.0035 | . | mg/L | @ | . | . |
| Arsenic | WS | Pond C | C-2 | SW7060 | ND | 0.0015 | 0.003 | mg/L | | . | . |
| Arsenic | WS | Pond C | C-1 | SW7060 | > | 0.0041 | . | mg/L | @ | . | . |
| Arsenic | WS | Pond C | C-4 | SW7060 | ND | 0.0015 | 0.003 | mg/L | | . | . |
| Barium | WS | Pond C | C-1 | SW6010 | > | 0.038 | . | mg/L | @ | . | . |
| Barium | WS | Pond C | C-5 | SW6010 | > | 0.03 | . | mg/L | @ | . | . |
| Barium | WS | Pond C | C-3 | SW6010 | > | 0.027 | . | mg/L | @ | . | . |
| Barium | WS | Pond C | C-4 | SW6010 | ND | 0.013 | 0.026 | mg/L | | . | . |
| Barium | WS | Pond C | C-2 | SW6010 | > | 0.038 | . | mg/L | @ | . | . |
| beta-BHC | WS | Pond C | C-1 | SW8080 | > | 0.00003 | . | mg/L | J | . | . |
| bis(2-Ethylhexyl)phthalate | WS | Pond C | C-2 | SW8270 | > | 0.004 | . | mg/L | J | . | . |
| bis(2-Ethylhexyl)phthalate | WS | Pond C | C-1 | SW8270 | > | 0.004 | . | mg/L | J | . | . |
| Boron | WS | Pond C | C-5 | SW6010 | > | 0.21 | . | mg/L | @ | . | . |
| Boron | WS | Pond C | C-4 | SW6010 | > | 0.17 | . | mg/L | @ | . | . |
| Boron | WS | Pond C | C-3 | SW6010 | > | 0.18 | . | mg/L | @ | . | . |
| Boron | WS | Pond C | C-2 | SW6010 | > | 0.26 | . | mg/L | @ | . | . |
| Boron | WS | Pond C | C-1 | SW6010 | > | 0.3 | . | mg/L | @ | . | . |
| Calcium | WS | Pond C | C-5 | SW6010 | > | 290 | . | mg/L | | . | . |
| Calcium | WS | Pond C | C-3 | SW6010 | > | 250 | . | mg/L | | . | . |
| Calcium | WS | Pond C | C-2 | SW6010 | > | 350 | . | mg/L | | . | . |
| Calcium | WS | Pond C | C-1 | SW6010 | > | 350 | . | mg/L | | . | . |
| Calcium | WS | Pond C | C-4 | SW6010 | > | 240 | . | mg/L | | . | . |
| Chromium VI | WS | Pond C | C-3 | SW7196 | > | 0.013 | . | mg/L | | . | . |
| Chromium VI | WS | Pond C | C-2 | SW7196 | > | 0.014 | . | mg/L | | . | . |
| Chromium VI | WS | Pond C | C-1 | SW7196 | ND | 0.0001 | 0.0002 | mg/L | | . | . |
| Chromium VI | WS | Pond C | C-4 | SW7196 | ND | 0.0001 | 0.0002 | mg/L | | . | . |
| Chromium VI | WS | Pond C | C-5 | SW7196 | ND | 0.0001 | 0.0002 | mg/L | | . | . |
| Hardness, as CaC03 | WS | Pond C | C-01 | E130.2 | > | 1900 | 83 | mg/L | | . | . |
| Iron | WS | Pond C | C-2 | SW6010 | > | 0.076 | . | mg/L | | . | . |
| Iron | WS | Pond C | C-3 | SW6010 | > | 0.057 | . | mg/L | @ | . | . |
| Iron | WS | Pond C | C-1 | SW6010 | > | 0.053 | . | mg/L | @ | . | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Iron | WS | Pond C | C-4 | SW6010 | > | 0.036 | . | mg/L | @ | . | . |
| Iron | WS | Pond C | C-5 | SW6010 | > | 0.041 | . | mg/L | @ | . | . |
| Lead | WS | Pond C | C-1 | SW7421 | > | 0.0045 | . | mg/L | @ | . | . |
| Lead | WS | Pond C | C-5 | SW7421 | > | 0.0058 | . | mg/L | @ | . | . |
| Lead | WS | Pond C | C-3 | SW7421 | > | 0.0073 | . | mg/L | @ | . | . |
| Lead | WS | Pond C | C-4 | SW7421 | > | 0.0051 | . | mg/L | @ | . | . |
| Lead | WS | Pond C | C-2 | SW7421 | > | 0.0045 | . | mg/L | @ | . | . |
| Magnesium | WS | Pond C | C-3 | SW6010 | > | 120 | . | mg/L | | . | . |
| Magnesium | WS | Pond C | C-2 | SW6010 | > | 170 | . | mg/L | | . | . |
| Magnesium | WS | Pond C | C-4 | SW6010 | > | 120 | . | mg/L | | . | . |
| Magnesium | WS | Pond C | C-1 | SW6010 | > | 170 | . | mg/L | | . | . |
| Magnesium | WS | Pond C | C-5 | SW6010 | > | 140 | . | mg/L | | . | . |
| Manganese | WS | Pond C | C-3 | SW6010 | > | 0.056 | . | mg/L | | . | . |
| Manganese | WS | Pond C | C-4 | SW6010 | > | 0.053 | . | mg/L | | . | . |
| Manganese | WS | Pond C | C-2 | SW6010 | > | 0.077 | . | mg/L | | . | . |
| Manganese | WS | Pond C | C-1 | SW6010 | > | 0.076 | . | mg/L | | . | . |
| Manganese | WS | Pond C | C-5 | SW6010 | > | 0.063 | . | mg/L | | . | . |
| Potassium | WS | Pond C | C-1 | SW6010 | > | 11 | . | mg/L | | . | . |
| Potassium | WS | Pond C | C-2 | SW6010 | > | 12 | . | mg/L | | . | . |
| Potassium | WS | Pond C | C-5 | SW6010 | > | 9.3 | . | mg/L | | . | . |
| Potassium | WS | Pond C | C-4 | SW6010 | > | 7.7 | . | mg/L | | . | . |
| Potassium | WS | Pond C | C-3 | SW6010 | > | 7.8 | . | mg/L | | . | . |
| Silicon | WS | Pond C | C-4 | SW6010 | > | 11 | . | mg/L | | . | . |
| Silicon | WS | Pond C | C-3 | SW6010 | > | 11 | . | mg/L | | . | . |
| Silicon | WS | Pond C | C-2 | SW6010 | > | 16 | . | mg/L | | . | . |
| Silicon | WS | Pond C | C-5 | SW6010 | > | 13 | . | mg/L | | . | . |
| Silicon | WS | Pond C | C-1 | SW6010 | > | 16 | . | mg/L | | . | . |
| Sodium | WS | Pond C | C-1 | SW6010 | > | 490 | . | mg/L | | . | . |
| Sodium | WS | Pond C | C-3 | SW6010 | > | 350 | . | mg/L | | . | . |
| Sodium | WS | Pond C | C-5 | SW6010 | > | 410 | . | mg/L | | . | . |
| Sodium | WS | Pond C | C-2 | SW6010 | > | 520 | . | mg/L | | . | . |
| Sodium | WS | Pond C | C-4 | SW6010 | > | 340 | . | mg/L | | . | . |
| Total dissolved solids | WS | Pond C | C-01 | E160.1 | > | 4400 | 10 | mg/L | | . | . |
| Vanadium | WS | Pond C | C-1 | SW6010 | > | 0.0062 | . | mg/L | @ | . | . |
| Vanadium | WS | Pond C | C-5 | SW6010 | > | 0.0054 | . | mg/L | @ | . | . |
| Vanadium | WS | Pond C | C-4 | SW6010 | > | 0.0049 | . | mg/L | @ | . | . |
| Vanadium | WS | Pond C | C-3 | SW6010 | > | 0.0056 | . | mg/L | @ | . | . |
| Vanadium | WS | Pond C | C-2 | SW6010 | > | 0.0078 | . | mg/L | @ | . | . |
| Zinc | WS | Pond C | C-4 | SW6010 | ND | 0.0015 | 0.003 | mg/L | | . | . |
| Zinc | WS | Pond C | C-3 | SW6010 | ND | 0.0015 | 0.003 | mg/L | | . | . |
| Zinc | WS | Pond C | C-2 | SW6010 | > | 0.013 | . | mg/L | @ | . | . |
| Zinc | WS | Pond C | C-5 | SW6010 | ND | 0.0015 | 0.003 | mg/L | | . | . |
| Zinc | WS | Pond C | C-1 | SW6010 | > | 0.012 | . | mg/L | @ | . | . |
| 2-Hexanone | SO | Pond D | BH-02 | SW8240 | < | 0.004 | 0.069 | mg/kg | JB | 8.5 | 12.5 |
| 3-Methyl pentane | SO | Pond D | BH-02 | SW8240 | > | 0.02 | . | mg/kg | | 8.5 | 12.5 |
| 4,4'-DDD | SO | Pond D | D-05 | SW8080 | > | 0.0036 | 0.0014 | mg/kg | C@ | 0 | 2 |
| 4,4'-DDD | SO | Pond D | D-01 | SW8080 | > | 0.00315 | 0.0015 | mg/kg | X@ | 0 | 2 |
| 4,4'-DDD | SO | Pond D | D-03 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 2 | 4 |
| 4,4'-DDD | SO | Pond D | D-05 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 2 | 4 |
| 4,4'-DDD | SO | Pond D | D-06 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 0 | 2 |
| 4,4'-DDD | SO | Pond D | D-03 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 0 | 2 |
| 4,4'-DDD | SO | Pond D | D-01 | SW8080 | < | 0.00135 | 0.0014 | mg/kg | | 2 | 4 |
| 4,4'-DDD | SO | Pond D | D-02 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4,4'-DDD | SO | Pond D | D-04 | SW8080 | > | 0.24 | 0.013 | mg/kg | C | 0 | 2 |
| 4,4'-DDE | SO | Pond D | D-01 | SW8080 | < | 0.0015 | 0.0015 | mg/kg | | 0 | 2 |
| 4,4'-DDE | SO | Pond D | D-01 | SW8080 | < | 0.00135 | 0.0014 | mg/kg | | 2 | 4 |
| 4,4'-DDE | SO | Pond D | D-06 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 0 | 2 |
| 4,4'-DDE | SO | Pond D | D-03 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 0 | 2 |
| 4,4'-DDE | SO | Pond D | D-02 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| 4,4'-DDE | SO | Pond D | D-05 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| 4,4'-DDE | SO | Pond D | D-04 | SW8080 | > | 0.035 | 0.013 | mg/kg | X@ | 0 | 2 |
| 4,4'-DDE | SO | Pond D | D-05 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 2 | 4 |
| 4,4'-DDE | SO | Pond D | D-03 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 2 | 4 |
| 4,4'-DDT | SO | Pond D | D-05 | SW8080 | < | 0.0027 | 0.0027 | mg/kg | | 0 | 2 |
| 4,4'-DDT | SO | Pond D | D-03 | SW8080 | > | 0.0052 | 0.0027 | mg/kg | X@ | 2 | 4 |
| 4,4'-DDT | SO | Pond D | D-01 | SW8080 | < | 0.00265 | 0.0027 | mg/kg | | 2 | 4 |
| 4,4'-DDT | SO | Pond D | D-04 | SW8080 | > | 0.052 | 0.026 | mg/kg | C@ | 0 | 2 |
| 4,4'-DDT | SO | Pond D | D-03 | SW8080 | < | 0.0026 | 0.0026 | mg/kg | | 0 | 2 |
| 4,4'-DDT | SO | Pond D | D-02 | SW8080 | < | 0.0028 | 0.0028 | mg/kg | | 0 | 2 |
| 4,4'-DDT | SO | Pond D | D-05 | SW8080 | > | 0.0034 | 0.0027 | mg/kg | X@ | 2 | 4 |
| 4,4'-DDT | SO | Pond D | D-01 | SW8080 | < | 0.003 | 0.003 | mg/kg | | 0 | 2 |
| 4,4'-DDT | SO | Pond D | D-06 | SW8080 | < | 0.0027 | 0.0027 | mg/kg | | 0 | 2 |
| 4-Hydroxy-4-methyl-2-pentano | SO | Pond D | D-01 | SW8270 | > | 13 | . | mg/kg | | 2 | 4 |
| Acetone | SO | Pond D | D-01 | SW8240 | ND | 0.1125 | 0.15 | mg/kg | | 0 | 2 |
| Acetone | SO | Pond D | D-06 | SW8240 | < | 0.035 | 0.13 | mg/kg | J | 0 | 2 |
| Acetone | SO | Pond D | D-05 | SW8240 | ND | 0.105 | 0.14 | mg/kg | | 2 | 4 |
| Acetone | SO | Pond D | D-05 | SW8240 | < | 0.05 | 0.14 | mg/kg | J | 0 | 2 |
| Acetone | SO | Pond D | D-04 | SW8240 | ND | 0.0975 | 0.13 | mg/kg | | 0 | 2 |
| Acetone | SO | Pond D | D-03 | SW8240 | ND | 0.0975 | 0.13 | mg/kg | | 2 | 4 |
| Acetone | SO | Pond D | D-03 | SW8240 | ND | 0.0975 | 0.13 | mg/kg | | 0 | 2 |
| Acetone | SO | Pond D | D-02 | SW8240 | ND | 0.105 | 0.14 | mg/kg | | 0 | 2 |
| Acetone | SO | Pond D | D-01 | SW8240 | ND | 0.0773333 | 0.14 | mg/kg | | 2 | 4 |
| alpha-Chlordane | SO | Pond D | D-05 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 2 | 4 |
| alpha-Chlordane | SO | Pond D | D-06 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 0 | 2 |
| alpha-Chlordane | SO | Pond D | D-04 | SW8080 | < | 0.013 | 0.013 | mg/kg | | 0 | 2 |
| alpha-Chlordane | SO | Pond D | D-05 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| alpha-Chlordane | SO | Pond D | D-03 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 0 | 2 |
| alpha-Chlordane | SO | Pond D | D-02 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| alpha-Chlordane | SO | Pond D | D-01 | SW8080 | < | 0.00135 | 0.0014 | mg/kg | | 2 | 4 |
| alpha-Chlordane | SO | Pond D | D-03 | SW8080 | > | 0.0015 | 0.0013 | mg/kg | X@ | 2 | 4 |
| alpha-Chlordane | SO | Pond D | D-01 | SW8080 | < | 0.0015 | 0.0015 | mg/kg | | 0 | 2 |
| Arsenic | SO | Pond D | D-03 | SW7060 | > | 0.78 | 0.41 | mg/kg | @ | 0 | 2 |
| Arsenic | SO | Pond D | D-02 | SW7060 | > | 0.8 | 0.47 | mg/kg | @ | 0 | 2 |
| Arsenic | SO | Pond D | D-01 | SW7060 | > | 2.8 | 0.46 | mg/kg | | 2 | 4 |
| Arsenic | SO | Pond D | D-03 | SW7060 | > | 0.78 | 0.43 | mg/kg | @ | 2 | 4 |
| Arsenic | SO | Pond D | D-04 | SW7060 | > | 0.9 | 0.43 | mg/kg | @ | 0 | 2 |
| Arsenic | SO | Pond D | D-01 | SW7060 | > | 0.795 | 0.51 | mg/kg | @ | 0 | 2 |
| Arsenic | SO | Pond D | D-05 | SW7060 | > | 1.2 | 0.48 | mg/kg | @ | 2 | 4 |
| Arsenic | SO | Pond D | D-06 | SW7060 | > | 2.1 | 0.44 | mg/kg | @ | 0 | 2 |
| Arsenic | SO | Pond D | D-05 | SW7060 | > | 0.9 | 0.38 | mg/kg | @ | 0 | 2 |
| Barium | SO | Pond D | D-01 | SW6010 | > | 74.5 | 4.3 | mg/kg | | 2 | 4 |
| Barium | SO | Pond D | BH-02 | SW6010 | > | 30 | 3.9 | mg/kg | | 8.5 | 12.5 |
| Barium | SO | Pond D | D-06 | SW6010 | > | 82 | 4.5 | mg/kg | | 0 | 2 |
| Barium | SO | Pond D | D-03 | SW6010 | > | 64 | 3.8 | mg/kg | | 2 | 4 |
| Barium | SO | Pond D | D-05 | SW6010 | > | 38 | 5.1 | mg/kg | | 0 | 2 |
| Barium | SO | Pond D | D-01 | SW6010 | > | 29 | 4.8 | mg/kg | | 0 | 2 |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Barium | SO | Pond D | D-04 | SW6010 | > | 44 | 3.5 | mg/kg | | 0 | 2 |
| Barium | SO | Pond D | D-03 | SW6010 | > | 21 | 4.1 | mg/kg | | 0 | 2 |
| Barium | SO | Pond D | D-05 | SW6010 | > | 31 | 5.6 | mg/kg | | 2 | 4 |
| Barium | SO | Pond D | D-02 | SW6010 | > | 23 | 4.5 | mg/kg | | 0 | 2 |
| beta-BHC | SO | Pond D | D-02 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| beta-BHC | SO | Pond D | D-05 | SW8080 | > | 0.0033 | 0.0014 | mg/kg | X@ | 2 | 4 |
| beta-BHC | SO | Pond D | D-06 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 0 | 2 |
| beta-BHC | SO | Pond D | D-05 | SW8080 | > | 0.0081 | 0.0014 | mg/kg | C | 0 | 2 |
| beta-BHC | SO | Pond D | D-04 | SW8080 | < | 0.013 | 0.013 | mg/kg | | 0 | 2 |
| beta-BHC | SO | Pond D | D-03 | SW8080 | > | 0.026 | 0.0013 | mg/kg | X | 2 | 4 |
| beta-BHC | SO | Pond D | D-03 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 0 | 2 |
| beta-BHC | SO | Pond D | D-01 | SW8080 | < | 0.0015 | 0.0015 | mg/kg | | 0 | 2 |
| beta-BHC | SO | Pond D | D-01 | SW8080 | < | 0.00135 | 0.0014 | mg/kg | | 2 | 4 |
| bis(2-Ethylhexyl)phthalate | SO | Pond D | D-01 | SW8270 | ND | 1.1333333 | 1.4 | mg/kg | | 2 | 4 |
| bis(2-Ethylhexyl)phthalate | SO | Pond D | D-05 | SW8270 | ND | 1.05 | 1.4 | mg/kg | | 0 | 2 |
| bis(2-Ethylhexyl)phthalate | SO | Pond D | D-05 | SW8270 | ND | 1.05 | 1.4 | mg/kg | | 2 | 4 |
| bis(2-Ethylhexyl)phthalate | SO | Pond D | D-02 | SW8270 | ND | 1.05 | 1.4 | mg/kg | | 0 | 2 |
| bis(2-Ethylhexyl)phthalate | SO | Pond D | D-04 | SW8270 | < | 1.1 | 1.3 | mg/kg | J | 0 | 2 |
| bis(2-Ethylhexyl)phthalate | SO | Pond D | D-03 | SW8270 | ND | 0.975 | 1.3 | mg/kg | | 2 | 4 |
| bis(2-Ethylhexyl)phthalate | SO | Pond D | D-03 | SW8270 | < | 0.64 | 1.3 | mg/kg | J | 0 | 2 |
| bis(2-Ethylhexyl)phthalate | SO | Pond D | D-01 | SW8270 | ND | 0.7866667 | 1.5 | mg/kg | | 0 | 2 |
| bis(2-Ethylhexyl)phthalate | SO | Pond D | D-06 | SW8270 | < | 0.82 | 1.3 | mg/kg | JB | 0 | 2 |
| Chromium | SO | Pond D | BH-02 | SW6010 | > | 4.6 | 3.9 | mg/kg | @ | 8.5 | 12.5 |
| Chromium | SO | Pond D | D-01 | SW6010 | ND | 3.375 | 4.8 | mg/kg | | 0 | 2 |
| Chromium | SO | Pond D | D-05 | SW6010 | ND | 4.2 | 5.6 | mg/kg | | 2 | 4 |
| Chromium | SO | Pond D | D-05 | SW6010 | ND | 3.825 | 5.1 | mg/kg | | 0 | 2 |
| Chromium | SO | Pond D | D-04 | SW6010 | > | 3.6 | 3.5 | mg/kg | @ | 0 | 2 |
| Chromium | SO | Pond D | D-03 | SW6010 | > | 7.9 | 3.8 | mg/kg | @ | 2 | 4 |
| Chromium | SO | Pond D | D-03 | SW6010 | ND | 3.075 | 4.1 | mg/kg | | 0 | 2 |
| Chromium | SO | Pond D | D-02 | SW6010 | ND | 3.375 | 4.5 | mg/kg | | 0 | 2 |
| Chromium | SO | Pond D | D-06 | SW6010 | ND | 3.375 | 4.5 | mg/kg | | 0 | 2 |
| Chromium | SO | Pond D | D-01 | SW6010 | > | 11.7 | 4.3 | mg/kg | @ | 2 | 4 |
| Cobalt | SO | Pond D | D-05 | SW6010 | ND | 3.825 | 5.1 | mg/kg | | 0 | 2 |
| Cobalt | SO | Pond D | D-04 | SW6010 | ND | 2.625 | 3.5 | mg/kg | | 0 | 2 |
| Cobalt | SO | Pond D | D-03 | SW6010 | ND | 2.85 | 3.8 | mg/kg | | 2 | 4 |
| Cobalt | SO | Pond D | D-03 | SW6010 | ND | 3.075 | 4.1 | mg/kg | | 0 | 2 |
| Cobalt | SO | Pond D | D-02 | SW6010 | ND | 3.375 | 4.5 | mg/kg | | 0 | 2 |
| Cobalt | SO | Pond D | D-01 | SW6010 | ND | 3.5833333 | 4.3 | mg/kg | | 2 | 4 |
| Cobalt | SO | Pond D | D-05 | SW6010 | ND | 4.2 | 5.6 | mg/kg | | 2 | 4 |
| Cobalt | SO | Pond D | D-06 | SW6010 | ND | 3.375 | 4.5 | mg/kg | | 0 | 2 |
| Cobalt | SO | Pond D | D-01 | SW6010 | ND | 3.375 | 4.8 | mg/kg | | 0 | 2 |
| Cyanide | SO | Pond D | D-04 | SW9012 | < | 0.31 | 0.31 | mg/kg | | 0 | 2 |
| Cyanide | SO | Pond D | D-05 | SW9012 | < | 0.33 | 0.33 | mg/kg | | 2 | 4 |
| Cyanide | SO | Pond D | D-03 | SW9012 | < | 0.27 | 0.27 | mg/kg | | 0 | 2 |
| Cyanide | SO | Pond D | D-01 | SW9012 | < | 0.275 | 0.29 | mg/kg | | 2 | 4 |
| Cyanide | SO | Pond D | D-02 | SW9012 | < | 0.35 | 0.35 | mg/kg | | 0 | 2 |
| Cyanide | SO | Pond D | D-01 | SW9012 | > | 2.78 | 0.28 | mg/kg | | 0 | 2 |
| Cyanide | SO | Pond D | D-03 | SW9012 | < | 0.29 | 0.29 | mg/kg | | 2 | 4 |
| Cyanide | SO | Pond D | D-06 | SW9012 | < | 0.3 | 0.3 | mg/kg | | 0 | 2 |
| Cyanide | SO | Pond D | D-05 | SW9012 | < | 0.34 | 0.34 | mg/kg | | 0 | 2 |
| delta-BHC | SO | Pond D | D-05 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 2 | 4 |
| delta-BHC | SO | Pond D | D-05 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| delta-BHC | SO | Pond D | D-04 | SW8080 | < | 0.013 | 0.013 | mg/kg | | 0 | 2 |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| delta-BHC | SO | Pond D | D-03 | SW8080 | > | 0.017 | 0.0013 | mg/kg | X | 2 | 4 |
| delta-BHC | SO | Pond D | D-03 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 0 | 2 |
| delta-BHC | SO | Pond D | D-02 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| delta-BHC | SO | Pond D | D-01 | SW8080 | < | 0.00135 | 0.0014 | mg/kg | | 2 | 4 |
| delta-BHC | SO | Pond D | D-06 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 0 | 2 |
| delta-BHC | SO | Pond D | D-01 | SW8080 | < | 0.0015 | 0.0015 | mg/kg | | 0 | 2 |
| Endosulfan sulfate | SO | Pond D | BH-02 | SW8080 | < | 0.0049 | 0.0069 | mg/kg | JC | 8.5 | 12.5 |
| Endosulfan sulfate | SO | Pond D | D-01 | SW8080 | < | 0.0066 | 0.0068 | mg/kg | | 2 | 4 |
| Endosulfan sulfate | SO | Pond D | D-02 | SW8080 | < | 0.0024 | 0.007 | mg/kg | JC | 0 | 2 |
| Endosulfan sulfate | SO | Pond D | D-03 | SW8080 | < | 0.00053 | 0.0066 | mg/kg | JX | 0 | 2 |
| Endosulfan sulfate | SO | Pond D | D-01 | SW8080 | < | 0.003815 | 0.0074 | mg/kg | JX | 0 | 2 |
| Endosulfan sulfate | SO | Pond D | D-05 | SW8080 | < | 0.0069 | 0.0069 | mg/kg | | 2 | 4 |
| Endosulfan sulfate | SO | Pond D | D-05 | SW8080 | < | 0.0068 | 0.0068 | mg/kg | | 0 | 2 |
| Endosulfan sulfate | SO | Pond D | D-04 | SW8080 | < | 0.064 | 0.064 | mg/kg | | 0 | 2 |
| Endosulfan sulfate | SO | Pond D | D-06 | SW8080 | < | 0.0067 | 0.0067 | mg/kg | | 0 | 2 |
| Endosulfan sulfate | SO | Pond D | D-03 | SW8080 | < | 0.0067 | 0.0067 | mg/kg | | 2 | 4 |
| gamma-BHC | SO | Pond D | D-01 | SW8080 | < | 0.0015 | 0.0015 | mg/kg | | 0 | 2 |
| gamma-BHC | SO | Pond D | D-05 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 2 | 4 |
| gamma-BHC | SO | Pond D | D-05 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| gamma-BHC | SO | Pond D | D-03 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 0 | 2 |
| gamma-BHC | SO | Pond D | D-04 | SW8080 | < | 0.013 | 0.013 | mg/kg | | 0 | 2 |
| gamma-BHC | SO | Pond D | D-06 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 0 | 2 |
| gamma-BHC | SO | Pond D | D-03 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 2 | 4 |
| gamma-BHC | SO | Pond D | D-02 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| gamma-BHC | SO | Pond D | D-01 | SW8080 | < | 0.0112 | 0.0014 | mg/kg | | 2 | 4 |
| Heptachlor | SO | Pond D | D-01 | SW8080 | < | 0.0015 | 0.0015 | mg/kg | | 0 | 2 |
| Heptachlor | SO | Pond D | D-06 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 0 | 2 |
| Heptachlor | SO | Pond D | D-03 | SW8080 | > | 0.0018 | 0.0013 | mg/kg | X@ | 2 | 4 |
| Heptachlor | SO | Pond D | D-05 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 2 | 4 |
| Heptachlor | SO | Pond D | D-05 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| Heptachlor | SO | Pond D | D-04 | SW8080 | < | 0.013 | 0.013 | mg/kg | | 0 | 2 |
| Heptachlor | SO | Pond D | D-03 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 0 | 2 |
| Heptachlor | SO | Pond D | D-02 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| Heptachlor | SO | Pond D | D-01 | SW8080 | > | 0.0018 | 0.0014 | mg/kg | X@ | 2 | 4 |
| Lead | SO | Pond D | D-02 | SW7421 | > | 0.89 | 0.35 | mg/kg | @ | 0 | 2 |
| Lead | SO | Pond D | D-01 | SW7421 | > | 5 | 0.35 | mg/kg | | 2 | 4 |
| Lead | SO | Pond D | D-03 | SW7421 | > | 1.1 | 0.31 | mg/kg | @ | 0 | 2 |
| Lead | SO | Pond D | D-01 | SW7421 | > | 1.35 | 0.38 | mg/kg | @ | 0 | 2 |
| Lead | SO | Pond D | D-06 | SW7421 | > | 1.5 | 0.33 | mg/kg | @ | 0 | 2 |
| Lead | SO | Pond D | D-03 | SW7421 | > | 2.9 | 0.32 | mg/kg | | 2 | 4 |
| Lead | SO | Pond D | D-05 | SW7421 | > | 1.7 | 0.28 | mg/kg | | 0 | 2 |
| Lead | SO | Pond D | D-04 | SW7421 | > | 2.2 | 0.32 | mg/kg | | 0 | 2 |
| Lead | SO | Pond D | D-05 | SW7421 | > | 1.8 | 0.36 | mg/kg | | 2 | 4 |
| Nickel | SO | Pond D | D-05 | SW6010 | ND | 8.25 | 11 | mg/kg | | 2 | 4 |
| Nickel | SO | Pond D | D-01 | SW6010 | ND | 6.675 | 9.5 | mg/kg | | 0 | 2 |
| Nickel | SO | Pond D | D-05 | SW6010 | ND | 7.5 | 10 | mg/kg | | 0 | 2 |
| Nickel | SO | Pond D | D-04 | SW6010 | ND | 5.25 | 7 | mg/kg | | 0 | 2 |
| Nickel | SO | Pond D | D-02 | SW6010 | ND | 6.75 | 9 | mg/kg | | 0 | 2 |
| Nickel | SO | Pond D | D-03 | SW6010 | ND | 5.625 | 7.5 | mg/kg | | 2 | 4 |
| Nickel | SO | Pond D | D-01 | SW6010 | > | 12.5 | 8.7 | mg/kg | @ | 2 | 4 |
| Nickel | SO | Pond D | D-03 | SW6010 | ND | 6.15 | 8.2 | mg/kg | | 0 | 2 |
| Nickel | SO | Pond D | D-06 | SW6010 | ND | 6.75 | 9 | mg/kg | | 0 | 2 |
| Selenium | SO | Pond D | D-01 | SW7740 | ND | 0.435 | 0.64 | mg/kg | | 0 | 2 |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Selenium | SO | Pond D | D-05 | SW7740 | ND | 0.45 | 0.6 | mg/kg | | 2 | 4 |
| Selenium | SO | Pond D | D-05 | SW7740 | > | 0.59 | 0.47 | mg/kg | @ | 0 | 2 |
| Selenium | SO | Pond D | D-04 | SW7740 | ND | 0.3975 | 0.53 | mg/kg | | 0 | 2 |
| Selenium | SO | Pond D | D-03 | SW7740 | ND | 0.3975 | 0.53 | mg/kg | | 2 | 4 |
| Selenium | SO | Pond D | D-03 | SW7740 | ND | 0.39 | 0.52 | mg/kg | | 0 | 2 |
| Selenium | SO | Pond D | D-02 | SW7740 | ND | 0.4425 | 0.59 | mg/kg | | 0 | 2 |
| Selenium | SO | Pond D | D-06 | SW7740 | ND | 0.4125 | 0.55 | mg/kg | | 0 | 2 |
| Selenium | SO | Pond D | D-01 | SW7740 | ND | 0.41625 | 0.58 | mg/kg | | 2 | 4 |
| Sulfide | SO | Pond D | D-05 | SW9030 | < | 34 | 34 | mg/kg | | 0 | 2 |
| Sulfide | SO | Pond D | D-04 | SW9030 | > | 82 | 32 | mg/kg | @ | 0 | 2 |
| Sulfide | SO | Pond D | D-03 | SW9030 | < | 30 | 30 | mg/kg | | 2 | 4 |
| Sulfide | SO | Pond D | D-03 | SW9030 | < | 33 | 33 | mg/kg | | 0 | 2 |
| Sulfide | SO | Pond D | D-02 | SW9030 | < | 31 | 31 | mg/kg | | 0 | 2 |
| Sulfide | SO | Pond D | D-01 | SW9030 | < | 32.5 | 34 | mg/kg | | 2 | 4 |
| Sulfide | SO | Pond D | D-05 | SW9030 | < | 34 | 34 | mg/kg | | 2 | 4 |
| Sulfide | SO | Pond D | D-06 | SW9030 | < | 32 | 32 | mg/kg | | 0 | 2 |
| Sulfide | SO | Pond D | D-01 | SW9030 | < | 35.5 | 37 | mg/kg | | 0 | 2 |
| Total organic carbon | SO | Pond D | BH-02 | | > | 2700 | 1100 | mg/kg | @ | 12.5 | 14.5 |
| Total organic carbon | SO | Pond D | BH-02 | | > | 2600 | 1100 | mg/kg | @ | 8.5 | 12.5 |
| Total organic carbon | SO | Pond D | BH-02 | | > | 8800 | 1100 | mg/kg | | 2.5 | 4.5 |
| Total organic carbon | SO | Pond D | BH-02 | | > | 2200 | 1100 | mg/kg | @ | 22.5 | 24.5 |
| Total organic carbon | SO | Pond D | D-01 | | > | 1650 | 1100 | mg/kg | @ | 2 | 4 |
| Total organic carbon | SO | Pond D | BH-02 | | = | 1100 | 1100 | mg/kg | @ | 18.5 | 20.5 |
| Total organic carbon | SO | Pond D | D-01 | | > | 2950 | 1100 | mg/kg | @ | 0 | 2 |
| Vanadium | SO | Pond D | D-05 | SW6010 | ND | 7.5 | 10 | mg/kg | | 0 | 2 |
| Vanadium | SO | Pond D | D-03 | SW6010 | ND | 6.15 | 8.2 | mg/kg | | 0 | 2 |
| Vanadium | SO | Pond D | D-05 | SW6010 | ND | 8.25 | 11 | mg/kg | | 2 | 4 |
| Vanadium | SO | Pond D | D-02 | SW6010 | ND | 6.75 | 9 | mg/kg | | 0 | 2 |
| Vanadium | SO | Pond D | D-04 | SW6010 | > | 9.4 | 7 | mg/kg | @ | 0 | 2 |
| Vanadium | SO | Pond D | D-01 | SW6010 | > | 24 | 8.7 | mg/kg | @ | 2 | 4 |
| Vanadium | SO | Pond D | D-03 | SW6010 | > | 15 | 7.5 | mg/kg | @ | 2 | 4 |
| Vanadium | SO | Pond D | D-01 | SW6010 | ND | 6.675 | 9.5 | mg/kg | | 0 | 2 |
| Vanadium | SO | Pond D | D-06 | SW6010 | > | 11 | 9 | mg/kg | @ | 0 | 2 |
| Vanadium | SO | Pond D | BH-02 | SW6010 | > | 8.4 | 7.8 | mg/kg | @ | 8.5 | 12.5 |
| Zinc | SO | Pond D | BH-02 | SW6010 | > | 8.9 | 7.8 | mg/kg | @ | 8.5 | 12.5 |
| Zinc | SO | Pond D | D-04 | SW6010 | > | 10 | 7 | mg/kg | @ | 0 | 2 |
| Zinc | SO | Pond D | D-06 | SW6010 | > | 11 | 9 | mg/kg | @ | 0 | 2 |
| Zinc | SO | Pond D | D-05 | SW6010 | ND | 8.25 | 11 | mg/kg | | 2 | 4 |
| Zinc | SO | Pond D | D-05 | SW6010 | ND | 7.5 | 10 | mg/kg | | 0 | 2 |
| Zinc | SO | Pond D | D-03 | SW6010 | > | 18 | 7.5 | mg/kg | @ | 2 | 4 |
| Zinc | SO | Pond D | D-03 | SW6010 | ND | 6.15 | 8.2 | mg/kg | | 0 | 2 |
| Zinc | SO | Pond D | D-02 | SW6010 | ND | 6.75 | 9 | mg/kg | | 0 | 2 |
| Zinc | SO | Pond D | D-01 | SW6010 | > | 27 | 8.7 | mg/kg | @ | 2 | 4 |
| Zinc | SO | Pond D | D-01 | SW6010 | > | 8.15 | 9.5 | mg/kg | @ | 0 | 2 |
| 4,4'-DDD | WS | Pond D | D-01 | SW8080 | > | 0.00003 | 9.50E-06 | mg/L | X@ | . | . |
| Arsenic | WS | Pond D | D-5 | SW7060 | ND | 0.003 | 0.006 | mg/L | | . | . |
| Arsenic | WS | Pond D | D-4 | SW7060 | ND | 0.003 | 0.006 | mg/L | | . | . |
| Arsenic | WS | Pond D | D-6 | SW7060 | ND | 0.003 | 0.006 | mg/L | | . | . |
| Arsenic | WS | Pond D | D-1 | SW7060 | > | 0.0039 | . | mg/L | @ | . | . |
| Arsenic | WS | Pond D | D-2 | SW7060 | > | 0.0056 | . | mg/L | @ | . | . |
| Arsenic | WS | Pond D | D-3 | SW7060 | > | 0.0062 | . | mg/L | @ | . | . |
| Barium | WS | Pond D | D-6 | SW6010 | > | 0.035 | . | mg/L | @ | . | . |
| Barium | WS | Pond D | D-5 | SW6010 | > | 0.035 | . | mg/L | @ | . | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Barium | WS | Pond D | D-4 | SW6010 | > | 0.036 | . | mg/L | @ | . | . |
| Barium | WS | Pond D | D-3 | SW6010 | > | 0.039 | . | mg/L | @ | . | . |
| Barium | WS | Pond D | D-2 | SW6010 | > | 0.038 | . | mg/L | @ | . | . |
| Barium | WS | Pond D | D-1 | SW6010 | > | 0.038 | . | mg/L | @ | . | . |
| Benzoic acid | WS | Pond D | D-6 | SW8270 | ND | 0.025 | 0.05 | mg/L | | . | . |
| Benzoic acid | WS | Pond D | D-5 | SW8270 | ND | 0.025 | 0.05 | mg/L | | . | . |
| Benzoic acid | WS | Pond D | D-4 | SW8270 | > | 0.028 | . | mg/L | J | . | . |
| Benzoic acid | WS | Pond D | D-3 | SW8270 | ND | 0.025 | 0.05 | mg/L | | . | . |
| Benzoic acid | WS | Pond D | D-2 | SW8270 | ND | 0.025 | 0.05 | mg/L | | . | . |
| bis(2-Ethylhexyl)phthalate | WS | Pond D | D-3 | SW8270 | > | 0.013 | . | mg/L | @B | . | . |
| bis(2-Ethylhexyl)phthalate | WS | Pond D | D-2 | SW8270 | ND | 0.005 | 0.01 | mg/L | | . | . |
| bis(2-Ethylhexyl)phthalate | WS | Pond D | D-4 | SW8270 | > | 0.02 | . | mg/L | @ | . | . |
| bis(2-Ethylhexyl)phthalate | WS | Pond D | D-1 | SW8270 | > | 0.004 | . | mg/L | J | . | . |
| bis(2-Ethylhexyl)phthalate | WS | Pond D | D-5 | SW8270 | > | 0.01 | . | mg/L | @B | . | . |
| bis(2-Ethylhexyl)phthalate | WS | Pond D | D-6 | SW8270 | > | 0.01 | . | mg/L | @B | . | . |
| Boron | WS | Pond D | D-4 | SW6010 | > | 0.3 | . | mg/L | @ | . | . |
| Boron | WS | Pond D | D-2 | SW6010 | > | 0.25 | . | mg/L | @ | . | . |
| Boron | WS | Pond D | D-1 | SW6010 | > | 0.28 | . | mg/L | @ | . | . |
| Boron | WS | Pond D | D-6 | SW6010 | > | 0.3 | . | mg/L | @ | . | . |
| Boron | WS | Pond D | D-5 | SW6010 | > | 0.3 | . | mg/L | @ | . | . |
| Boron | WS | Pond D | D-3 | SW6010 | > | 0.25 | . | mg/L | @ | . | . |
| Butylbenzylphthalate | WS | Pond D | D-4 | SW8270 | > | 0.004 | . | mg/L | J | . | . |
| Calcium | WS | Pond D | D-4 | SW6010 | > | 340 | . | mg/L | | . | . |
| Calcium | WS | Pond D | D-2 | SW6010 | > | 330 | . | mg/L | | . | . |
| Calcium | WS | Pond D | D-1 | SW6010 | > | 330 | . | mg/L | | . | . |
| Calcium | WS | Pond D | D-3 | SW6010 | > | 340 | . | mg/L | | . | . |
| Calcium | WS | Pond D | D-6 | SW6010 | > | 330 | . | mg/L | | . | . |
| Calcium | WS | Pond D | D-5 | SW6010 | > | 330 | . | mg/L | | . | . |
| delta-BHC | WS | Pond D | D-01 | SW8080 | > | 0.000021 | 9.50E-06 | mg/L | X@ | . | . |
| Dibutylphthalate | WS | Pond D | D-4 | SW8270 | > | 0.004 | . | mg/L | J | . | . |
| Dieldrin | WS | Pond D | D-01 | SW8080 | > | 0.000015 | 9.50E-06 | mg/L | X@ | . | . |
| Diethylphthalate | WS | Pond D | D-4 | SW8270 | > | 0.002 | . | mg/L | J | . | . |
| Endosulfan sulfate | WS | Pond D | D-01 | SW8080 | < | 0.000013 | 0.000048 | mg/L | JB | . | . |
| gamma-BHC | WS | Pond D | D-01 | SW8080 | > | 0.00001 | 9.50E-06 | mg/L | @ | . | . |
| gamma-Chlordane | WS | Pond D | D-01 | SW8080 | < | 5.80E-06 | 9.50E-06 | mg/L | J | . | . |
| Hardness, as CaC03 | WS | Pond D | D-01 | E130.2 | > | 2100 | 120 | mg/L | | . | . |
| Heptachlor epoxide | WS | Pond D | D-01 | SW8080 | > | 0.00001 | 9.50E-06 | mg/L | X@ | . | . |
| Iron | WS | Pond D | D-2 | SW6010 | > | 0.031 | . | mg/L | @ | . | . |
| Iron | WS | Pond D | D-1 | SW6010 | > | 0.028 | . | mg/L | @ | . | . |
| Iron | WS | Pond D | D-3 | SW6010 | > | 0.042 | . | mg/L | @ | . | . |
| Iron | WS | Pond D | D-6 | SW6010 | > | 0.054 | . | mg/L | @ | . | . |
| Iron | WS | Pond D | D-5 | SW6010 | > | 0.034 | . | mg/L | @ | . | . |
| Iron | WS | Pond D | D-4 | SW6010 | > | 0.02 | . | mg/L | @ | . | . |
| Lead | WS | Pond D | D-5 | SW7421 | > | 0.0054 | . | mg/L | @ | . | . |
| Lead | WS | Pond D | D-1 | SW7421 | > | 0.0038 | . | mg/L | @ | . | . |
| Lead | WS | Pond D | D-6 | SW7421 | > | 0.0044 | . | mg/L | @ | . | . |
| Lead | WS | Pond D | D-4 | SW7421 | > | 0.0027 | . | mg/L | @ | . | . |
| Lead | WS | Pond D | D-3 | SW7421 | > | 0.0041 | . | mg/L | @ | . | . |
| Lead | WS | Pond D | D-2 | SW7421 | > | 0.0047 | . | mg/L | @ | . | . |
| Lead (organic) | WS | Pond D | D-5 | E239.1 | > | 0.12 | . | mg/L | @ | . | . |
| Lead (organic) | WS | Pond D | D-4 | E239.1 | > | 0.11 | . | mg/L | @ | . | . |
| Lead (organic) | WS | Pond D | D-3 | E239.1 | ND | 0.05 | 0.1 | mg/L | | . | . |
| Lead (organic) | WS | Pond D | D-2 | E239.1 | ND | 0.05 | 0.1 | mg/L | | . | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lead (organic) | WS | Pond D | D-6 | E239.1 | ND | 0.05 | 0.1 | mg/L | | . | . |
| Lead (organic) | WS | Pond D | D-1 | E239.1 | ND | 0.05 | 0.1 | mg/L | | . | . |
| Magnesium | WS | Pond D | D-1 | SW6010 | > | 170 | . | mg/L | | . | . |
| Magnesium | WS | Pond D | D-3 | SW6010 | > | 180 | . | mg/L | | . | . |
| Magnesium | WS | Pond D | D-2 | SW6010 | > | 170 | . | mg/L | | . | . |
| Magnesium | WS | Pond D | D-6 | SW6010 | > | 170 | . | mg/L | | . | . |
| Magnesium | WS | Pond D | D-4 | SW6010 | > | 170 | . | mg/L | | . | . |
| Magnesium | WS | Pond D | D-5 | SW6010 | > | 170 | . | mg/L | | . | . |
| Manganese | WS | Pond D | D-1 | SW6010 | > | 0.074 | . | mg/L | | . | . |
| Manganese | WS | Pond D | D-2 | SW6010 | > | 0.072 | . | mg/L | | . | . |
| Manganese | WS | Pond D | D-5 | SW6010 | > | 0.039 | . | mg/L | @ | . | . |
| Manganese | WS | Pond D | D-3 | SW6010 | > | 0.074 | . | mg/L | | . | . |
| Manganese | WS | Pond D | D-6 | SW6010 | > | 0.04 | . | mg/L | | . | . |
| Manganese | WS | Pond D | D-4 | SW6010 | > | 0.04 | . | mg/L | | . | . |
| Mercury | WS | Pond D | D-4 | SW7470 | > | 0.00051 | . | mg/L | @ | . | . |
| Mercury | WS | Pond D | D-3 | SW7470 | ND | 0.0001 | 0.0002 | mg/L | | . | . |
| Mercury | WS | Pond D | D-2 | SW7470 | ND | 0.0001 | 0.0002 | mg/L | | . | . |
| Mercury | WS | Pond D | D-5 | SW7470 | > | 0.00074 | . | mg/L | @ | . | . |
| Mercury | WS | Pond D | D-1 | SW7470 | ND | 0.0001 | 0.0002 | mg/L | | . | . |
| Mercury | WS | Pond D | D-6 | SW7470 | > | 0.00062 | . | mg/L | @ | . | . |
| Methoxychlor | WS | Pond D | D-5 | SW8080 | > | 0.00002 | . | mg/L | J | . | . |
| Phenol | WS | Pond D | D-2 | SW8270 | ND | 0.005 | 0.01 | mg/L | | . | . |
| Phenol | WS | Pond D | D-6 | SW8270 | ND | 0.005 | 0.01 | mg/L | | . | . |
| Phenol | WS | Pond D | D-5 | SW8270 | ND | 0.005 | 0.01 | mg/L | | . | . |
| Phenol | WS | Pond D | D-4 | SW8270 | > | 0.007 | . | mg/L | J | . | . |
| Phenol | WS | Pond D | D-3 | SW8270 | ND | 0.005 | 0.01 | mg/L | | . | . |
| Potassium | WS | Pond D | D-2 | SW6010 | > | 12 | . | mg/L | | . | . |
| Potassium | WS | Pond D | D-6 | SW6010 | > | 12 | . | mg/L | | . | . |
| Potassium | WS | Pond D | D-1 | SW6010 | > | 12 | . | mg/L | | . | . |
| Potassium | WS | Pond D | D-4 | SW6010 | > | 12 | . | mg/L | | . | . |
| Potassium | WS | Pond D | D-3 | SW6010 | > | 12 | . | mg/L | | . | . |
| Potassium | WS | Pond D | D-5 | SW6010 | > | 12 | . | mg/L | | . | . |
| Selenium | WS | Pond D | D-2 | SW7740 | ND | 0.001 | 0.002 | mg/L | | . | . |
| Selenium | WS | Pond D | D-3 | SW7740 | ND | 0.001 | 0.002 | mg/L | | . | . |
| Selenium | WS | Pond D | D-1 | SW7740 | ND | 0.001 | 0.002 | mg/L | | . | . |
| Selenium | WS | Pond D | D-4 | SW7740 | > | 0.0025 | . | mg/L | @ | . | . |
| Selenium | WS | Pond D | D-6 | SW7740 | ND | 0.001 | 0.002 | mg/L | | . | . |
| Selenium | WS | Pond D | D-5 | SW7740 | > | 0.003 | . | mg/L | @ | . | . |
| Silicon | WS | Pond D | D-4 | SW6010 | > | 14 | . | mg/L | | . | . |
| Silicon | WS | Pond D | D-2 | SW6010 | > | 17 | . | mg/L | | . | . |
| Silicon | WS | Pond D | D-6 | SW6010 | > | 14 | . | mg/L | | . | . |
| Silicon | WS | Pond D | D-3 | SW6010 | > | 16 | . | mg/L | | . | . |
| Silicon | WS | Pond D | D-5 | SW6010 | > | 14 | . | mg/L | | . | . |
| Silicon | WS | Pond D | D-1 | SW6010 | > | 17 | . | mg/L | | . | . |
| Sodium | WS | Pond D | D-6 | SW6010 | > | 480 | . | mg/L | | . | . |
| Sodium | WS | Pond D | D-5 | SW6010 | > | 480 | . | mg/L | | . | . |
| Sodium | WS | Pond D | D-4 | SW6010 | > | 490 | . | mg/L | | . | . |
| Sodium | WS | Pond D | D-3 | SW6010 | > | 520 | . | mg/L | | . | . |
| Sodium | WS | Pond D | D-1 | SW6010 | > | 500 | . | mg/L | | . | . |
| Sodium | WS | Pond D | D-2 | SW6010 | > | 500 | . | mg/L | | . | . |
| Total dissolved solids | WS | Pond D | D-01 | E160.1 | > | 4600 | 10 | mg/L | | . | . |
| Vanadium | WS | Pond D | D-4 | SW6010 | ND | 0.0025 | 0.005 | mg/L | | . | . |
| Vanadium | WS | Pond D | D-5 | SW6010 | ND | 0.0025 | 0.005 | mg/L | | . | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Vanadium | WS | Pond D | D-2 | SW6010 | > | 0.006 | . | mg/L | @ | . | . |
| Vanadium | WS | Pond D | D-3 | SW6010 | > | 0.0063 | . | mg/L | @ | . | . |
| Vanadium | WS | Pond D | D-1 | SW6010 | > | 0.0051 | . | mg/L | @ | . | . |
| Vanadium | WS | Pond D | D-6 | SW6010 | ND | 0.0025 | 0.005 | mg/L | | . | . |
| Zinc | WS | Pond D | D-1 | SW6010 | > | 0.0038 | . | mg/L | @ | . | . |
| Zinc | WS | Pond D | D-6 | SW6010 | > | 0.0076 | . | mg/L | @ | . | . |
| Zinc | WS | Pond D | D-2 | SW6010 | ND | 0.0015 | 0.003 | mg/L | | . | . |
| Zinc | WS | Pond D | D-5 | SW6010 | > | 0.0081 | . | mg/L | @ | . | . |
| Zinc | WS | Pond D | D-4 | SW6010 | > | 0.0052 | . | mg/L | @ | . | . |
| Zinc | WS | Pond D | D-3 | SW6010 | ND | 0.0015 | 0.003 | mg/L | | . | . |
| 4,4'-DDT | WG | Pond D/E/ | MW-15 | SW8080 | ND | 9.50E-06 | 0.000019 | mg/L | | . | . |
| 4,4'-DDT | WG | Pond D/E/ | MW-03 | SW8080 | ND | 9.50E-06 | 0.000019 | mg/L | | . | . |
| 4,4'-DDT | WG | Pond D/E/ | MW-03 | SW8080 | > | 0.00024 | 0.00002 | mg/L | C | . | . |
| 4,4'-DDT | WG | Pond D/E/ | MWS-05 | SW8080 | > | 0.000049 | 0.000019 | mg/L | X@ | . | . |
| 4,4'-DDT | WG | Pond D/E/ | MWS-05 | SW8080 | ND | 9.50E-06 | 0.000019 | mg/L | | . | . |
| 4,4'-DDT | WG | Pond D/E/ | MW-03 | SW8080 | > | 0.000091 | 0.000019 | mg/L | G@ | . | . |
| 4,4'-DDT | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 9.50E-06 | 0.000019 | mg/L | | . | . |
| 4,4'-DDT | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 9.50E-06 | 0.000019 | mg/L | | . | . |
| 4,4'-DDT | WG | Pond D/E/ | MWD-04 | SW8080 | ND | 9.50E-06 | 0.000019 | mg/L | | . | . |
| 4,4'-DDT | WG | Pond D/E/ | MW-15 | SW8080 | ND | 9.50E-06 | 0.000019 | mg/L | | . | . |
| 4,4'-DDT | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 0.00001 | 0.00002 | mg/L | | . | . |
| 4,4'-DDT | WG | Pond D/E/ | MW-14 | SW8080 | ND | 9.50E-06 | 0.000019 | mg/L | | . | . |
| Aldrin | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Aldrin | WG | Pond D/E/ | MWS-05 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Aldrin | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Aldrin | WG | Pond D/E/ | MWD-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Aldrin | WG | Pond D/E/ | MW-15 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Aldrin | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 4.90E-06 | 9.80E-06 | mg/L | | . | . |
| Aldrin | WG | Pond D/E/ | MW-14 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Aldrin | WG | Pond D/E/ | MW-14 | SW8080 | ND | 4.85E-06 | 9.70E-06 | mg/L | | . | . |
| Aldrin | WG | Pond D/E/ | MW-03 | SW8080 | > | 0.00003 | 9.50E-06 | mg/L | @ | . | . |
| Aldrin | WG | Pond D/E/ | MW-15 | SW8080 | ND | 4.85E-06 | 9.70E-06 | mg/L | | . | . |
| Aldrin | WG | Pond D/E/ | MW-03 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Aldrin | WG | Pond D/E/ | MW-03 | SW8080 | > | 0.000097 | 0.00001 | mg/L | C | . | . |
| Aldrin | WG | Pond D/E/ | MWS-05 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| alpha-BHC | WG | Pond D/E/ | MW-14 | SW8080 | > | 0.00005 | 9.70E-06 | mg/L | X | . | . |
| alpha-BHC | WG | Pond D/E/ | MW-03 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| alpha-BHC | WG | Pond D/E/ | MW-14 | SW8080 | > | 0.0000535 | 9.50E-06 | mg/L | X@ | . | . |
| alpha-BHC | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| alpha-BHC | WG | Pond D/E/ | MW-03 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| alpha-BHC | WG | Pond D/E/ | MWS-05 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| alpha-BHC | WG | Pond D/E/ | MWD-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| alpha-BHC | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| alpha-BHC | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 4.90E-06 | 9.80E-06 | mg/L | | . | . |
| alpha-BHC | WG | Pond D/E/ | MWS-05 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| alpha-BHC | WG | Pond D/E/ | MW-03 | SW8080 | ND | 5.00E-06 | 0.00001 | mg/L | | . | . |
| alpha-BHC | WG | Pond D/E/ | MW-15 | SW8080 | ND | 4.85E-06 | 9.70E-06 | mg/L | | . | . |
| alpha-BHC | WG | Pond D/E/ | MW-15 | SW8080 | ND | 4.388E-05 | 9.50E-06 | mg/L | | . | . |
| alpha-Chlordane | WG | Pond D/E/ | MW-03 | SW8080 | > | 0.000015 | 9.50E-06 | mg/L | X@ | . | . |
| alpha-Chlordane | WG | Pond D/E/ | MW-14 | SW8080 | < | 1.20E-06 | 9.70E-06 | mg/L | JX | . | . |
| alpha-Chlordane | WG | Pond D/E/ | MWS-05 | SW8080 | < | 6.00E-06 | 9.50E-06 | mg/L | JX | . | . |
| alpha-Chlordane | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| alpha-Chlordane | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 4.90E-06 | 9.80E-06 | mg/L | | . | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| alpha-Chlordane | WG | Pond D/E/ | MWD-04 | SW8080 | < | 5.50E-06 | 9.50E-06 | mg/L | JX | . | . |
| alpha-Chlordane | WG | Pond D/E/ | MW-15 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| alpha-Chlordane | WG | Pond D/E/ | MW-15 | SW8080 | < | 2.60E-06 | 9.70E-06 | mg/L | JX | . | . |
| alpha-Chlordane | WG | Pond D/E/ | MWS-05 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| alpha-Chlordane | WG | Pond D/E/ | MW-14 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Barium | WG | Pond D/E/ | MW-14 | SW6010 | > | 0.035 | 0.01 | mg/L | @ | . | . |
| Barium | WG | Pond D/E/ | MW-15 | SW6010 | > | 0.042 | 0.01 | mg/L | @ | . | . |
| Barium | WG | Pond D/E/ | MWS-05 | SW6010 | > | 0.021 | 0.01 | mg/L | @ | . | . |
| Barium | WG | Pond D/E/ | MWD-04 | SW6010 | > | 0.074 | 0.01 | mg/L | | . | . |
| Beryllium | WG | Pond D/E/ | MW-15 | SW6010 | < | -0.00004 | 0.002 | mg/L | J | . | . |
| beta-BHC | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| beta-BHC | WG | Pond D/E/ | MWD-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| beta-BHC | WG | Pond D/E/ | MW-15 | SW8080 | ND | 4.85E-06 | 9.70E-06 | mg/L | | . | . |
| beta-BHC | WG | Pond D/E/ | MW-14 | SW8080 | > | 0.000013 | 9.70E-06 | mg/L | X@ | . | . |
| beta-BHC | WG | Pond D/E/ | MW-03 | SW8080 | > | 0.000017 | 9.50E-06 | mg/L | X@ | . | . |
| beta-BHC | WG | Pond D/E/ | MW-03 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| beta-BHC | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 4.90E-06 | 9.80E-06 | mg/L | | . | . |
| beta-BHC | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| beta-BHC | WG | Pond D/E/ | MW-03 | SW8080 | ND | 5.00E-06 | 0.00001 | mg/L | | . | . |
| beta-BHC | WG | Pond D/E/ | MWS-05 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| beta-BHC | WG | Pond D/E/ | MWS-05 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| bis(2-Ethylhexyl)phthalate | WG | Pond D/E/ | MW-15 | SW8270 | < | 0.0024 | 0.0096 | mg/L | J | . | . |
| Cadmium | WG | Pond D/E/ | MWS-05 | SW6010 | > | 0.014 | 0.005 | mg/L | @ | . | . |
| Cadmium | WG | Pond D/E/ | MW-15 | SW6010 | > | 0.011 | 0.005 | mg/L | @ | . | . |
| delta-BHC | WG | Pond D/E/ | MW-15 | SW8080 | ND | 4.85E-06 | 9.70E-06 | mg/L | | . | . |
| delta-BHC | WG | Pond D/E/ | MWD-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| delta-BHC | WG | Pond D/E/ | MW-03 | SW8080 | > | 0.000035 | 9.50E-06 | mg/L | X@ | . | . |
| delta-BHC | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| delta-BHC | WG | Pond D/E/ | MW-03 | SW8080 | > | 0.000032 | 0.00001 | mg/L | @C | . | . |
| delta-BHC | WG | Pond D/E/ | MW-14 | SW8080 | ND | 4.85E-06 | 9.70E-06 | mg/L | | . | . |
| delta-BHC | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 4.90E-06 | 9.80E-06 | mg/L | | . | . |
| delta-BHC | WG | Pond D/E/ | MW-03 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| delta-BHC | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| delta-BHC | WG | Pond D/E/ | MW-15 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| delta-BHC | WG | Pond D/E/ | MWS-05 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| delta-BHC | WG | Pond D/E/ | MW-14 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| delta-BHC | WG | Pond D/E/ | MWS-05 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Dieldrin | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 4.90E-06 | 9.80E-06 | mg/L | | . | . |
| Dieldrin | WG | Pond D/E/ | MW-15 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Dieldrin | WG | Pond D/E/ | MW-03 | SW8080 | > | 0.00002 | 9.50E-06 | mg/L | X@ | . | . |
| Dieldrin | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Dieldrin | WG | Pond D/E/ | MW-14 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Dieldrin | WG | Pond D/E/ | MW-03 | SW8080 | > | 0.00025 | 0.00001 | mg/L | C | . | . |
| Dieldrin | WG | Pond D/E/ | MW-14 | SW8080 | ND | 4.85E-06 | 9.70E-06 | mg/L | | . | . |
| Dieldrin | WG | Pond D/E/ | MWS-05 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Dieldrin | WG | Pond D/E/ | MW-15 | SW8080 | ND | 4.85E-06 | 9.70E-06 | mg/L | | . | . |
| Dieldrin | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Dieldrin | WG | Pond D/E/ | MW-03 | SW8080 | > | 0.000012 | 9.50E-06 | mg/L | X@ | . | . |
| Dieldrin | WG | Pond D/E/ | MWD-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Dieldrin | WG | Pond D/E/ | MWS-05 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Endosulfan II | WG | Pond D/E/ | MWS-05 | SW8080 | ND | 0.0000145 | 0.000029 | mg/L | | . | . |
| Endosulfan II | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 0.0000145 | 0.000029 | mg/L | | . | . |
| Endosulfan II | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 0.0000145 | 0.000029 | mg/L | | . | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Endosulfan II | WG | Pond D/E/ | MWD-04 | SW8080 | ND | 0.0000145 | 0.000029 | mg/L | | . | . |
| Endosulfan II | WG | Pond D/E/ | MW-15 | SW8080 | ND | 0.0000145 | 0.000029 | mg/L | | . | . |
| Endosulfan II | WG | Pond D/E/ | MW-15 | SW8080 | ND | 0.0000145 | 0.000029 | mg/L | | . | . |
| Endosulfan II | WG | Pond D/E/ | MW-14 | SW8080 | ND | 0.0000145 | 0.000029 | mg/L | | . | . |
| Endosulfan II | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 0.0000145 | 0.000029 | mg/L | | . | . |
| Endosulfan II | WG | Pond D/E/ | MW-14 | SW8080 | ND | 0.0000145 | 0.000029 | mg/L | | . | . |
| Endosulfan II | WG | Pond D/E/ | MW-03 | SW8080 | > | 0.000067 | 0.000029 | mg/L | @ | . | . |
| Endosulfan II | WG | Pond D/E/ | MW-03 | SW8080 | < | 0.000022 | 0.000029 | mg/L | J | . | . |
| Endosulfan II | WG | Pond D/E/ | MWS-05 | SW8080 | ND | 0.0000145 | 0.000029 | mg/L | | . | . |
| Endosulfan II | WG | Pond D/E/ | MW-03 | SW8080 | ND | 0.000015 | 0.00003 | mg/L | | . | . |
| Endosulfan sulfate | WG | Pond D/E/ | MW-14 | SW8080 | ND | 0.000024 | 0.000048 | mg/L | | . | . |
| Endosulfan sulfate | WG | Pond D/E/ | MW-15 | SW8080 | ND | 0.000027 | 0.000048 | mg/L | | . | . |
| Endosulfan sulfate | WG | Pond D/E/ | MW-15 | SW8080 | ND | 0.0000245 | 0.000049 | mg/L | | . | . |
| Endosulfan sulfate | WG | Pond D/E/ | MWS-04 | SW8080 | < | 9.40E-06 | 0.000049 | mg/L | J | . | . |
| Endosulfan sulfate | WG | Pond D/E/ | MW-14 | SW8080 | ND | 0.0000245 | 0.000049 | mg/L | | . | . |
| Endosulfan sulfate | WG | Pond D/E/ | MWS-05 | SW8080 | < | 0.000018 | 0.000048 | mg/L | JX | . | . |
| Endosulfan sulfate | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 0.000024 | 0.000048 | mg/L | | . | . |
| Endosulfan sulfate | WG | Pond D/E/ | MWS-05 | SW8080 | < | 0.000028 | 0.000048 | mg/L | JB | . | . |
| Endosulfan sulfate | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 0.000024 | 0.000048 | mg/L | | . | . |
| Endosulfan sulfate | WG | Pond D/E/ | MW-03 | SW8080 | < | 0.000018 | 0.000048 | mg/L | J | . | . |
| Endosulfan sulfate | WG | Pond D/E/ | MWD-04 | SW8080 | < | 0.000013 | 0.000048 | mg/L | JB | . | . |
| Endosulfan sulfate | WG | Pond D/E/ | MW-03 | SW8080 | < | 0.000036 | 0.000048 | mg/L | JX | . | . |
| Endosulfan sulfate | WG | Pond D/E/ | MW-03 | SW8080 | ND | 0.000025 | 0.00005 | mg/L | | . | . |
| Endrin | WG | Pond D/E/ | MW-03 | SW8080 | > | 0.00015 | 9.50E-06 | mg/L | G | . | . |
| Endrin | WG | Pond D/E/ | MW-03 | SW8080 | > | 0.00002 | 9.50E-06 | mg/L | X@ | . | . |
| Endrin | WG | Pond D/E/ | MWS-05 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Endrin | WG | Pond D/E/ | MW-14 | SW8080 | ND | 4.85E-06 | 9.70E-06 | mg/L | | . | . |
| Endrin | WG | Pond D/E/ | MWS-05 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Endrin | WG | Pond D/E/ | MW-03 | SW8080 | > | 0.00028 | 0.00001 | mg/L | C | . | . |
| Endrin | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 4.90E-06 | 9.80E-06 | mg/L | | . | . |
| Endrin | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Endrin | WG | Pond D/E/ | MWD-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Endrin aldehyde | WG | Pond D/E/ | MWS-05 | SW8080 | < | 4.00E-06 | 0.000019 | mg/L | JX | . | . |
| Endrin aldehyde | WG | Pond D/E/ | MWS-05 | SW8080 | ND | 9.50E-06 | 0.000019 | mg/L | | . | . |
| Endrin aldehyde | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 9.50E-06 | 0.000019 | mg/L | | . | . |
| Endrin aldehyde | WG | Pond D/E/ | MWD-04 | SW8080 | ND | 9.50E-06 | 0.000019 | mg/L | | . | . |
| Endrin aldehyde | WG | Pond D/E/ | MW-15 | SW8080 | ND | 8.60E-06 | 0.000019 | mg/L | | . | . |
| Endrin aldehyde | WG | Pond D/E/ | MW-15 | SW8080 | < | 9.70E-06 | 0.000019 | mg/L | JX | . | . |
| Endrin aldehyde | WG | Pond D/E/ | MW-14 | SW8080 | ND | 6.80E-06 | 0.000019 | mg/L | | . | . |
| Endrin aldehyde | WG | Pond D/E/ | MW-14 | SW8080 | ND | 9.50E-06 | 0.000019 | mg/L | | . | . |
| Endrin aldehyde | WG | Pond D/E/ | MW-03 | SW8080 | > | 0.000077 | 0.000019 | mg/L | GB@ | . | . |
| Endrin aldehyde | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 9.50E-06 | 0.000019 | mg/L | | . | . |
| Endrin aldehyde | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 0.00001 | 0.00002 | mg/L | | . | . |
| Endrin aldehyde | WG | Pond D/E/ | MW-03 | SW8080 | ND | 9.50E-06 | 0.000019 | mg/L | | . | . |
| Endrin aldehyde | WG | Pond D/E/ | MW-03 | SW8080 | ND | 0.00001 | 0.00002 | mg/L | | . | . |
| gamma-BHC | WG | Pond D/E/ | MWD-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| gamma-BHC | WG | Pond D/E/ | MWS-05 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| gamma-BHC | WG | Pond D/E/ | MW-03 | SW8080 | > | 0.00015 | 0.00001 | mg/L | C | . | . |
| gamma-BHC | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 4.90E-06 | 9.80E-06 | mg/L | | . | . |
| gamma-BHC | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| gamma-BHC | WG | Pond D/E/ | MWS-05 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| gamma-BHC | WG | Pond D/E/ | MW-15 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| gamma-BHC | WG | Pond D/E/ | MW-15 | SW8080 | > | 0.00001 | 9.70E-06 | mg/L | @ | . | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| gamma-BHC | WG | Pond D/E/ | MW-14 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| gamma-BHC | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| gamma-BHC | WG | Pond D/E/ | MW-14 | SW8080 | > | 0.000027 | 9.70E-06 | mg/L | @ | . | . |
| gamma-BHC | WG | Pond D/E/ | MW-03 | SW8080 | > | 0.000085 | 9.50E-06 | mg/L | X | . | . |
| gamma-BHC | WG | Pond D/E/ | MW-03 | SW8080 | > | 0.000018 | 9.50E-06 | mg/L | X@ | . | . |
| gamma-Chlordane | WG | Pond D/E/ | MWS-05 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| gamma-Chlordane | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| gamma-Chlordane | WG | Pond D/E/ | MW-15 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| gamma-Chlordane | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 4.90E-06 | 9.80E-06 | mg/L | | . | . |
| gamma-Chlordane | WG | Pond D/E/ | MWS-05 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| gamma-Chlordane | WG | Pond D/E/ | MWD-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| gamma-Chlordane | WG | Pond D/E/ | MW-15 | SW8080 | < | 3.00E-06 | 9.70E-06 | mg/L | JX | . | . |
| gamma-Chlordane | WG | Pond D/E/ | MW-14 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| gamma-Chlordane | WG | Pond D/E/ | MW-03 | SW8080 | > | 0.00016 | 9.50E-06 | mg/L | G | . | . |
| gamma-Chlordane | WG | Pond D/E/ | MW-14 | SW8080 | < | 2.40E-06 | 9.70E-06 | mg/L | J | . | . |
| gamma-Chlordane | WG | Pond D/E/ | MW-03 | SW8080 | > | 0.000026 | 9.50E-06 | mg/L | X@ | . | . |
| Hardness, as CaC03 | WG | Pond D/E/ | MWD-04 | E130.2 | > | 10000 | 120 | mg/L | | . | . |
| Hardness, as CaC03 | WG | Pond D/E/ | MWS-05 | E130.2 | > | 20000 | 250 | mg/L | | . | . |
| Hardness, as CaC03 | WG | Pond D/E/ | MW-15 | E130.2 | > | 16000 | 500 | mg/L | | . | . |
| Hardness, as CaC03 | WG | Pond D/E/ | MW-14 | E130.2 | > | 14000 | 250 | mg/L | | . | . |
| Heptachlor | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Heptachlor | WG | Pond D/E/ | MW-15 | SW8080 | > | 0.000025 | 9.70E-06 | mg/L | G@ | . | . |
| Heptachlor | WG | Pond D/E/ | MWD-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Heptachlor | WG | Pond D/E/ | MW-14 | SW8080 | > | 0.00002 | 9.70E-06 | mg/L | G@ | . | . |
| Heptachlor | WG | Pond D/E/ | MW-03 | SW8080 | > | 0.000082 | 0.00001 | mg/L | C | . | . |
| Heptachlor | WG | Pond D/E/ | MW-03 | SW8080 | > | 0.000032 | 9.50E-06 | mg/L | @ | . | . |
| Heptachlor | WG | Pond D/E/ | MWS-05 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Heptachlor | WG | Pond D/E/ | MW-14 | SW8080 | > | 0.000015 | 9.50E-06 | mg/L | G@ | . | . |
| Heptachlor | WG | Pond D/E/ | MWS-04 | SW8080 | < | 4.10E-06 | 9.50E-06 | mg/L | J | . | . |
| Heptachlor | WG | Pond D/E/ | MW-03 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Heptachlor | WG | Pond D/E/ | MW-15 | SW8080 | > | 0.0000155 | 9.50E-06 | mg/L | G@ | . | . |
| Heptachlor | WG | Pond D/E/ | MWS-05 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Heptachlor epoxide | WG | Pond D/E/ | MW-03 | SW8080 | ND | 5.00E-06 | 0.00001 | mg/L | | . | . |
| Heptachlor epoxide | WG | Pond D/E/ | MW-15 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Heptachlor epoxide | WG | Pond D/E/ | MWS-05 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Heptachlor epoxide | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Heptachlor epoxide | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Heptachlor epoxide | WG | Pond D/E/ | MW-15 | SW8080 | ND | 4.85E-06 | 9.70E-06 | mg/L | | . | . |
| Heptachlor epoxide | WG | Pond D/E/ | MW-14 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Heptachlor epoxide | WG | Pond D/E/ | MW-14 | SW8080 | ND | 4.85E-06 | 9.70E-06 | mg/L | | . | . |
| Heptachlor epoxide | WG | Pond D/E/ | MW-03 | SW8080 | > | 0.000011 | 9.50E-06 | mg/L | @ | . | . |
| Isodrin | WG | Pond D/E/ | MWS-05 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Isodrin | WG | Pond D/E/ | MW-15 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Isodrin | WG | Pond D/E/ | MWS-05 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Isodrin | WG | Pond D/E/ | MWD-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Isodrin | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 4.90E-06 | 9.80E-06 | mg/L | | . | . |
| Isodrin | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Isodrin | WG | Pond D/E/ | MW-14 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Isodrin | WG | Pond D/E/ | MW-14 | SW8080 | > | 0.00002 | 9.70E-06 | mg/L | X@ | . | . |
| Isodrin | WG | Pond D/E/ | MW-03 | SW8080 | > | 0.000054 | 9.50E-06 | mg/L | X | . | . |
| Isodrin | WG | Pond D/E/ | MW-15 | SW8080 | ND | 4.85E-06 | 9.70E-06 | mg/L | | . | . |
| Isodrin | WG | Pond D/E/ | MW-03 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Lead | WG | Pond D/E/ | MW-14 | SW7421 | < | -0.008 | 0.006 | mg/L | @ | . | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lead | WG | Pond D/E/ | MW-15 | SW7421 | < | -0.022 | 0.006 | mg/L | @ | . | . |
| Mercury | WG | Pond D/E/ | MW-14 | SW7470 | < | 0.00002 | 0.00036 | mg/L | J | . | . |
| Mercury | WG | Pond D/E/ | MW-15 | SW7470 | < | 0.00001 | 0.00018 | mg/L | J | . | . |
| Methoxychlor | WG | Pond D/E/ | MW-14 | SW8080 | ND | 0.0000245 | 0.000049 | mg/L | | . | . |
| Methoxychlor | WG | Pond D/E/ | MW-03 | SW8080 | ND | 0.000025 | 0.00005 | mg/L | | . | . |
| Methoxychlor | WG | Pond D/E/ | MW-03 | SW8080 | > | 0.00021 | 0.000048 | mg/L | G@ | . | . |
| Methoxychlor | WG | Pond D/E/ | MW-14 | SW8080 | ND | 0.000024 | 0.000048 | mg/L | | . | . |
| Methoxychlor | WG | Pond D/E/ | MW-03 | SW8080 | ND | 0.000024 | 0.000048 | mg/L | | . | . |
| Methoxychlor | WG | Pond D/E/ | MWS-05 | SW8080 | ND | 0.000024 | 0.000048 | mg/L | | . | . |
| Methoxychlor | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 0.000024 | 0.000048 | mg/L | | . | . |
| Methoxychlor | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 0.0000245 | 0.000049 | mg/L | | . | . |
| Methoxychlor | WG | Pond D/E/ | MWS-04 | SW8080 | ND | 0.000024 | 0.000048 | mg/L | | . | . |
| Methoxychlor | WG | Pond D/E/ | MWD-04 | SW8080 | ND | 0.000024 | 0.000048 | mg/L | | . | . |
| Methoxychlor | WG | Pond D/E/ | MW-15 | SW8080 | ND | 0.000024 | 0.000048 | mg/L | | . | . |
| Methoxychlor | WG | Pond D/E/ | MWS-05 | SW8080 | ND | 0.000024 | 0.000048 | mg/L | | . | . |
| Methoxychlor | WG | Pond D/E/ | MW-15 | SW8080 | ND | 0.0000245 | 0.000049 | mg/L | | . | . |
| Sulfide | WG | Pond D/E/ | MWS-05 | SW9030 | < | 0.99 | 1 | mg/L | @ | . | . |
| Sulfide | WG | Pond D/E/ | MWD-04 | SW9030 | < | 0.84 | 1 | mg/L | @ | . | . |
| Thallium | WG | Pond D/E/ | MW-14 | SW7841 | < | -0.0008 | 0.01 | mg/L | J | . | . |
| Total dissolved solids | WG | Pond D/E/ | MWD-04 | E160.1 | > | 14000 | 10 | mg/L | | . | . |
| Total dissolved solids | WG | Pond D/E/ | MW-15 | E160.1 | > | 51000 | 10 | mg/L | | . | . |
| Total dissolved solids | WG | Pond D/E/ | MW-14 | E160.1 | > | 35000 | 10 | mg/L | | . | . |
| Total dissolved solids | WG | Pond D/E/ | MWS-05 | E160.1 | > | 55000 | 10 | mg/L | | . | . |
| Vanadium | WG | Pond D/E/ | MW-15 | SW6010 | < | 0.0066 | 0.02 | mg/L | @ | . | . |
| Zinc | WG | Pond D/E/ | MW-15 | SW6010 | < | 0.011 | 0.02 | mg/L | @ | . | . |
| Antimony | SE | Pond E | E-01 | SW6010 | < | 6.6 | 11 | mg/kg | @ | 0 | 0.5 |
| Arsenic | SE | Pond E | E-01 | SW7060 | > | 2.7 | 1.2 | mg/kg | @ | 0 | 0.5 |
| Barium | SE | Pond E | E-01 | SW6010 | > | 36 | 1.1 | mg/kg | | 0 | 0.5 |
| bis(2-Ethylhexyl)phthalate | SE | Pond E | E-01 | SW8270 | < | 0.66 | 6.7 | mg/kg | J | 0 | 0.5 |
| Cadmium | SE | Pond E | E-01 | SW6010 | < | 0.082 | 0.56 | mg/kg | @ | 0 | 0.5 |
| Chromium | SE | Pond E | E-01 | SW6010 | > | 2.9 | 1.1 | mg/kg | @ | 0 | 0.5 |
| Copper | SE | Pond E | E-01 | SW6010 | > | 5.2 | 2.2 | mg/kg | @ | 0 | 0.5 |
| Diethylphthalate | SE | Pond E | E-01 | SW8270 | < | 0.12 | 6.7 | mg/kg | J | 0 | 0.5 |
| gamma-Chlordane | SE | Pond E | E-01 | SW8080 | < | 0.54 | 0.67 | mg/kg | J | 0 | 0.5 |
| Heptachlor | SE | Pond E | E-01 | SW8080 | < | 0.59 | 0.67 | mg/kg | J | 0 | 0.5 |
| Heptachlor epoxide | SE | Pond E | E-01 | SW8080 | > | 78 | 0.67 | mg/kg | X | 0 | 0.5 |
| Lead | SE | Pond E | E-01 | SW7421 | > | 21 | 0.45 | mg/kg | | 0 | 0.5 |
| Molecular sulfur | SE | Pond E | E-01 | SW8270 | > | 53 | . | mg/kg | | 0 | 0.5 |
| Nickel | SE | Pond E | E-01 | SW6010 | > | 3.1 | 2.2 | mg/kg | @ | 0 | 0.5 |
| Selenium | SE | Pond E | E-01 | SW7740 | < | 0.67 | 0.76 | mg/kg | @ | 0 | 0.5 |
| Silver | SE | Pond E | E-01 | SW6010 | < | 0.8 | 1.1 | mg/kg | @ | 0 | 0.5 |
| Tin | SE | Pond E | E-01 | SW6010 | < | 0.27 | 67 | mg/kg | @ | 0 | 0.5 |
| Vanadium | SE | Pond E | E-01 | SW6010 | > | 7.1 | 2.2 | mg/kg | @ | 0 | 0.5 |
| Zinc | SE | Pond E | E-01 | SW6010 | > | 8.3 | 2.2 | mg/kg | @ | 0 | 0.5 |
| 4,4'-DDD | SL | Pond E | E-03 | SW8080 | > | 4.085 | 0.051 | mg/kg | CD | . | . |
| 4,4'-DDD | SL | Pond E | E-02 | SW8080 | > | 0.24 | 0.05 | mg/kg | C@ | . | . |
| 4,4'-DDD | SL | Pond E | E-05 | SW8080 | > | 0.16 | 0.059 | mg/kg | X@ | . | . |
| 4,4'-DDD | SL | Pond E | E-01 | SW8080 | > | 0.38 | 0.066 | mg/kg | C | . | . |
| 4,4'-DDD | SL | Pond E | E-04 | SW8080 | > | 0.15 | 0.054 | mg/kg | X@ | . | . |
| 4,4'-DDE | SL | Pond E | E-02 | SW8080 | > | 0.17 | 0.05 | mg/kg | X@ | . | . |
| 4,4'-DDE | SL | Pond E | E-03 | SW8080 | > | 1.205 | 0.051 | mg/kg | CD | . | . |
| 4,4'-DDE | SL | Pond E | E-01 | SW8080 | > | 0.25 | 0.066 | mg/kg | X@ | . | . |
| 4,4'-DDE | SL | Pond E | E-05 | SW8080 | < | 0.059 | 0.059 | mg/kg | | . | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4,4'-DDE | SL | Pond E | E-04 | SW8080 | > | 0.16 | 0.054 | mg/kg | X@ | . | . |
| 4,4'-DDT | SL | Pond E | E-04 | SW8080 | < | 0.093 | 0.11 | mg/kg | JX | . | . |
| 4,4'-DDT | SL | Pond E | E-05 | SW8080 | < | 0.12 | 0.12 | mg/kg | | . | . |
| 4,4'-DDT | SL | Pond E | E-02 | SW8080 | < | 0.1 | 0.1 | mg/kg | | . | . |
| 4,4'-DDT | SL | Pond E | E-03 | SW8080 | < | 0.063 | 0.076 | mg/kg | | . | . |
| 4,4'-DDT | SL | Pond E | E-01 | SW8080 | < | 0.13 | 0.13 | mg/kg | | . | . |
| Arsenic | SL | Pond E | E-05 | SW7060 | > | 2.3 | 1.8 | mg/kg | @ | . | . |
| Arsenic | SL | Pond E | E-02 | SW7060 | ND | 1.05 | 1.4 | mg/kg | | . | . |
| Arsenic | SL | Pond E | E-01 | SW7060 | ND | 1.425 | 1.9 | mg/kg | | . | . |
| Arsenic | SL | Pond E | E-04 | SW7060 | > | 1.9 | 1.6 | mg/kg | @ | . | . |
| Arsenic | SL | Pond E | E-03 | SW7060 | = | 1.35 | 1.4 | mg/kg | @ | . | . |
| Barium | SL | Pond E | E-02 | SW6010 | > | 61 | 3.8 | mg/kg | | . | . |
| Barium | SL | Pond E | E-01 | SW6010 | > | 81 | 4.8 | mg/kg | | . | . |
| Barium | SL | Pond E | E-05 | SW6010 | > | 110 | 4.5 | mg/kg | | . | . |
| Barium | SL | Pond E | E-04 | SW6010 | > | 83 | 4.3 | mg/kg | | . | . |
| Barium | SL | Pond E | E-03 | SW6010 | > | 66 | 3.9 | mg/kg | | . | . |
| bis(2-Ethylhexyl)phthalate | SL | Pond E | E-05 | SW8270 | > | 12 | 5.9 | mg/kg | @ | . | . |
| bis(2-Ethylhexyl)phthalate | SL | Pond E | E-03 | SW8270 | > | 6.25 | 3.8 | mg/kg | @ | . | . |
| bis(2-Ethylhexyl)phthalate | SL | Pond E | E-04 | SW8270 | > | 6.6 | 5.4 | mg/kg | @ | . | . |
| bis(2-Ethylhexyl)phthalate | SL | Pond E | E-01 | SW8270 | > | 9 | 6.5 | mg/kg | @ | . | . |
| bis(2-Ethylhexyl)phthalate | SL | Pond E | E-02 | SW8270 | < | 3.6 | 5 | mg/kg | J | . | . |
| Cadmium | SL | Pond E | E-04 | SW6010 | ND | 1.65 | 2.2 | mg/kg | | . | . |
| Cadmium | SL | Pond E | E-01 | SW6010 | > | 2.9 | 2.4 | mg/kg | @ | . | . |
| Cadmium | SL | Pond E | E-05 | SW6010 | ND | 1.725 | 2.3 | mg/kg | | . | . |
| Cadmium | SL | Pond E | E-03 | SW6010 | ND | 1.3875 | 2 | mg/kg | | . | . |
| Cadmium | SL | Pond E | E-02 | SW6010 | ND | 1.425 | 1.9 | mg/kg | | . | . |
| Chromium | SL | Pond E | E-03 | SW6010 | > | 16 | 3.9 | mg/kg | @ | . | . |
| Chromium | SL | Pond E | E-04 | SW6010 | > | 23 | 4.3 | mg/kg | | . | . |
| Chromium | SL | Pond E | E-02 | SW6010 | > | 26 | 3.8 | mg/kg | | . | . |
| Chromium | SL | Pond E | E-01 | SW6010 | > | 28 | 4.8 | mg/kg | | . | . |
| Chromium | SL | Pond E | E-05 | SW6010 | > | 21 | 4.5 | mg/kg | @ | . | . |
| Cobalt | SL | Pond E | E-03 | SW6010 | < | 4.35 | 3.9 | mg/kg | | . | . |
| Cobalt | SL | Pond E | E-05 | SW6010 | > | 5.2 | 4.5 | mg/kg | @ | . | . |
| Cobalt | SL | Pond E | E-04 | SW6010 | < | 4.3 | 4.3 | mg/kg | | . | . |
| Cobalt | SL | Pond E | E-02 | SW6010 | < | 3.8 | 3.8 | mg/kg | | . | . |
| Cobalt | SL | Pond E | E-01 | SW6010 | < | 4.8 | 4.8 | mg/kg | | . | . |
| Copper | SL | Pond E | E-01 | SW6010 | > | 75 | 9.5 | mg/kg | | . | . |
| Copper | SL | Pond E | E-04 | SW6010 | > | 48 | 8.7 | mg/kg | | . | . |
| Copper | SL | Pond E | E-02 | SW6010 | > | 28 | 7.7 | mg/kg | @ | . | . |
| Copper | SL | Pond E | E-03 | SW6010 | > | 23 | 7.8 | mg/kg | @ | . | . |
| Copper | SL | Pond E | E-05 | SW6010 | > | 45 | 9.1 | mg/kg | @ | . | . |
| Cyanide | SL | Pond E | E-04 | SW9012 | > | 2.5 | 1.2 | mg/kg | @ | . | . |
| Cyanide | SL | Pond E | E-01 | SW9012 | > | 180 | 5 | mg/kg | | . | . |
| Cyanide | SL | Pond E | E-05 | SW9012 | > | 3 | 1.3 | mg/kg | @ | . | . |
| Cyanide | SL | Pond E | E-03 | SW9012 | < | 0.675 | 0.85 | mg/kg | | . | . |
| Cyanide | SL | Pond E | E-02 | SW9012 | > | 6.1 | 0.87 | mg/kg | | . | . |
| Dibutylphthalate | SL | Pond E | E-02 | SW8270 | ND | 3.75 | 5 | mg/kg | | . | . |
| Dibutylphthalate | SL | Pond E | E-01 | SW8270 | ND | 4.875 | 6.5 | mg/kg | | . | . |
| Dibutylphthalate | SL | Pond E | E-05 | SW8270 | ND | 4.425 | 5.9 | mg/kg | | . | . |
| Dibutylphthalate | SL | Pond E | E-04 | SW8270 | ND | 4.05 | 5.4 | mg/kg | | . | . |
| Dibutylphthalate | SL | Pond E | E-03 | SW8270 | ND | 1.9766667 | 3.8 | mg/kg | | . | . |
| gamma-BHC | SL | Pond E | E-01 | SW8080 | > | 0.11 | 0.066 | mg/kg | C@ | . | . |
| gamma-BHC | SL | Pond E | E-02 | SW8080 | > | 0.082 | 0.05 | mg/kg | X@ | . | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| gamma-BHC | SL | Pond E | E-05 | SW8080 | < | 0.059 | 0.059 | mg/kg | | . | . |
| gamma-BHC | SL | Pond E | E-04 | SW8080 | < | 0.054 | 0.054 | mg/kg | | . | . |
| gamma-BHC | SL | Pond E | E-03 | SW8080 | < | 0.032 | 0.038 | mg/kg | | . | . |
| gamma-Chlordane | SL | Pond E | E-05 | SW8080 | > | 0.062 | 0.059 | mg/kg | X@ | . | . |
| gamma-Chlordane | SL | Pond E | E-04 | SW8080 | < | 0.054 | 0.054 | mg/kg | | . | . |
| gamma-Chlordane | SL | Pond E | E-03 | SW8080 | > | 0.1595 | 0.038 | mg/kg | X@ | . | . |
| gamma-Chlordane | SL | Pond E | E-02 | SW8080 | < | 0.05 | 0.05 | mg/kg | | . | . |
| gamma-Chlordane | SL | Pond E | E-01 | SW8080 | < | 0.066 | 0.066 | mg/kg | | . | . |
| Lead | SL | Pond E | E-01 | SW7421 | > | 13 | 1.4 | mg/kg | | . | . |
| Lead | SL | Pond E | E-05 | SW7421 | > | 11 | 1.3 | mg/kg | | . | . |
| Lead | SL | Pond E | E-04 | SW7421 | > | 10 | 1.2 | mg/kg | | . | . |
| Lead | SL | Pond E | E-03 | SW7421 | > | 10.2 | 1 | mg/kg | | . | . |
| Lead | SL | Pond E | E-02 | SW7421 | > | 8.2 | 1.1 | mg/kg | | . | . |
| Mercury | SL | Pond E | E-01 | SW7471 | > | 0.31 | 0.3 | mg/kg | @ | . | . |
| Mercury | SL | Pond E | E-05 | SW7471 | ND | 0.195 | 0.26 | mg/kg | | . | . |
| Mercury | SL | Pond E | E-02 | SW7471 | > | 0.29 | 0.22 | mg/kg | @ | . | . |
| Mercury | SL | Pond E | E-04 | SW7471 | > | 0.44 | 0.25 | mg/kg | @ | . | . |
| Mercury | SL | Pond E | E-03 | SW7471 | ND | 0.10875 | 0.17 | mg/kg | | . | . |
| Nickel | SL | Pond E | E-05 | SW6010 | ND | 6.825 | 9.1 | mg/kg | | . | . |
| Nickel | SL | Pond E | E-03 | SW6010 | ND | 7.1666667 | 7.8 | mg/kg | | . | . |
| Nickel | SL | Pond E | E-02 | SW6010 | ND | 5.775 | 7.7 | mg/kg | | . | . |
| Nickel | SL | Pond E | E-04 | SW6010 | ND | 6.525 | 8.7 | mg/kg | | . | . |
| Nickel | SL | Pond E | E-01 | SW6010 | > | 12 | 9.5 | mg/kg | @ | . | . |
| Phenanthrene | SL | Pond E | E-01 | SW8270 | < | 0.81 | 6.5 | mg/kg | J | . | . |
| Phenanthrene | SL | Pond E | E-03 | SW8270 | < | 1.5933333 | 3.8 | mg/kg | J | . | . |
| Phenanthrene | SL | Pond E | E-04 | SW8270 | < | 0.34 | 5.4 | mg/kg | J | . | . |
| Phenanthrene | SL | Pond E | E-02 | SW8270 | < | 0.54 | 5 | mg/kg | J | . | . |
| Phenanthrene | SL | Pond E | E-05 | SW8270 | ND | 4.425 | 5.9 | mg/kg | | . | . |
| Selenium | SL | Pond E | E-01 | SW7740 | > | 2.7 | 2.4 | mg/kg | @ | . | . |
| Selenium | SL | Pond E | E-05 | SW7740 | ND | 1.65 | 2.2 | mg/kg | | . | . |
| Selenium | SL | Pond E | E-02 | SW7740 | ND | 1.35 | 1.8 | mg/kg | | . | . |
| Selenium | SL | Pond E | E-04 | SW7740 | ND | 1.5 | 2 | mg/kg | | . | . |
| Selenium | SL | Pond E | E-03 | SW7740 | ND | 1.00875 | 1.7 | mg/kg | | . | . |
| Silver | SL | Pond E | E-03 | SW6010 | > | 14.5 | 3.9 | mg/kg | @ | . | . |
| Silver | SL | Pond E | E-02 | SW6010 | > | 27 | 3.8 | mg/kg | | . | . |
| Silver | SL | Pond E | E-04 | SW6010 | > | 34 | 4.3 | mg/kg | | . | . |
| Silver | SL | Pond E | E-05 | SW6010 | > | 18 | 4.5 | mg/kg | @ | . | . |
| Silver | SL | Pond E | E-01 | SW6010 | > | 39 | 4.8 | mg/kg | | . | . |
| Sulfide | SL | Pond E | E-04 | SW9030 | < | 130 | 130 | mg/kg | | . | . |
| Sulfide | SL | Pond E | E-02 | SW9030 | > | 720 | 120 | mg/kg | | . | . |
| Sulfide | SL | Pond E | E-05 | SW9030 | > | 850 | 150 | mg/kg | | . | . |
| Sulfide | SL | Pond E | E-01 | SW9030 | < | 160 | 160 | mg/kg | | . | . |
| Sulfide | SL | Pond E | E-03 | SW9030 | > | 590 | 94 | mg/kg | | . | . |
| Toluene | SL | Pond E | E-01 | SW8240 | < | 0.66 | 0.66 | mg/kg | | . | . |
| Toluene | SL | Pond E | E-05 | SW8240 | < | 0.59 | 0.59 | mg/kg | | . | . |
| Toluene | SL | Pond E | E-04 | SW8240 | < | 0.54 | 0.54 | mg/kg | | . | . |
| Toluene | SL | Pond E | E-03 | SW8240 | < | 0.227 | 0.38 | mg/kg | | . | . |
| Toluene | SL | Pond E | E-02 | SW8240 | < | 0.5 | 0.5 | mg/kg | | . | . |
| Vanadium | SL | Pond E | E-04 | SW6010 | > | 28 | 8.7 | mg/kg | @ | . | . |
| Vanadium | SL | Pond E | E-03 | SW6010 | > | 25 | 7.8 | mg/kg | @ | . | . |
| Vanadium | SL | Pond E | E-02 | SW6010 | > | 24 | 7.7 | mg/kg | @ | . | . |
| Vanadium | SL | Pond E | E-05 | SW6010 | > | 33 | 9.1 | mg/kg | @ | . | . |
| Vanadium | SL | Pond E | E-01 | SW6010 | > | 34 | 9.5 | mg/kg | @ | . | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Xylenes | SL | Pond E | E-01 | SW8240 | < | 0.25 | 0.66 | mg/kg | J | . | . |
| Xylenes | SL | Pond E | E-04 | SW8240 | < | 0.54 | 0.54 | mg/kg | | . | . |
| Xylenes | SL | Pond E | E-03 | SW8240 | < | 0.32 | 0.38 | mg/kg | | . | . |
| Xylenes | SL | Pond E | E-02 | SW8240 | < | 0.5 | 0.5 | mg/kg | | . | . |
| Xylenes | SL | Pond E | E-05 | SW8240 | < | 0.59 | 0.59 | mg/kg | | . | . |
| Zinc | SL | Pond E | E-03 | SW6010 | > | 52 | 7.8 | mg/kg | @ | . | . |
| Zinc | SL | Pond E | E-02 | SW6010 | > | 48 | 7.7 | mg/kg | | . | . |
| Zinc | SL | Pond E | E-04 | SW6010 | > | 63 | 8.7 | mg/kg | | . | . |
| Zinc | SL | Pond E | E-01 | SW6010 | > | 86 | 9.5 | mg/kg | | . | . |
| Zinc | SL | Pond E | E-05 | SW6010 | > | 67 | 9.1 | mg/kg | | . | . |
| 1,1,2-Trichlorotrifluoroethane | SO | Pond E | E-05 | SW8240 | > | 0.017 | . | mg/kg | | 0 | 2 |
| 4,4'-DDD | SO | Pond E | E-05 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 0 | 2 |
| 4,4'-DDD | SO | Pond E | E-05 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 2 | 4 |
| 4,4'-DDD | SO | Pond E | E-03 | SW8080 | > | 0.0815 | 0.0013 | mg/kg | C | 0 | 2 |
| 4,4'-DDD | SO | Pond E | E-01 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| 4,4'-DDD | SO | Pond E | E-01 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 2 | 4 |
| 4,4'-DDD | SO | Pond E | E-02 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| 4,4'-DDD | SO | Pond E | E-03 | SW8080 | > | 0.0216 | 0.0014 | mg/kg | C | 2 | 4 |
| 4,4'-DDD | SO | Pond E | E-04 | SW8080 | > | 0.0036 | 0.0014 | mg/kg | X@ | 0 | 2 |
| 4,4'-DDD | SO | Pond E | E-02 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 2 | 4 |
| 4,4'-DDE | SO | Pond E | E-03 | SW8080 | > | 0.00705 | 0.0013 | mg/kg | C | 0 | 2 |
| 4,4'-DDE | SO | Pond E | E-04 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| 4,4'-DDE | SO | Pond E | E-05 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 2 | 4 |
| 4,4'-DDE | SO | Pond E | E-01 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| 4,4'-DDE | SO | Pond E | E-05 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 0 | 2 |
| 4,4'-DDE | SO | Pond E | E-01 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 2 | 4 |
| 4,4'-DDE | SO | Pond E | E-02 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| 4,4'-DDE | SO | Pond E | E-03 | SW8080 | > | 0.0053 | 0.0014 | mg/kg | C@ | 2 | 4 |
| 4,4'-DDE | SO | Pond E | E-02 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 2 | 4 |
| 4,4'-DDT | SO | Pond E | E-03 | SW8080 | > | 0.00275 | 0.0026 | mg/kg | X@ | 0 | 2 |
| 4,4'-DDT | SO | Pond E | E-01 | SW8080 | < | 0.0028 | 0.0028 | mg/kg | | 2 | 4 |
| 4,4'-DDT | SO | Pond E | E-01 | SW8080 | < | 0.0027 | 0.0027 | mg/kg | | 0 | 2 |
| 4,4'-DDT | SO | Pond E | E-05 | SW8080 | < | 0.0025 | 0.0025 | mg/kg | | 2 | 4 |
| 4,4'-DDT | SO | Pond E | E-02 | SW8080 | > | 0.004 | 0.0029 | mg/kg | X@ | 2 | 4 |
| 4,4'-DDT | SO | Pond E | E-05 | SW8080 | < | 0.0026 | 0.0026 | mg/kg | | 0 | 2 |
| 4,4'-DDT | SO | Pond E | E-04 | SW8080 | < | 0.0027 | 0.0027 | mg/kg | | 0 | 2 |
| 4,4'-DDT | SO | Pond E | E-03 | SW8080 | > | 0.0033 | 0.0028 | mg/kg | X@ | 2 | 4 |
| 4,4'-DDT | SO | Pond E | E-02 | SW8080 | < | 0.0028 | 0.0028 | mg/kg | | 0 | 2 |
| Acetone | SO | Pond E | E-02 | SW8240 | ND | 0.105 | 0.14 | mg/kg | | 2 | 4 |
| Acetone | SO | Pond E | E-05 | SW8240 | ND | 0.0975 | 0.13 | mg/kg | | 2 | 4 |
| Acetone | SO | Pond E | E-01 | SW8240 | ND | 0.105 | 0.14 | mg/kg | | 0 | 2 |
| Acetone | SO | Pond E | E-04 | SW8240 | < | 0.062 | 0.14 | mg/kg | JB | 0 | 2 |
| Acetone | SO | Pond E | E-03 | SW8240 | ND | 0.105 | 0.14 | mg/kg | | 2 | 4 |
| Acetone | SO | Pond E | E-03 | SW8240 | ND | 0.09375 | 0.13 | mg/kg | | 0 | 2 |
| Acetone | SO | Pond E | E-05 | SW8240 | ND | 0.0975 | 0.13 | mg/kg | | 0 | 2 |
| Acetone | SO | Pond E | E-02 | SW8240 | ND | 0.105 | 0.14 | mg/kg | | 0 | 2 |
| Acetone | SO | Pond E | E-01 | SW8240 | ND | 0.105 | 0.14 | mg/kg | | 2 | 4 |
| Aldrin | SO | Pond E | E-05 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 0 | 2 |
| Aldrin | SO | Pond E | E-04 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| Aldrin | SO | Pond E | E-02 | SW8080 | > | 0.0024 | 0.0014 | mg/kg | X@ | 2 | 4 |
| Aldrin | SO | Pond E | E-03 | SW8080 | < | 0.00125 | 0.0013 | mg/kg | | 0 | 2 |
| Aldrin | SO | Pond E | E-05 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 2 | 4 |
| Aldrin | SO | Pond E | E-03 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 2 | 4 |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Aldrin | SO | Pond E | E-01 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 2 | 4 |
| Aldrin | SO | Pond E | E-02 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| Aldrin | SO | Pond E | E-01 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| alpha-BHC | SO | Pond E | E-03 | SW8080 | > | 0.0019 | 0.0014 | mg/kg | C@ | 2 | 4 |
| alpha-BHC | SO | Pond E | E-03 | SW8080 | > | 0.00175 | 0.0013 | mg/kg | C@ | 0 | 2 |
| alpha-BHC | SO | Pond E | E-02 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 2 | 4 |
| alpha-BHC | SO | Pond E | E-02 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| alpha-BHC | SO | Pond E | E-01 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 2 | 4 |
| alpha-BHC | SO | Pond E | E-04 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| alpha-BHC | SO | Pond E | E-05 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 0 | 2 |
| alpha-BHC | SO | Pond E | E-01 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| alpha-BHC | SO | Pond E | E-05 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 2 | 4 |
| alpha-Chlordane | SO | Pond E | E-02 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| alpha-Chlordane | SO | Pond E | E-01 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| alpha-Chlordane | SO | Pond E | E-03 | SW8080 | < | 0.0013 | 0.0014 | mg/kg | JX | 2 | 4 |
| alpha-Chlordane | SO | Pond E | E-03 | SW8080 | = | 0.00125 | 0.0013 | mg/kg | X@ | 0 | 2 |
| alpha-Chlordane | SO | Pond E | E-01 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 2 | 4 |
| alpha-Chlordane | SO | Pond E | E-05 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 0 | 2 |
| alpha-Chlordane | SO | Pond E | E-05 | SW8080 | < | 0.00052 | 0.0013 | mg/kg | JX | 2 | 4 |
| alpha-Chlordane | SO | Pond E | E-02 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 2 | 4 |
| alpha-Chlordane | SO | Pond E | E-04 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| Arsenic | SO | Pond E | E-05 | SW7060 | > | 2 | 0.35 | mg/kg | | 2 | 4 |
| Arsenic | SO | Pond E | E-03 | SW7060 | > | 2.65 | 0.55 | mg/kg | | 2 | 4 |
| Arsenic | SO | Pond E | E-02 | SW7060 | > | 2.6 | 0.43 | mg/kg | | 2 | 4 |
| Arsenic | SO | Pond E | E-03 | SW7060 | > | 0.71 | 0.47 | mg/kg | @ | 0 | 2 |
| Arsenic | SO | Pond E | E-04 | SW7060 | > | 1 | 0.41 | mg/kg | @ | 0 | 2 |
| Arsenic | SO | Pond E | E-02 | SW7060 | > | 2.4 | 0.41 | mg/kg | | 0 | 2 |
| Arsenic | SO | Pond E | E-05 | SW7060 | > | 1.2 | 0.39 | mg/kg | @ | 0 | 2 |
| Arsenic | SO | Pond E | E-01 | SW7060 | > | 1.1 | 0.38 | mg/kg | @ | 2 | 4 |
| Arsenic | SO | Pond E | E-01 | SW7060 | > | 1.1 | 0.34 | mg/kg | @ | 0 | 2 |
| Barium | SO | Pond E | E-05 | SW6010 | > | 130 | 4.1 | mg/kg | | 2 | 4 |
| Barium | SO | Pond E | E-01 | SW6010 | > | 94 | 4.3 | mg/kg | | 0 | 2 |
| Barium | SO | Pond E | E-04 | SW6010 | > | 67 | 4.2 | mg/kg | | 0 | 2 |
| Barium | SO | Pond E | E-03 | SW6010 | > | 62.5 | 5.1 | mg/kg | | 2 | 4 |
| Barium | SO | Pond E | E-03 | SW6010 | > | 30.5 | 4.4 | mg/kg | | 0 | 2 |
| Barium | SO | Pond E | E-02 | SW6010 | > | 45 | 4.3 | mg/kg | | 2 | 4 |
| Barium | SO | Pond E | E-05 | SW6010 | > | 47 | 3.9 | mg/kg | | 0 | 2 |
| Barium | SO | Pond E | E-02 | SW6010 | > | 86 | 3.9 | mg/kg | | 0 | 2 |
| Barium | SO | Pond E | E-01 | SW6010 | > | 74 | 4.5 | mg/kg | | 2 | 4 |
| beta-BHC | SO | Pond E | E-01 | SW8080 | > | 0.0041 | 0.0014 | mg/kg | X@ | 0 | 2 |
| beta-BHC | SO | Pond E | E-01 | SW8080 | < | 0.0013 | 0.0014 | mg/kg | JX | 2 | 4 |
| beta-BHC | SO | Pond E | E-02 | SW8080 | > | 0.0044 | 0.0014 | mg/kg | C@ | 0 | 2 |
| beta-BHC | SO | Pond E | E-02 | SW8080 | > | 0.0096 | 0.0014 | mg/kg | C | 2 | 4 |
| beta-BHC | SO | Pond E | E-03 | SW8080 | > | 0.0194 | 0.0014 | mg/kg | X@ | 2 | 4 |
| beta-BHC | SO | Pond E | E-05 | SW8080 | > | 0.0027 | 0.0013 | mg/kg | X@ | 2 | 4 |
| beta-BHC | SO | Pond E | E-05 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 0 | 2 |
| beta-BHC | SO | Pond E | E-04 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| beta-BHC | SO | Pond E | E-03 | SW8080 | > | 0.0013 | 0.0013 | mg/kg | X@ | 0 | 2 |
| bis(2-Ethylhexyl)phthalate | SO | Pond E | E-01 | SW8270 | ND | 0.975 | 1.3 | mg/kg | | 0 | 2 |
| bis(2-Ethylhexyl)phthalate | SO | Pond E | E-05 | SW8270 | ND | 0.975 | 1.3 | mg/kg | | 2 | 4 |
| bis(2-Ethylhexyl)phthalate | SO | Pond E | E-03 | SW8270 | < | 2.005 | 1.3 | mg/kg | J | 0 | 2 |
| bis(2-Ethylhexyl)phthalate | SO | Pond E | E-05 | SW8270 | ND | 0.975 | 1.3 | mg/kg | | 0 | 2 |
| bis(2-Ethylhexyl)phthalate | SO | Pond E | E-04 | SW8270 | ND | 1.05 | 1.4 | mg/kg | | 0 | 2 |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| bis(2-Ethylhexyl)phthalate | SO | Pond E | E-03 | SW8270 | ND | 0.78 | 1.4 | mg/kg | | 2 | 4 |
| bis(2-Ethylhexyl)phthalate | SO | Pond E | E-02 | SW8270 | > | 5.4 | 1.4 | mg/kg | @ | 2 | 4 |
| bis(2-Ethylhexyl)phthalate | SO | Pond E | E-02 | SW8270 | ND | 1.05 | 1.4 | mg/kg | | 0 | 2 |
| bis(2-Ethylhexyl)phthalate | SO | Pond E | E-01 | SW8270 | ND | 1.05 | 1.4 | mg/kg | | 2 | 4 |
| Carbon disulfide | SO | Pond E | E-05 | SW8240 | ND | 0.004725 | 0.0063 | mg/kg | | 2 | 4 |
| Carbon disulfide | SO | Pond E | E-03 | SW8240 | > | 0.012 | 0.007 | mg/kg | @ | 2 | 4 |
| Carbon disulfide | SO | Pond E | E-03 | SW8240 | > | 0.018 | 0.0066 | mg/kg | @ | 0 | 2 |
| Carbon disulfide | SO | Pond E | E-02 | SW8240 | ND | 0.0054 | 0.0072 | mg/kg | | 2 | 4 |
| Carbon disulfide | SO | Pond E | E-02 | SW8240 | ND | 0.00525 | 0.007 | mg/kg | | 0 | 2 |
| Carbon disulfide | SO | Pond E | E-01 | SW8240 | ND | 0.00525 | 0.007 | mg/kg | | 2 | 4 |
| Carbon disulfide | SO | Pond E | E-04 | SW8240 | = | 0.0069 | 0.0069 | mg/kg | @ | 0 | 2 |
| Carbon disulfide | SO | Pond E | E-05 | SW8240 | ND | 0.00495 | 0.0066 | mg/kg | | 0 | 2 |
| Carbon disulfide | SO | Pond E | E-01 | SW8240 | ND | 0.0051 | 0.0068 | mg/kg | | 0 | 2 |
| Chromium | SO | Pond E | E-02 | SW6010 | > | 5 | 3.9 | mg/kg | @ | 0 | 2 |
| Chromium | SO | Pond E | E-01 | SW6010 | ND | 3.225 | 4.3 | mg/kg | | 0 | 2 |
| Chromium | SO | Pond E | E-03 | SW6010 | > | 8.45 | 5.1 | mg/kg | @ | 2 | 4 |
| Chromium | SO | Pond E | E-03 | SW6010 | ND | 3.4333333 | 4.4 | mg/kg | | 0 | 2 |
| Chromium | SO | Pond E | E-01 | SW6010 | ND | 3.375 | 4.5 | mg/kg | | 2 | 4 |
| Chromium | SO | Pond E | E-05 | SW6010 | > | 4.2 | 3.9 | mg/kg | @ | 0 | 2 |
| Chromium | SO | Pond E | E-05 | SW6010 | > | 4.2 | 4.1 | mg/kg | @ | 2 | 4 |
| Chromium | SO | Pond E | E-02 | SW6010 | ND | 3.225 | 4.3 | mg/kg | | 2 | 4 |
| Chromium | SO | Pond E | E-04 | SW6010 | ND | 3.15 | 4.2 | mg/kg | | 0 | 2 |
| Cobalt | SO | Pond E | E-01 | SW6010 | ND | 3.225 | 4.3 | mg/kg | | 0 | 2 |
| Cobalt | SO | Pond E | E-01 | SW6010 | ND | 3.375 | 4.5 | mg/kg | | 2 | 4 |
| Cobalt | SO | Pond E | E-02 | SW6010 | > | 7 | 3.9 | mg/kg | @ | 0 | 2 |
| Cobalt | SO | Pond E | E-02 | SW6010 | ND | 3.225 | 4.3 | mg/kg | | 2 | 4 |
| Cobalt | SO | Pond E | E-03 | SW6010 | ND | 3.675 | 5.1 | mg/kg | | 2 | 4 |
| Cobalt | SO | Pond E | E-05 | SW6010 | ND | 3.075 | 4.1 | mg/kg | | 2 | 4 |
| Cobalt | SO | Pond E | E-05 | SW6010 | ND | 2.925 | 3.9 | mg/kg | | 0 | 2 |
| Cobalt | SO | Pond E | E-04 | SW6010 | ND | 3.15 | 4.2 | mg/kg | | 0 | 2 |
| Cobalt | SO | Pond E | E-03 | SW6010 | ND | 2.9625 | 4.4 | mg/kg | | 0 | 2 |
| Cyanide | SO | Pond E | E-01 | SW9012 | < | 0.33 | 0.33 | mg/kg | | 0 | 2 |
| Cyanide | SO | Pond E | E-05 | SW9012 | > | 0.72 | 0.3 | mg/kg | @ | 2 | 4 |
| Cyanide | SO | Pond E | E-03 | SW9012 | < | 0.31 | 0.32 | mg/kg | | 0 | 2 |
| Cyanide | SO | Pond E | E-05 | SW9012 | > | 1.2 | 0.3 | mg/kg | @ | 0 | 2 |
| Cyanide | SO | Pond E | E-04 | SW9012 | > | 2.9 | 0.32 | mg/kg | | 0 | 2 |
| Cyanide | SO | Pond E | E-03 | SW9012 | < | 0.325 | 0.33 | mg/kg | | 2 | 4 |
| Cyanide | SO | Pond E | E-02 | SW9012 | > | 0.88 | 0.35 | mg/kg | @ | 2 | 4 |
| Cyanide | SO | Pond E | E-02 | SW9012 | > | 0.69 | 0.35 | mg/kg | @ | 0 | 2 |
| Cyanide | SO | Pond E | E-01 | SW9012 | > | 0.93 | 0.35 | mg/kg | @ | 2 | 4 |
| delta-BHC | SO | Pond E | E-03 | SW8080 | < | 0.00125 | 0.0013 | mg/kg | | 0 | 2 |
| delta-BHC | SO | Pond E | E-04 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| delta-BHC | SO | Pond E | E-05 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 2 | 4 |
| delta-BHC | SO | Pond E | E-03 | SW8080 | > | 0.0054 | 0.0014 | mg/kg | X | 2 | 4 |
| delta-BHC | SO | Pond E | E-05 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 0 | 2 |
| delta-BHC | SO | Pond E | E-02 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| delta-BHC | SO | Pond E | E-01 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 2 | 4 |
| delta-BHC | SO | Pond E | E-02 | SW8080 | > | 0.011 | 0.0014 | mg/kg | X | 2 | 4 |
| delta-BHC | SO | Pond E | E-01 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| Endosulfan II | SO | Pond E | E-05 | SW8080 | < | 0.0038 | 0.0038 | mg/kg | | 2 | 4 |
| Endosulfan II | SO | Pond E | E-03 | SW8080 | < | 0.00385 | 0.004 | mg/kg | | 0 | 2 |
| Endosulfan II | SO | Pond E | E-04 | SW8080 | < | 0.0041 | 0.0041 | mg/kg | | 0 | 2 |
| Endosulfan II | SO | Pond E | E-03 | SW8080 | < | 0.0042 | 0.0042 | mg/kg | | 2 | 4 |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Endosulfan II | SO | Pond E | E-05 | SW8080 | < | 0.0039 | 0.0039 | mg/kg | | 0 | 2 |
| Endosulfan II | SO | Pond E | E-02 | SW8080 | < | 0.0042 | 0.0042 | mg/kg | | 0 | 2 |
| Endosulfan II | SO | Pond E | E-01 | SW8080 | < | 0.0042 | 0.0042 | mg/kg | | 2 | 4 |
| Endosulfan II | SO | Pond E | E-02 | SW8080 | < | 0.0017 | 0.0043 | mg/kg | JX | 2 | 4 |
| Endosulfan II | SO | Pond E | E-01 | SW8080 | < | 0.00069 | 0.0041 | mg/kg | JX | 0 | 2 |
| Endosulfan sulfate | SO | Pond E | E-05 | SW8080 | < | 0.0016 | 0.0065 | mg/kg | JC | 0 | 2 |
| Endosulfan sulfate | SO | Pond E | E-01 | SW8080 | < | 0.0068 | 0.0068 | mg/kg | | 0 | 2 |
| Endosulfan sulfate | SO | Pond E | E-04 | SW8080 | < | 0.0019 | 0.0068 | mg/kg | JC | 0 | 2 |
| Endosulfan sulfate | SO | Pond E | E-03 | SW8080 | < | 0.007 | 0.007 | mg/kg | | 2 | 4 |
| Endosulfan sulfate | SO | Pond E | E-02 | SW8080 | < | 0.0011 | 0.007 | mg/kg | JC | 0 | 2 |
| Endosulfan sulfate | SO | Pond E | E-03 | SW8080 | < | 0.00335 | 0.0066 | mg/kg | | 0 | 2 |
| Endosulfan sulfate | SO | Pond E | E-01 | SW8080 | < | 0.00089 | 0.007 | mg/kg | JX | 2 | 4 |
| Endosulfan sulfate | SO | Pond E | E-02 | SW8080 | < | 0.0072 | 0.0072 | mg/kg | | 2 | 4 |
| Endosulfan sulfate | SO | Pond E | E-05 | SW8080 | < | 0.00092 | 0.0063 | mg/kg | JX | 2 | 4 |
| gamma-Chlordane | SO | Pond E | E-05 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 2 | 4 |
| gamma-Chlordane | SO | Pond E | E-05 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 0 | 2 |
| gamma-Chlordane | SO | Pond E | E-04 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| gamma-Chlordane | SO | Pond E | E-01 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 2 | 4 |
| gamma-Chlordane | SO | Pond E | E-03 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 2 | 4 |
| gamma-Chlordane | SO | Pond E | E-03 | SW8080 | > | 0.00565 | 0.0013 | mg/kg | X@ | 0 | 2 |
| gamma-Chlordane | SO | Pond E | E-02 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 2 | 4 |
| gamma-Chlordane | SO | Pond E | E-02 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| gamma-Chlordane | SO | Pond E | E-01 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| Heptachlor | SO | Pond E | E-01 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| Heptachlor | SO | Pond E | E-05 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 0 | 2 |
| Heptachlor | SO | Pond E | E-04 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| Heptachlor | SO | Pond E | E-03 | SW8080 | > | 0.0016 | 0.0014 | mg/kg | X@ | 2 | 4 |
| Heptachlor | SO | Pond E | E-03 | SW8080 | < | 0.00125 | 0.0013 | mg/kg | | 0 | 2 |
| Heptachlor | SO | Pond E | E-02 | SW8080 | < | 0.00086 | 0.0014 | mg/kg | JX | 2 | 4 |
| Heptachlor | SO | Pond E | E-02 | SW8080 | > | 0.0021 | 0.0014 | mg/kg | X@ | 0 | 2 |
| Heptachlor | SO | Pond E | E-05 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 2 | 4 |
| Heptachlor | SO | Pond E | E-01 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 2 | 4 |
| Lead | SO | Pond E | E-04 | SW7421 | > | 0.89 | 0.31 | mg/kg | @ | 0 | 2 |
| Lead | SO | Pond E | E-03 | SW7421 | > | 4.2 | 0.41 | mg/kg | | 2 | 4 |
| Lead | SO | Pond E | E-03 | SW7421 | > | 1.6 | 0.36 | mg/kg | @ | 0 | 2 |
| Lead | SO | Pond E | E-02 | SW7421 | > | 1.3 | 0.32 | mg/kg | @ | 2 | 4 |
| Lead | SO | Pond E | E-02 | SW7421 | > | 1.6 | 0.31 | mg/kg | | 0 | 2 |
| Lead | SO | Pond E | E-01 | SW7421 | > | 0.87 | 0.28 | mg/kg | @ | 2 | 4 |
| Lead | SO | Pond E | E-05 | SW7421 | > | 2.7 | 0.29 | mg/kg | | 0 | 2 |
| Lead | SO | Pond E | E-05 | SW7421 | > | 2.3 | 0.27 | mg/kg | | 2 | 4 |
| Lead | SO | Pond E | E-01 | SW7421 | ND | 0.1875 | 0.25 | mg/kg | | 0 | 2 |
| Methylene chloride | SO | Pond E | E-03 | SW8240 | ND | 0.00525 | 0.007 | mg/kg | | 2 | 4 |
| Methylene chloride | SO | Pond E | E-01 | SW8240 | ND | 0.00525 | 0.007 | mg/kg | | 2 | 4 |
| Methylene chloride | SO | Pond E | E-05 | SW8240 | ND | 0.00495 | 0.0066 | mg/kg | | 0 | 2 |
| Methylene chloride | SO | Pond E | E-01 | SW8240 | ND | 0.0051 | 0.0068 | mg/kg | | 0 | 2 |
| Methylene chloride | SO | Pond E | E-03 | SW8240 | ND | 0.0048 | 0.0066 | mg/kg | | 0 | 2 |
| Methylene chloride | SO | Pond E | E-04 | SW8240 | < | 0.0024 | 0.0069 | mg/kg | J | 0 | 2 |
| Methylene chloride | SO | Pond E | E-05 | SW8240 | ND | 0.004725 | 0.0063 | mg/kg | | 2 | 4 |
| Methylene chloride | SO | Pond E | E-02 | SW8240 | ND | 0.0054 | 0.0072 | mg/kg | | 2 | 4 |
| Methylene chloride | SO | Pond E | E-02 | SW8240 | ND | 0.00525 | 0.007 | mg/kg | | 0 | 2 |
| Selenium | SO | Pond E | E-03 | SW7740 | ND | 0.46875 | 0.68 | mg/kg | | 2 | 4 |
| Selenium | SO | Pond E | E-02 | SW7740 | ND | 0.3825 | 0.51 | mg/kg | | 0 | 2 |
| Selenium | SO | Pond E | E-03 | SW7740 | ND | 0.405 | 0.59 | mg/kg | | 0 | 2 |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Selenium | SO | Pond E | E-01 | SW7740 | ND | 0.6375 | 0.85 | mg/kg | | 0 | 2 |
| Selenium | SO | Pond E | E-04 | SW7740 | ND | 0.3825 | 0.51 | mg/kg | | 0 | 2 |
| Selenium | SO | Pond E | E-05 | SW7740 | ND | 0.3675 | 0.49 | mg/kg | | 0 | 2 |
| Selenium | SO | Pond E | E-01 | SW7740 | > | 1 | 0.95 | mg/kg | @ | 2 | 4 |
| Selenium | SO | Pond E | E-02 | SW7740 | ND | 0.405 | 0.54 | mg/kg | | 2 | 4 |
| Selenium | SO | Pond E | E-05 | SW7740 | ND | 0.33 | 0.44 | mg/kg | | 2 | 4 |
| Sulfide | SO | Pond E | E-01 | SW9030 | > | 59 | 31 | mg/kg | @ | 0 | 2 |
| Sulfide | SO | Pond E | E-03 | SW9030 | > | 82 | 34 | mg/kg | @ | 2 | 4 |
| Sulfide | SO | Pond E | E-05 | SW9030 | < | 31 | 31 | mg/kg | | 2 | 4 |
| Sulfide | SO | Pond E | E-05 | SW9030 | < | 33 | 33 | mg/kg | | 0 | 2 |
| Sulfide | SO | Pond E | E-04 | SW9030 | < | 34 | 34 | mg/kg | | 0 | 2 |
| Sulfide | SO | Pond E | E-03 | SW9030 | > | 56.5 | 31 | mg/kg | @ | 0 | 2 |
| Sulfide | SO | Pond E | E-02 | SW9030 | < | 34 | 34 | mg/kg | | 2 | 4 |
| Sulfide | SO | Pond E | E-02 | SW9030 | > | 90 | 33 | mg/kg | @ | 0 | 2 |
| Sulfide | SO | Pond E | E-01 | SW9030 | < | 33 | 33 | mg/kg | | 2 | 4 |
| Toluene | SO | Pond E | E-02 | SW8240 | < | 0.0072 | 0.0072 | mg/kg | | 2 | 4 |
| Toluene | SO | Pond E | E-02 | SW8240 | < | 0.00012 | 0.007 | mg/kg | J | 0 | 2 |
| Toluene | SO | Pond E | E-01 | SW8240 | < | 0.007 | 0.007 | mg/kg | | 2 | 4 |
| Toluene | SO | Pond E | E-03 | SW8240 | < | 0.003395 | 0.0066 | mg/kg | | 0 | 2 |
| Toluene | SO | Pond E | E-01 | SW8240 | < | 0.0068 | 0.0068 | mg/kg | | 0 | 2 |
| Toluene | SO | Pond E | E-05 | SW8240 | < | 0.00027 | 0.0066 | mg/kg | J | 0 | 2 |
| Toluene | SO | Pond E | E-05 | SW8240 | < | 0.0063 | 0.0063 | mg/kg | | 2 | 4 |
| Toluene | SO | Pond E | E-04 | SW8240 | < | 0.0018 | 0.0069 | mg/kg | J | 0 | 2 |
| Toluene | SO | Pond E | E-03 | SW8240 | < | 0.007 | 0.007 | mg/kg | | 2 | 4 |
| Total organic carbon | SO | Pond E | E-02 | | > | 2000 | 1100 | mg/kg | @ | 0 | 2 |
| Total organic carbon | SO | Pond E | E-02 | | > | 1400 | 1100 | mg/kg | @ | 2 | 4 |
| Vanadium | SO | Pond E | E-05 | SW6010 | > | 13 | 8.2 | mg/kg | @ | 2 | 4 |
| Vanadium | SO | Pond E | E-03 | SW6010 | > | 19 | 10 | mg/kg | @ | 2 | 4 |
| Vanadium | SO | Pond E | E-02 | SW6010 | ND | 6.375 | 8.5 | mg/kg | | 2 | 4 |
| Vanadium | SO | Pond E | E-03 | SW6010 | ND | 7.15 | 8.9 | mg/kg | | 0 | 2 |
| Vanadium | SO | Pond E | E-04 | SW6010 | > | 9.5 | 8.4 | mg/kg | @ | 0 | 2 |
| Vanadium | SO | Pond E | E-02 | SW6010 | > | 13 | 7.8 | mg/kg | @ | 0 | 2 |
| Vanadium | SO | Pond E | E-05 | SW6010 | > | 11 | 7.8 | mg/kg | @ | 0 | 2 |
| Vanadium | SO | Pond E | E-01 | SW6010 | ND | 6.75 | 9 | mg/kg | | 2 | 4 |
| Vanadium | SO | Pond E | E-01 | SW6010 | > | 9.9 | 8.6 | mg/kg | @ | 0 | 2 |
| Zinc | SO | Pond E | E-05 | SW6010 | > | 11 | 8.2 | mg/kg | @ | 2 | 4 |
| Zinc | SO | Pond E | E-01 | SW6010 | > | 12 | 8.6 | mg/kg | @ | 0 | 2 |
| Zinc | SO | Pond E | E-04 | SW6010 | > | 15 | 8.4 | mg/kg | @ | 0 | 2 |
| Zinc | SO | Pond E | E-03 | SW6010 | > | 22 | 10 | mg/kg | @ | 2 | 4 |
| Zinc | SO | Pond E | E-03 | SW6010 | > | 8.8 | 8.9 | mg/kg | @ | 0 | 2 |
| Zinc | SO | Pond E | E-02 | SW6010 | > | 12 | 8.5 | mg/kg | @ | 2 | 4 |
| Zinc | SO | Pond E | E-05 | SW6010 | > | 11 | 7.8 | mg/kg | @ | 0 | 2 |
| Zinc | SO | Pond E | E-02 | SW6010 | > | 14 | 7.8 | mg/kg | @ | 0 | 2 |
| Zinc | SO | Pond E | E-01 | SW6010 | > | 14 | 9 | mg/kg | @ | 2 | 4 |
| 4,4'-DDD | WS | Pond E | E-01 | SW8080 | > | 0.000026 | 9.50E-06 | mg/L | X@ | . | . |
| 4,4'-DDE | WS | Pond E | E-01 | SW8080 | ND | 4.77E-06 | 9.60E-06 | mg/L | | . | . |
| 4,4'-DDE | WS | Pond E | E-5 | SW8080 | ND | 0.0003 | 0.0006 | mg/L | | . | . |
| 4,4'-DDE | WS | Pond E | E-4 | SW8080 | ND | 0.0003 | 0.0006 | mg/L | | . | . |
| 4,4'-DDE | WS | Pond E | E-1 | SW8080 | > | 0.0004 | . | mg/L | J | . | . |
| Barium | WS | Pond E | E-2 | SW6010 | > | 0.027 | . | mg/L | @ | . | . |
| Barium | WS | Pond E | E-6 | SW6010 | > | 0.037 | . | mg/L | @ | . | . |
| Barium | WS | Pond E | E-1 | SW6010 | > | 0.037 | . | mg/L | @ | . | . |
| Barium | WS | Pond E | E-3 | SW6010 | > | 0.034 | . | mg/L | @ | . | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Barium | WS | Pond E | E-4 | SW6010 | > | 0.036 | . | mg/L | @ | . | . |
| Barium | WS | Pond E | E-5 | SW6010 | > | 0.035 | . | mg/L | @ | . | . |
| Benzoic acid | WS | Pond E | E-1 | SW8270 | > | 0.01 | . | mg/L | J | . | . |
| bis(2-Ethylhexyl)phthalate | WS | Pond E | E-1 | SW8270 | > | 0.011 | . | mg/L | JB | . | . |
| bis(2-Ethylhexyl)phthalate | WS | Pond E | E-6 | SW8270 | > | 0.005 | . | mg/L | JB | . | . |
| bis(2-Ethylhexyl)phthalate | WS | Pond E | E-5 | SW8270 | > | 0.003 | . | mg/L | JB | . | . |
| bis(2-Ethylhexyl)phthalate | WS | Pond E | E-4 | SW8270 | > | 0.015 | . | mg/L | JB | . | . |
| bis(2-Ethylhexyl)phthalate | WS | Pond E | E-3 | SW8270 | > | 0.005 | . | mg/L | JB | . | . |
| bis(2-Ethylhexyl)phthalate | WS | Pond E | E-2 | SW8270 | > | 0.007 | . | mg/L | JB | . | . |
| Boron | WS | Pond E | E-4 | SW6010 | > | 0.32 | . | mg/L | @ | . | . |
| Boron | WS | Pond E | E-2 | SW6010 | > | 0.24 | . | mg/L | @ | . | . |
| Boron | WS | Pond E | E-1 | SW6010 | > | 0.33 | . | mg/L | @ | . | . |
| Boron | WS | Pond E | E-5 | SW6010 | > | 0.28 | . | mg/L | @ | . | . |
| Boron | WS | Pond E | E-3 | SW6010 | > | 0.29 | . | mg/L | @ | . | . |
| Boron | WS | Pond E | E-6 | SW6010 | > | 0.3 | . | mg/L | @ | . | . |
| Calcium | WS | Pond E | E-2 | SW6010 | > | 250 | . | mg/L | | . | . |
| Calcium | WS | Pond E | E-4 | SW6010 | > | 350 | . | mg/L | | . | . |
| Calcium | WS | Pond E | E-3 | SW6010 | > | 310 | . | mg/L | | . | . |
| Calcium | WS | Pond E | E-1 | SW6010 | > | 340 | . | mg/L | | . | . |
| Calcium | WS | Pond E | E-5 | SW6010 | > | 330 | . | mg/L | | . | . |
| Calcium | WS | Pond E | E-6 | SW6010 | > | 35 | . | mg/L | | . | . |
| Dieldrin | WS | Pond E | E-01 | SW8080 | > | 0.0000145 | 9.50E-06 | mg/L | X@ | . | . |
| gamma-BHC | WS | Pond E | E-01 | SW8080 | > | 0.0000145 | 9.50E-06 | mg/L | @ | . | . |
| gamma-Chlordane | WS | Pond E | E-01 | SW8080 | < | 5.20E-06 | 9.50E-06 | mg/L | J | . | . |
| Hardness, as CaC03 | WS | Pond E | E-01 | E130.2 | > | 2133.3333 | 83 | mg/L | | . | . |
| Heptachlor epoxide | WS | Pond E | E-01 | SW8080 | > | 0.00001 | 9.50E-06 | mg/L | @ | . | . |
| Iron | WS | Pond E | E-6 | SW6010 | > | 0.035 | . | mg/L | @ | . | . |
| Iron | WS | Pond E | E-5 | SW6010 | > | 0.022 | . | mg/L | @ | . | . |
| Iron | WS | Pond E | E-4 | SW6010 | > | 0.02 | . | mg/L | @ | . | . |
| Iron | WS | Pond E | E-3 | SW6010 | > | 0.024 | . | mg/L | @ | . | . |
| Iron | WS | Pond E | E-1 | SW6010 | > | 0.017 | . | mg/L | @ | . | . |
| Iron | WS | Pond E | E-2 | SW6010 | > | 0.016 | . | mg/L | @ | . | . |
| Lead | WS | Pond E | E-5 | SW7421 | ND | 0.001 | 0.002 | mg/L | | . | . |
| Lead | WS | Pond E | E-2 | SW7421 | > | 0.0028 | . | mg/L | @ | . | . |
| Lead | WS | Pond E | E-6 | SW7421 | ND | 0.001 | 0.002 | mg/L | | . | . |
| Lead | WS | Pond E | E-1 | SW7421 | > | 0.0029 | . | mg/L | @ | . | . |
| Lead | WS | Pond E | E-4 | SW7421 | ND | 0.001 | 0.002 | mg/L | | . | . |
| Lead | WS | Pond E | E-3 | SW7421 | > | 0.0048 | . | mg/L | @ | . | . |
| Lead (organic) | WS | Pond E | E-1 | E239.1 | ND | 0.05 | 0.1 | mg/L | | . | . |
| Lead (organic) | WS | Pond E | E-3 | E239.1 | > | 0.1 | . | mg/L | @ | . | . |
| Lead (organic) | WS | Pond E | E-6 | E239.1 | ND | 0.05 | 0.1 | mg/L | | . | . |
| Lead (organic) | WS | Pond E | E-5 | E239.1 | ND | 0.05 | 0.1 | mg/L | | . | . |
| Lead (organic) | WS | Pond E | E-4 | E239.1 | ND | 0.05 | 0.1 | mg/L | | . | . |
| Lead (organic) | WS | Pond E | E-2 | E239.1 | ND | 0.05 | 0.1 | mg/L | | . | . |
| Magnesium | WS | Pond E | E-4 | SW6010 | > | 170 | . | mg/L | | . | . |
| Magnesium | WS | Pond E | E-3 | SW6010 | > | 160 | . | mg/L | | . | . |
| Magnesium | WS | Pond E | E-2 | SW6010 | > | 130 | . | mg/L | | . | . |
| Magnesium | WS | Pond E | E-5 | SW6010 | > | 160 | . | mg/L | | . | . |
| Magnesium | WS | Pond E | E-1 | SW6010 | > | 170 | . | mg/L | | . | . |
| Magnesium | WS | Pond E | E-6 | SW6010 | > | 170 | . | mg/L | | . | . |
| Manganese | WS | Pond E | E-4 | SW6010 | > | 0.038 | . | mg/L | @ | . | . |
| Manganese | WS | Pond E | E-5 | SW6010 | > | 0.034 | . | mg/L | @ | . | . |
| Manganese | WS | Pond E | E-6 | SW6010 | > | 0.037 | . | mg/L | @ | . | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Manganese | WS | Pond E | E-3 | SW6010 | > | 0.033 | . | mg/L | @ | . | . |
| Manganese | WS | Pond E | E-1 | SW6010 | > | 0.039 | . | mg/L | @ | . | . |
| Manganese | WS | Pond E | E-2 | SW6010 | > | 0.021 | . | mg/L | @ | . | . |
| Mercury | WS | Pond E | E-5 | SW7470 | > | 0.0004 | . | mg/L | @ | . | . |
| Mercury | WS | Pond E | E-3 | SW7470 | > | 0.00051 | . | mg/L | @ | . | . |
| Mercury | WS | Pond E | E-1 | SW7470 | > | 0.00062 | . | mg/L | | . | . |
| Mercury | WS | Pond E | E-4 | SW7470 | > | 0.00051 | . | mg/L | @ | . | . |
| Mercury | WS | Pond E | E-6 | SW7470 | > | 0.0004 | . | mg/L | @ | . | . |
| Mercury | WS | Pond E | E-2 | SW7470 | > | 0.00051 | . | mg/L | @ | . | . |
| Potassium | WS | Pond E | E-2 | SW6010 | > | 8.6 | . | mg/L | | . | . |
| Potassium | WS | Pond E | E-1 | SW6010 | > | 12 | . | mg/L | | . | . |
| Potassium | WS | Pond E | E-3 | SW6010 | > | 11 | . | mg/L | | . | . |
| Potassium | WS | Pond E | E-6 | SW6010 | > | 12 | . | mg/L | | . | . |
| Potassium | WS | Pond E | E-5 | SW6010 | > | 11 | . | mg/L | | . | . |
| Potassium | WS | Pond E | E-4 | SW6010 | > | 12 | . | mg/L | | . | . |
| Selenium | WS | Pond E | E-5 | SW7740 | > | 0.0024 | . | mg/L | @ | . | . |
| Selenium | WS | Pond E | E-1 | SW7740 | > | 0.0055 | . | mg/L | @ | . | . |
| Selenium | WS | Pond E | E-6 | SW7740 | ND | 0.001 | 0.002 | mg/L | | . | . |
| Selenium | WS | Pond E | E-4 | SW7740 | > | 0.0035 | . | mg/L | @ | . | . |
| Selenium | WS | Pond E | E-3 | SW7740 | > | 0.0042 | . | mg/L | @ | . | . |
| Selenium | WS | Pond E | E-2 | SW7740 | > | 0.0025 | . | mg/L | @ | . | . |
| Silicon | WS | Pond E | E-5 | SW6010 | > | 14 | . | mg/L | | . | . |
| Silicon | WS | Pond E | E-4 | SW6010 | > | 15 | . | mg/L | | . | . |
| Silicon | WS | Pond E | E-3 | SW6010 | > | 14 | . | mg/L | | . | . |
| Silicon | WS | Pond E | E-2 | SW6010 | > | 10 | . | mg/L | | . | . |
| Silicon | WS | Pond E | E-6 | SW6010 | > | 15 | . | mg/L | | . | . |
| Silicon | WS | Pond E | E-1 | SW6010 | > | 14 | . | mg/L | | . | . |
| Sodium | WS | Pond E | E-2 | SW6010 | > | 360 | . | mg/L | | . | . |
| Sodium | WS | Pond E | E-4 | SW6010 | > | 500 | . | mg/L | | . | . |
| Sodium | WS | Pond E | E-6 | SW6010 | > | 500 | . | mg/L | | . | . |
| Sodium | WS | Pond E | E-3 | SW6010 | > | 450 | . | mg/L | | . | . |
| Sodium | WS | Pond E | E-5 | SW6010 | > | 470 | . | mg/L | | . | . |
| Sodium | WS | Pond E | E-1 | SW6010 | > | 490 | . | mg/L | | . | . |
| Total dissolved solids | WS | Pond E | E-01 | E160.1 | > | 4633.3333 | 10 | mg/L | | . | . |
| 4,4'-DDD | SL | Pond F | F-02 | SW8080 | > | 1.4 | 0.053 | mg/kg | C | . | . |
| 4,4'-DDD | SL | Pond F | F-01 | SW8080 | > | 11 | 0.065 | mg/kg | C | . | . |
| 4,4'-DDE | SL | Pond F | F-02 | SW8080 | > | 0.87 | 0.053 | mg/kg | X | . | . |
| 4,4'-DDE | SL | Pond F | F-01 | SW8080 | > | 1.9 | 0.065 | mg/kg | C | . | . |
| 4,4'-DDT | SL | Pond F | F-02 | SW8080 | = | 0.11 | 0.11 | mg/kg | X@ | . | . |
| 4,4'-DDT | SL | Pond F | F-01 | SW8080 | > | 0.16 | 0.13 | mg/kg | C@ | . | . |
| Acetone | SL | Pond F | F-01 | SW8240 | > | 1.4 | 0.65 | mg/kg | @ | . | . |
| Acetone | SL | Pond F | F-02 | SW8240 | < | 0.41 | 0.53 | mg/kg | J | . | . |
| alpha-Chlordane | SL | Pond F | F-01 | SW8080 | > | 0.25 | 0.065 | mg/kg | X@ | . | . |
| alpha-Chlordane | SL | Pond F | F-02 | SW8080 | < | 0.053 | 0.053 | mg/kg | | . | . |
| Arsenic | SL | Pond F | F-01 | SW7060 | > | 4 | 2.3 | mg/kg | @ | . | . |
| Arsenic | SL | Pond F | F-02 | SW7060 | > | 2.3 | 1.7 | mg/kg | @ | . | . |
| Barium | SL | Pond F | F-01 | SW6010 | > | 59 | 5.3 | mg/kg | | . | . |
| Barium | SL | Pond F | F-02 | SW6010 | > | 39 | 4.2 | mg/kg | | . | . |
| bis(2-Ethylhexyl)phthalate | SL | Pond F | F-02 | SW8270 | < | 3.6 | 5.2 | mg/kg | JB | . | . |
| bis(2-Ethylhexyl)phthalate | SL | Pond F | F-01 | SW8270 | < | 5.4 | 6.4 | mg/kg | JB | . | . |
| Carbon disulfide | SL | Pond F | F-01 | SW8240 | > | 0.037 | 0.033 | mg/kg | @ | . | . |
| Carbon disulfide | SL | Pond F | F-02 | SW8240 | > | 0.038 | 0.027 | mg/kg | @ | . | . |
| Chromium | SL | Pond F | F-01 | SW6010 | > | 33 | 5.3 | mg/kg | | . | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Chromium | SL | Pond F | F-02 | SW6010 | > | 26 | 4.2 | mg/kg | | . | . |
| Copper | SL | Pond F | F-01 | SW6010 | > | 75 | 11 | mg/kg | | . | . |
| Copper | SL | Pond F | F-02 | SW6010 | > | 42 | 8.3 | mg/kg | | . | . |
| delta-BHC | SL | Pond F | F-02 | SW8080 | > | 2.2 | 0.053 | mg/kg | X | . | . |
| delta-BHC | SL | Pond F | F-01 | SW8080 | > | 5 | 0.065 | mg/kg | X | . | . |
| Dibenzofuran | SL | Pond F | F-02 | SW8270 | ND | 3.9 | 5.2 | mg/kg | | . | . |
| Dibenzofuran | SL | Pond F | F-01 | SW8270 | < | 0.86 | 6.4 | mg/kg | J | . | . |
| Ethyl benzene | SL | Pond F | F-02 | SW8240 | < | 0.012 | 0.027 | mg/kg | J | . | . |
| Ethyl benzene | SL | Pond F | F-01 | SW8240 | < | 0.033 | 0.033 | mg/kg | | . | . |
| Fluorene | SL | Pond F | F-02 | SW8270 | < | 5.2 | 5.2 | mg/kg | | . | . |
| Fluorene | SL | Pond F | F-01 | SW8270 | < | 0.82 | 6.4 | mg/kg | J | . | . |
| gamma-BHC | SL | Pond F | F-01 | SW8080 | < | 0.065 | 0.065 | mg/kg | | . | . |
| gamma-BHC | SL | Pond F | F-02 | SW8080 | > | 0.076 | 0.053 | mg/kg | C@ | . | . |
| gamma-Chlordane | SL | Pond F | F-02 | SW8080 | < | 0.048 | 0.053 | mg/kg | JX | . | . |
| gamma-Chlordane | SL | Pond F | F-01 | SW8080 | < | 0.064 | 0.065 | mg/kg | JX | . | . |
| Heptachlor | SL | Pond F | F-01 | SW8080 | < | 0.05 | 0.065 | mg/kg | JC | . | . |
| Heptachlor | SL | Pond F | F-02 | SW8080 | < | 0.053 | 0.053 | mg/kg | | . | . |
| Lead | SL | Pond F | F-02 | SW7421 | > | 9.6 | 1.3 | mg/kg | | . | . |
| Lead | SL | Pond F | F-01 | SW7421 | > | 17 | 1.7 | mg/kg | | . | . |
| Mercury | SL | Pond F | F-01 | SW7471 | > | 0.43 | 0.3 | mg/kg | @ | . | . |
| Mercury | SL | Pond F | F-02 | SW7471 | > | 0.28 | 0.24 | mg/kg | @ | . | . |
| Methyl ethyl ketone | SL | Pond F | F-02 | SW8240 | < | 0.053 | 0.53 | mg/kg | J | . | . |
| Methyl ethyl ketone | SL | Pond F | F-01 | SW8240 | < | 0.22 | 0.65 | mg/kg | J | . | . |
| Nickel | SL | Pond F | F-02 | SW6010 | ND | 6.225 | 8.3 | mg/kg | | . | . |
| Nickel | SL | Pond F | F-01 | SW6010 | > | 13 | 11 | mg/kg | @ | . | . |
| Phenanthrene | SL | Pond F | F-01 | SW8270 | < | 4.6 | 6.4 | mg/kg | J | . | . |
| Phenanthrene | SL | Pond F | F-02 | SW8270 | < | 0.55 | 5.2 | mg/kg | J | . | . |
| Selenium | SL | Pond F | F-01 | SW7740 | ND | 2.1 | 2.8 | mg/kg | | . | . |
| Selenium | SL | Pond F | F-02 | SW7740 | > | 2.5 | 2.2 | mg/kg | @ | . | . |
| Silver | SL | Pond F | F-02 | SW6010 | > | 38 | 4.2 | mg/kg | | . | . |
| Silver | SL | Pond F | F-01 | SW6010 | > | 59 | 5.3 | mg/kg | | . | . |
| Sulfide | SL | Pond F | F-02 | SW9030 | > | 1100 | 130 | mg/kg | | . | . |
| Sulfide | SL | Pond F | F-01 | SW9030 | > | 1800 | 160 | mg/kg | | . | . |
| Toluene | SL | Pond F | F-01 | SW8240 | < | 0.005 | 0.033 | mg/kg | JB | . | . |
| Toluene | SL | Pond F | F-02 | SW8240 | < | 0.01 | 0.027 | mg/kg | JB | . | . |
| Vanadium | SL | Pond F | F-01 | SW6010 | > | 36 | 11 | mg/kg | @ | . | . |
| Vanadium | SL | Pond F | F-02 | SW6010 | > | 19 | 8.3 | mg/kg | @ | . | . |
| Xylenes | SL | Pond F | F-02 | SW8240 | > | 0.038 | 0.027 | mg/kg | @ | . | . |
| Xylenes | SL | Pond F | F-01 | SW8240 | < | 0.014 | 0.033 | mg/kg | J | . | . |
| Zinc | SL | Pond F | F-02 | SW6010 | > | 57 | 8.3 | mg/kg | | . | . |
| Zinc | SL | Pond F | F-01 | SW6010 | > | 98 | 11 | mg/kg | | . | . |
| 4,4'-DDD | SO | Pond F | F-01 | SW8080 | > | 0.037 | 0.0014 | mg/kg | C | 0 | 2 |
| 4,4'-DDE | SO | Pond F | F-01 | SW8080 | > | 0.015 | 0.0014 | mg/kg | X | 0 | 2 |
| 4,4'-DDT | SO | Pond F | F-01 | SW8080 | > | 0.0058 | 0.0029 | mg/kg | X@ | 0 | 2 |
| Arsenic | SO | Pond F | F-01 | SW7060 | > | 0.96 | 0.41 | mg/kg | @ | 0 | 2 |
| Barium | SO | Pond F | F-01 | SW6010 | > | 28 | 4.1 | mg/kg | | 0 | 2 |
| delta-BHC | SO | Pond F | F-01 | SW8080 | > | 0.0027 | 0.0014 | mg/kg | X@ | 0 | 2 |
| gamma-Chlordane | SO | Pond F | F-01 | SW8080 | < | 0.00045 | 0.0014 | mg/kg | JC | 0 | 2 |
| Lead | SO | Pond F | F-01 | SW7421 | > | 0.5 | 0.31 | mg/kg | @ | 0 | 2 |
| Sulfide | SO | Pond F | F-01 | SW9030 | > | 60 | 34 | mg/kg | @ | 0 | 2 |
| Toluene | SO | Pond F | F-01 | SW8240 | < | 0.00094 | 0.0073 | mg/kg | JB | 0 | 2 |
| Total organic carbon | SO | Pond F | F-01 | | > | 1600 | 1100 | mg/kg | @ | 0 | 2 |
| 4,4'-DDD | WS | Pond F | F-01 | SW8080 | > | 0.000035 | 9.50E-06 | mg/L | @ | . | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4,4'-DDE | WS | Pond F | F-01 | SW8080 | > | 0.00012 | 9.50E-06 | mg/L | G | . | . |
| alpha-Chlordane | WS | Pond F | F-01 | SW8080 | > | 0.00003 | 9.50E-06 | mg/L | G@ | . | . |
| gamma-BHC | WS | Pond F | F-01 | SW8080 | > | 0.000012 | 9.50E-06 | mg/L | X@ | . | . |
| gamma-Chlordane | WS | Pond F | F-01 | SW8080 | > | 0.00001 | 9.50E-06 | mg/L | @ | . | . |
| Hardness, as CaC03 | WS | Pond F | F-01 | E130.2 | > | 1800 | 120 | mg/L | | . | . |
| Total dissolved solids | WS | Pond F | F-01 | E160.1 | > | 4200 | 10 | mg/L | | . | . |
| 4,4'-DDD | SL | Pond G | G-03 | SW8080 | > | 0.3 | 0.041 | mg/kg | C | . | . |
| 4,4'-DDD | SL | Pond G | G-04 | SW8080 | > | 0.98 | 0.037 | mg/kg | C | . | . |
| 4,4'-DDD | SL | Pond G | G-02 | SW8080 | > | 3.1 | 0.032 | mg/kg | C | . | . |
| 4,4'-DDD | SL | Pond G | G-01 | SW8080 | > | 0.4 | 0.0016 | mg/kg | C | . | . |
| 4,4'-DDD | SL | Pond G | G-05 | SW8080 | > | 0.1 | 0.025 | mg/kg | C@ | . | . |
| 4,4'-DDD | SL | Pond G | G-06 | SW8080 | < | 0.07 | 0.07 | mg/kg | | . | . |
| 4,4'-DDE | SL | Pond G | G-06 | SW8080 | < | 0.07 | 0.07 | mg/kg | | . | . |
| 4,4'-DDE | SL | Pond G | G-01 | SW8080 | > | 0.036 | 0.0016 | mg/kg | C | . | . |
| 4,4'-DDE | SL | Pond G | G-03 | SW8080 | > | 0.14 | 0.041 | mg/kg | C@ | . | . |
| 4,4'-DDE | SL | Pond G | G-04 | SW8080 | > | 0.29 | 0.037 | mg/kg | X | . | . |
| 4,4'-DDE | SL | Pond G | G-02 | SW8080 | > | 0.45 | 0.032 | mg/kg | X | . | . |
| 4,4'-DDE | SL | Pond G | G-05 | SW8080 | > | 0.083 | 0.025 | mg/kg | C@ | . | . |
| 4,4'-DDT | SL | Pond G | G-04 | SW8080 | < | 0.074 | 0.074 | mg/kg | | . | . |
| 4,4'-DDT | SL | Pond G | G-05 | SW8080 | < | 0.049 | 0.049 | mg/kg | | . | . |
| 4,4'-DDT | SL | Pond G | G-01 | SW8080 | > | 0.027 | 0.0032 | mg/kg | C | . | . |
| 4,4'-DDT | SL | Pond G | G-03 | SW8080 | < | 0.083 | 0.083 | mg/kg | | . | . |
| 4,4'-DDT | SL | Pond G | G-02 | SW8080 | > | 0.12 | 0.064 | mg/kg | C@ | . | . |
| 4,4'-DDT | SL | Pond G | G-06 | SW8080 | < | 0.14 | 0.14 | mg/kg | | . | . |
| Acetone | SL | Pond G | G-02 | SW8240 | ND | 3.5625 | 6.4 | mg/kg | | . | . |
| Acetone | SL | Pond G | G-01 | SW8240 | < | 0.087 | 0.16 | mg/kg | J | . | . |
| Acetone | SL | Pond G | G-06 | SW8240 | ND | 10.5 | 14 | mg/kg | | . | . |
| Acetone | SL | Pond G | G-05 | SW8240 | ND | 3.675 | 4.9 | mg/kg | | . | . |
| Acetone | SL | Pond G | G-04 | SW8240 | ND | 5.625 | 7.5 | mg/kg | | . | . |
| Acetone | SL | Pond G | G-03 | SW8240 | ND | 6.225 | 8.3 | mg/kg | | . | . |
| Acetophenone | SL | Pond G | G-01 | SW8270 | < | 1.6 | 1.6 | mg/kg | | . | . |
| Acetophenone | SL | Pond G | G-06 | SW8270 | < | 6.9 | 6.9 | mg/kg | | . | . |
| Acetophenone | SL | Pond G | G-05 | SW8270 | < | 2.4 | 2.4 | mg/kg | | . | . |
| Acetophenone | SL | Pond G | G-04 | SW8270 | < | 3.7 | 3.7 | mg/kg | | . | . |
| Acetophenone | SL | Pond G | G-03 | SW8270 | < | 4.1 | 4.1 | mg/kg | | . | . |
| Acetophenone | SL | Pond G | G-02 | SW8270 | < | 0.85 | 3.2 | mg/kg | J | . | . |
| alpha-BHC | SL | Pond G | G-04 | SW8080 | > | 0.077 | 0.037 | mg/kg | C@ | . | . |
| alpha-BHC | SL | Pond G | G-03 | SW8080 | > | 0.079 | 0.041 | mg/kg | C@ | . | . |
| alpha-BHC | SL | Pond G | G-02 | SW8080 | < | 0.032 | 0.032 | mg/kg | | . | . |
| alpha-BHC | SL | Pond G | G-05 | SW8080 | < | 0.025 | 0.025 | mg/kg | | . | . |
| alpha-BHC | SL | Pond G | G-06 | SW8080 | < | 0.07 | 0.07 | mg/kg | | . | . |
| alpha-BHC | SL | Pond G | G-01 | SW8080 | < | 0.0016 | 0.0016 | mg/kg | | . | . |
| alpha-Chlordane | SL | Pond G | G-03 | SW8080 | < | 0.041 | 0.041 | mg/kg | | . | . |
| alpha-Chlordane | SL | Pond G | G-01 | SW8080 | > | 0.0096 | 0.0016 | mg/kg | X | . | . |
| alpha-Chlordane | SL | Pond G | G-06 | SW8080 | < | 0.07 | 0.07 | mg/kg | | . | . |
| alpha-Chlordane | SL | Pond G | G-05 | SW8080 | < | 0.011 | 0.025 | mg/kg | JX | . | . |
| alpha-Chlordane | SL | Pond G | G-02 | SW8080 | > | 0.11 | 0.032 | mg/kg | X@ | . | . |
| alpha-Chlordane | SL | Pond G | G-04 | SW8080 | < | 0.037 | 0.037 | mg/kg | | . | . |
| Arsenic | SL | Pond G | G-04 | SW7060 | > | 1.8 | 1.3 | mg/kg | @ | . | . |
| Arsenic | SL | Pond G | G-03 | SW7060 | > | 2.3 | 1.1 | mg/kg | @ | . | . |
| Arsenic | SL | Pond G | G-02 | SW7060 | > | 3.3 | 0.95 | mg/kg | @ | . | . |
| Arsenic | SL | Pond G | G-05 | SW7060 | > | 1.3 | 0.83 | mg/kg | @ | . | . |
| Arsenic | SL | Pond G | G-06 | SW7060 | > | 2.4 | 2.1 | mg/kg | @ | . | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | SL | Pond G | G-01 | SW7060 | > | 1.4 | 0.47 | mg/kg | @ | . | . |
| Barium | SL | Pond G | G-02 | SW6010 | > | 120 | 2.4 | mg/kg | | . | . |
| Barium | SL | Pond G | G-04 | SW6010 | > | 85 | 3 | mg/kg | | . | . |
| Barium | SL | Pond G | G-01 | SW6010 | > | 81 | 4.8 | mg/kg | | . | . |
| Barium | SL | Pond G | G-05 | SW6010 | > | 65 | 1.8 | mg/kg | | . | . |
| Barium | SL | Pond G | G-03 | SW6010 | > | 92 | 3 | mg/kg | | . | . |
| Barium | SL | Pond G | G-06 | SW6010 | > | 83 | 6.2 | mg/kg | | . | . |
| Beryllium | SL | Pond G | G-01 | SW6010 | ND | 0.7125 | 0.95 | mg/kg | | . | . |
| Beryllium | SL | Pond G | G-04 | SW6010 | ND | 0.4575 | 0.61 | mg/kg | | . | . |
| Beryllium | SL | Pond G | G-05 | SW6010 | ND | 0.27 | 0.36 | mg/kg | | . | . |
| Beryllium | SL | Pond G | G-06 | SW6010 | ND | 0.9 | 1.2 | mg/kg | | . | . |
| Beryllium | SL | Pond G | G-03 | SW6010 | ND | 0.4575 | 0.61 | mg/kg | | . | . |
| Beryllium | SL | Pond G | G-02 | SW6010 | > | 0.68 | 0.49 | mg/kg | @ | . | . |
| bis(2-Ethylhexyl)phthalate | SL | Pond G | G-01 | SW8270 | < | 0.69 | 1.6 | mg/kg | JB | . | . |
| bis(2-Ethylhexyl)phthalate | SL | Pond G | G-06 | SW8270 | < | 3.8 | 6.9 | mg/kg | J | . | . |
| bis(2-Ethylhexyl)phthalate | SL | Pond G | G-05 | SW8270 | < | 1.7 | 2.4 | mg/kg | J | . | . |
| bis(2-Ethylhexyl)phthalate | SL | Pond G | G-04 | SW8270 | > | 3.9 | 3.7 | mg/kg | @ | . | . |
| bis(2-Ethylhexyl)phthalate | SL | Pond G | G-03 | SW8270 | < | 0.58 | 4.1 | mg/kg | J | . | . |
| bis(2-Ethylhexyl)phthalate | SL | Pond G | G-02 | SW8270 | < | 1.3 | 3.2 | mg/kg | J | . | . |
| Carbon disulfide | SL | Pond G | G-03 | SW8240 | < | 0.41 | 0.41 | mg/kg | | . | . |
| Carbon disulfide | SL | Pond G | G-02 | SW8240 | < | 0.235 | 0.32 | mg/kg | | . | . |
| Carbon disulfide | SL | Pond G | G-01 | SW8240 | > | 0.037 | 0.0079 | mg/kg | @ | . | . |
| Carbon disulfide | SL | Pond G | G-06 | SW8240 | < | 0.7 | 0.7 | mg/kg | | . | . |
| Carbon disulfide | SL | Pond G | G-05 | SW8240 | < | 0.25 | 0.25 | mg/kg | | . | . |
| Carbon disulfide | SL | Pond G | G-04 | SW8240 | < | 0.37 | 0.37 | mg/kg | | . | . |
| Chromium | SL | Pond G | G-06 | SW6010 | > | 16 | 6.2 | mg/kg | @ | . | . |
| Chromium | SL | Pond G | G-01 | SW6010 | > | 9 | 4.8 | mg/kg | @ | . | . |
| Chromium | SL | Pond G | G-05 | SW6010 | > | 10 | 1.8 | mg/kg | | . | . |
| Chromium | SL | Pond G | G-04 | SW6010 | > | 15 | 3 | mg/kg | | . | . |
| Chromium | SL | Pond G | G-03 | SW6010 | > | 15 | 3 | mg/kg | | . | . |
| Chromium | SL | Pond G | G-02 | SW6010 | > | 18 | 2.4 | mg/kg | | . | . |
| Cobalt | SL | Pond G | G-04 | SW6010 | > | 3.6 | 3 | mg/kg | @ | . | . |
| Cobalt | SL | Pond G | G-05 | SW6010 | > | 2.7 | 1.8 | mg/kg | @ | . | . |
| Cobalt | SL | Pond G | G-02 | SW6010 | > | 5.4 | 2.4 | mg/kg | @ | . | . |
| Cobalt | SL | Pond G | G-03 | SW6010 | > | 3.4 | 3 | mg/kg | @ | . | . |
| Cobalt | SL | Pond G | G-01 | SW6010 | < | 4.8 | 4.8 | mg/kg | | . | . |
| Cobalt | SL | Pond G | G-06 | SW6010 | < | 6.2 | 6.2 | mg/kg | | . | . |
| Copper | SL | Pond G | G-06 | SW6010 | > | 23 | 12 | mg/kg | @ | . | . |
| Copper | SL | Pond G | G-05 | SW6010 | > | 19 | 3.6 | mg/kg | | . | . |
| Copper | SL | Pond G | G-04 | SW6010 | > | 21 | 6.1 | mg/kg | @ | . | . |
| Copper | SL | Pond G | G-03 | SW6010 | > | 20 | 6.1 | mg/kg | @ | . | . |
| Copper | SL | Pond G | G-02 | SW6010 | > | 24 | 4.9 | mg/kg | @ | . | . |
| Copper | SL | Pond G | G-01 | SW6010 | ND | 7.125 | 9.5 | mg/kg | | . | . |
| Cyanide | SL | Pond G | G-03 | SW9012 | < | 0.91 | 0.91 | mg/kg | | . | . |
| Cyanide | SL | Pond G | G-02 | SW9012 | < | 0.66 | 0.66 | mg/kg | | . | . |
| Cyanide | SL | Pond G | G-06 | SW9012 | > | 5.6 | 1.6 | mg/kg | @ | . | . |
| Cyanide | SL | Pond G | G-01 | SW9012 | > | 1.1 | 0.28 | mg/kg | @ | . | . |
| Cyanide | SL | Pond G | G-04 | SW9012 | < | 0.81 | 0.81 | mg/kg | | . | . |
| Cyanide | SL | Pond G | G-05 | SW9012 | < | 0.5 | 0.5 | mg/kg | | . | . |
| gamma-Chlordane | SL | Pond G | G-03 | SW8080 | > | 0.06 | 0.041 | mg/kg | X@ | . | . |
| gamma-Chlordane | SL | Pond G | G-02 | SW8080 | > | 0.31 | 0.032 | mg/kg | X | . | . |
| gamma-Chlordane | SL | Pond G | G-06 | SW8080 | < | 0.07 | 0.07 | mg/kg | | . | . |
| gamma-Chlordane | SL | Pond G | G-05 | SW8080 | < | 0.025 | 0.025 | mg/kg | | . | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| gamma-Chlordane | SL | Pond G | G-04 | SW8080 | < | 0.037 | 0.037 | mg/kg | | . | . |
| gamma-Chlordane | SL | Pond G | G-01 | SW8080 | > | 0.028 | 0.0016 | mg/kg | X | . | . |
| Kepone (Mirex) | SL | Pond G | G-05 | SW8080 | ND | 0.01875 | 0.025 | mg/kg | | . | . |
| Kepone (Mirex) | SL | Pond G | G-04 | SW8080 | ND | 0.02775 | 0.037 | mg/kg | | . | . |
| Kepone (Mirex) | SL | Pond G | G-03 | SW8080 | ND | 0.03075 | 0.041 | mg/kg | | . | . |
| Kepone (Mirex) | SL | Pond G | G-02 | SW8080 | ND | 0.024 | 0.032 | mg/kg | | . | . |
| Kepone (Mirex) | SL | Pond G | G-06 | SW8080 | ND | 0.0525 | 0.07 | mg/kg | | . | . |
| Kepone (Mirex) | SL | Pond G | G-01 | SW8080 | > | 0.0017 | 0.0016 | mg/kg | X@ | . | . |
| Lead | SL | Pond G | G-04 | SW7421 | > | 38 | 1.9 | mg/kg | | . | . |
| Lead | SL | Pond G | G-05 | SW7421 | > | 15 | 1.2 | mg/kg | | . | . |
| Lead | SL | Pond G | G-02 | SW7421 | > | 280.5 | 28 | mg/kg | | . | . |
| Lead | SL | Pond G | G-03 | SW7421 | > | 23 | 1.7 | mg/kg | | . | . |
| Lead | SL | Pond G | G-01 | SW7421 | > | 5.8 | 0.36 | mg/kg | | . | . |
| Lead | SL | Pond G | G-06 | SW7421 | > | 27 | 1.6 | mg/kg | | . | . |
| Mercury | SL | Pond G | G-01 | SW7471 | ND | 0.05325 | 0.071 | mg/kg | | . | . |
| Mercury | SL | Pond G | G-06 | SW7471 | ND | 0.24 | 0.32 | mg/kg | | . | . |
| Mercury | SL | Pond G | G-02 | SW7471 | = | 0.15 | 0.15 | mg/kg | @ | . | . |
| Mercury | SL | Pond G | G-05 | SW7471 | ND | 0.0825 | 0.11 | mg/kg | | . | . |
| Mercury | SL | Pond G | G-04 | SW7471 | > | 0.18 | 0.17 | mg/kg | @ | . | . |
| Mercury | SL | Pond G | G-03 | SW7471 | ND | 0.1425 | 0.19 | mg/kg | | . | . |
| Nickel | SL | Pond G | G-05 | SW6010 | > | 5.6 | 3.6 | mg/kg | @ | . | . |
| Nickel | SL | Pond G | G-06 | SW6010 | ND | 9 | 12 | mg/kg | | . | . |
| Nickel | SL | Pond G | G-03 | SW6010 | > | 6.9 | 6.1 | mg/kg | @ | . | . |
| Nickel | SL | Pond G | G-02 | SW6010 | > | 12 | 4.9 | mg/kg | @ | . | . |
| Nickel | SL | Pond G | G-04 | SW6010 | > | 10 | 6.1 | mg/kg | @ | . | . |
| Nickel | SL | Pond G | G-01 | SW6010 | ND | 7.125 | 9.5 | mg/kg | | . | . |
| Selenium | SL | Pond G | G-06 | SW7740 | ND | 1.95 | 2.6 | mg/kg | | . | . |
| Selenium | SL | Pond G | G-01 | SW7740 | ND | 0.4425 | 0.59 | mg/kg | | . | . |
| Selenium | SL | Pond G | G-03 | SW7740 | ND | 1.05 | 1.4 | mg/kg | | . | . |
| Selenium | SL | Pond G | G-04 | SW7740 | ND | 1.2 | 1.6 | mg/kg | | . | . |
| Selenium | SL | Pond G | G-02 | SW7740 | ND | 1.0333333 | 1.2 | mg/kg | | . | . |
| Selenium | SL | Pond G | G-05 | SW7740 | ND | 0.75 | 1 | mg/kg | | . | . |
| Sulfide | SL | Pond G | G-04 | SW9030 | > | 2000 | 91 | mg/kg | | . | . |
| Sulfide | SL | Pond G | G-05 | SW9030 | < | 61 | 61 | mg/kg | | . | . |
| Sulfide | SL | Pond G | G-01 | SW9030 | > | 50 | 39 | mg/kg | @ | . | . |
| Sulfide | SL | Pond G | G-03 | SW9030 | > | 540 | 100 | mg/kg | | . | . |
| Sulfide | SL | Pond G | G-02 | SW9030 | > | 780 | 77 | mg/kg | | . | . |
| Sulfide | SL | Pond G | G-06 | SW9030 | > | 1300 | 170 | mg/kg | | . | . |
| Vanadium | SL | Pond G | G-02 | SW6010 | > | 30 | 4.9 | mg/kg | | . | . |
| Vanadium | SL | Pond G | G-01 | SW6010 | > | 15 | 9.5 | mg/kg | @ | . | . |
| Vanadium | SL | Pond G | G-06 | SW6010 | > | 24 | 12 | mg/kg | @ | . | . |
| Vanadium | SL | Pond G | G-05 | SW6010 | > | 15 | 3.6 | mg/kg | @ | . | . |
| Vanadium | SL | Pond G | G-04 | SW6010 | > | 26 | 6.1 | mg/kg | @ | . | . |
| Vanadium | SL | Pond G | G-03 | SW6010 | > | 25 | 6.1 | mg/kg | @ | . | . |
| Zinc | SL | Pond G | G-01 | SW6010 | > | 26 | 9.5 | mg/kg | @ | . | . |
| Zinc | SL | Pond G | G-06 | SW6010 | > | 50 | 12 | mg/kg | @ | . | . |
| Zinc | SL | Pond G | G-05 | SW6010 | > | 30 | 3.6 | mg/kg | | . | . |
| Zinc | SL | Pond G | G-04 | SW6010 | > | 53 | 6.1 | mg/kg | | . | . |
| Zinc | SL | Pond G | G-03 | SW6010 | > | 49 | 6.1 | mg/kg | | . | . |
| Zinc | SL | Pond G | G-02 | SW6010 | > | 66 | 4.9 | mg/kg | | . | . |
| 4,4'-DDD | SO | Pond G | G-05 | SW8080 | < | 0.0016 | 0.0016 | mg/kg | | 0 | 2 |
| 4,4'-DDD | SO | Pond G | G-05 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 2 | 4 |
| 4,4'-DDD | SO | Pond G | G-03 | SW8080 | > | 0.0048 | 0.0016 | mg/kg | C@ | 0 | 2 |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4,4'-DDD | SO | Pond G | G-02 | SW8080 | > | 0.0038 | 0.0014 | mg/kg | C@ | 0 | 2 |
| 4,4'-DDD | SO | Pond G | G-02 | SW8080 | < | 0.0015 | 0.0015 | mg/kg | | 2 | 4 |
| 4,4'-DDD | SO | Pond G | G-06 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 0 | 2 |
| 4,4'-DDD | SO | Pond G | G-01 | SW8080 | > | 0.0075 | 0.0015 | mg/kg | C | 0 | 2 |
| 4,4'-DDD | SO | Pond G | G-04 | SW8080 | > | 0.0069 | 0.0015 | mg/kg | C@ | 0 | 2 |
| 4,4'-DDE | SO | Pond G | G-06 | SW8080 | > | 0.0025 | 0.0013 | mg/kg | X@ | 0 | 2 |
| 4,4'-DDE | SO | Pond G | G-05 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 2 | 4 |
| 4,4'-DDE | SO | Pond G | G-02 | SW8080 | < | 0.0015 | 0.0015 | mg/kg | | 2 | 4 |
| 4,4'-DDE | SO | Pond G | G-02 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| 4,4'-DDE | SO | Pond G | G-05 | SW8080 | < | 0.0016 | 0.0016 | mg/kg | | 0 | 2 |
| 4,4'-DDE | SO | Pond G | G-04 | SW8080 | > | 0.0031 | 0.0015 | mg/kg | X@ | 0 | 2 |
| 4,4'-DDE | SO | Pond G | G-03 | SW8080 | < | 0.0016 | 0.0016 | mg/kg | | 0 | 2 |
| 4,4'-DDE | SO | Pond G | G-01 | SW8080 | < | 0.0015 | 0.0015 | mg/kg | | 0 | 2 |
| Acetone | SO | Pond G | G-02 | SW8240 | ND | 0.10875 | 0.15 | mg/kg | | 2 | 4 |
| Acetone | SO | Pond G | G-03 | SW8240 | ND | 0.12 | 0.16 | mg/kg | | 0 | 2 |
| Acetone | SO | Pond G | G-06 | SW8240 | ND | 0.0975 | 0.13 | mg/kg | | 0 | 2 |
| Acetone | SO | Pond G | G-04 | SW8240 | < | 0.047 | 0.15 | mg/kg | J | 0 | 2 |
| Acetone | SO | Pond G | G-05 | SW8240 | < | 0.063 | 0.14 | mg/kg | J | 2 | 4 |
| Acetone | SO | Pond G | G-05 | SW8240 | ND | 0.12 | 0.16 | mg/kg | | 0 | 2 |
| Acetone | SO | Pond G | G-01 | SW8240 | < | 0.14 | 0.15 | mg/kg | J | 0 | 2 |
| Acetone | SO | Pond G | G-02 | SW8240 | < | 0.103 | 0.15 | mg/kg | J | 0 | 2 |
| alpha-BHC | SO | Pond G | G-05 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 2 | 4 |
| alpha-BHC | SO | Pond G | G-06 | SW8080 | > | 0.0024 | 0.0013 | mg/kg | C@ | 0 | 2 |
| alpha-BHC | SO | Pond G | G-01 | SW8080 | < | 0.0015 | 0.0015 | mg/kg | | 0 | 2 |
| alpha-BHC | SO | Pond G | G-02 | SW8080 | > | 0.0033 | 0.0014 | mg/kg | X@ | 0 | 2 |
| alpha-BHC | SO | Pond G | G-05 | SW8080 | < | 0.0016 | 0.0016 | mg/kg | | 0 | 2 |
| alpha-BHC | SO | Pond G | G-02 | SW8080 | < | 0.0015 | 0.0015 | mg/kg | | 2 | 4 |
| alpha-BHC | SO | Pond G | G-04 | SW8080 | > | 0.0027 | 0.0015 | mg/kg | X@ | 0 | 2 |
| alpha-BHC | SO | Pond G | G-03 | SW8080 | < | 0.0016 | 0.0016 | mg/kg | | 0 | 2 |
| Arsenic | SO | Pond G | G-03 | SW7060 | > | 1.6 | 0.49 | mg/kg | @ | 0 | 2 |
| Arsenic | SO | Pond G | G-02 | SW7060 | > | 1.85 | 0.45 | mg/kg | @ | 0 | 2 |
| Arsenic | SO | Pond G | G-01 | SW7060 | > | 1.7 | 0.51 | mg/kg | @ | 0 | 2 |
| Arsenic | SO | Pond G | G-04 | SW7060 | > | 3.1 | 0.91 | mg/kg | @ | 0 | 2 |
| Arsenic | SO | Pond G | G-02 | SW7060 | > | 1.85 | 0.53 | mg/kg | @ | 2 | 4 |
| Arsenic | SO | Pond G | G-06 | SW7060 | > | 1.3 | 0.38 | mg/kg | @ | 0 | 2 |
| Arsenic | SO | Pond G | G-05 | SW7060 | > | 1.5 | 0.94 | mg/kg | @ | 2 | 4 |
| Arsenic | SO | Pond G | G-05 | SW7060 | > | 1.6 | 0.51 | mg/kg | @ | 0 | 2 |
| Barium | SO | Pond G | G-01 | SW6010 | > | 100 | 4.5 | mg/kg | | 0 | 2 |
| Barium | SO | Pond G | G-06 | SW6010 | > | 100 | 4 | mg/kg | | 0 | 2 |
| Barium | SO | Pond G | G-05 | SW6010 | > | 180 | 4.2 | mg/kg | | 2 | 4 |
| Barium | SO | Pond G | G-05 | SW6010 | > | 120 | 4.5 | mg/kg | | 0 | 2 |
| Barium | SO | Pond G | G-04 | SW6010 | > | 180 | 4.3 | mg/kg | | 0 | 2 |
| Barium | SO | Pond G | G-03 | SW6010 | > | 140 | 5.4 | mg/kg | | 0 | 2 |
| Barium | SO | Pond G | G-02 | SW6010 | > | 130 | 4.8 | mg/kg | | 2 | 4 |
| Barium | SO | Pond G | G-02 | SW6010 | > | 130 | 4.3 | mg/kg | | 0 | 2 |
| beta-BHC | SO | Pond G | G-02 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| beta-BHC | SO | Pond G | G-05 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 2 | 4 |
| beta-BHC | SO | Pond G | G-02 | SW8080 | < | 0.0015 | 0.0015 | mg/kg | | 2 | 4 |
| beta-BHC | SO | Pond G | G-06 | SW8080 | = | 0.0013 | 0.0013 | mg/kg | CB@ | 0 | 2 |
| beta-BHC | SO | Pond G | G-01 | SW8080 | > | 0.0019 | 0.0015 | mg/kg | X@ | 0 | 2 |
| beta-BHC | SO | Pond G | G-05 | SW8080 | > | 0.011 | 0.0016 | mg/kg | XB | 0 | 2 |
| beta-BHC | SO | Pond G | G-04 | SW8080 | > | 0.0046 | 0.0015 | mg/kg | CB@ | 0 | 2 |
| beta-BHC | SO | Pond G | G-03 | SW8080 | < | 0.0016 | 0.0016 | mg/kg | | 0 | 2 |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| bis(2-Ethylhexyl)phthalate | SO | Pond G | G-02 | SW8270 | ND | 1.125 | 1.5 | mg/kg | | 2 | 4 |
| bis(2-Ethylhexyl)phthalate | SO | Pond G | G-06 | SW8270 | < | 0.15 | 1.3 | mg/kg | J | 0 | 2 |
| bis(2-Ethylhexyl)phthalate | SO | Pond G | G-01 | SW8270 | < | 0.29 | 1.5 | mg/kg | JB | 0 | 2 |
| bis(2-Ethylhexyl)phthalate | SO | Pond G | G-05 | SW8270 | < | 0.31 | 1.6 | mg/kg | J | 0 | 2 |
| bis(2-Ethylhexyl)phthalate | SO | Pond G | G-04 | SW8270 | ND | 1.125 | 1.5 | mg/kg | | 0 | 2 |
| bis(2-Ethylhexyl)phthalate | SO | Pond G | G-03 | SW8270 | > | 3.6 | 1.6 | mg/kg | @ | 0 | 2 |
| bis(2-Ethylhexyl)phthalate | SO | Pond G | G-05 | SW8270 | ND | 1.05 | 1.4 | mg/kg | | 2 | 4 |
| bis(2-Ethylhexyl)phthalate | SO | Pond G | G-02 | SW8270 | > | 2.1 | 1.4 | mg/kg | @ | 0 | 2 |
| Butylbenzylphthalate | SO | Pond G | G-03 | SW8270 | < | 1.6 | 1.6 | mg/kg | | 0 | 2 |
| Butylbenzylphthalate | SO | Pond G | G-02 | SW8270 | < | 0.88 | 1.5 | mg/kg | J | 2 | 4 |
| Butylbenzylphthalate | SO | Pond G | G-02 | SW8270 | < | 1.4 | 1.4 | mg/kg | | 0 | 2 |
| Butylbenzylphthalate | SO | Pond G | G-04 | SW8270 | < | 1.5 | 1.5 | mg/kg | | 0 | 2 |
| Butylbenzylphthalate | SO | Pond G | G-05 | SW8270 | < | 1.6 | 1.6 | mg/kg | | 0 | 2 |
| Butylbenzylphthalate | SO | Pond G | G-01 | SW8270 | < | 1.5 | 1.5 | mg/kg | | 0 | 2 |
| Butylbenzylphthalate | SO | Pond G | G-06 | SW8270 | < | 1.3 | 1.3 | mg/kg | | 0 | 2 |
| Butylbenzylphthalate | SO | Pond G | G-05 | SW8270 | < | 1.4 | 1.4 | mg/kg | | 2 | 4 |
| Carbon disulfide | SO | Pond G | G-02 | SW8240 | ND | 0.00555 | 0.0077 | mg/kg | | 2 | 4 |
| Carbon disulfide | SO | Pond G | G-03 | SW8240 | < | 0.0034 | 0.0079 | mg/kg | J | 0 | 2 |
| Carbon disulfide | SO | Pond G | G-06 | SW8240 | > | 0.013 | 0.0067 | mg/kg | @ | 0 | 2 |
| Carbon disulfide | SO | Pond G | G-04 | SW8240 | < | 0.002 | 0.0075 | mg/kg | J | 0 | 2 |
| Carbon disulfide | SO | Pond G | G-05 | SW8240 | ND | 0.0054 | 0.0072 | mg/kg | | 2 | 4 |
| Carbon disulfide | SO | Pond G | G-05 | SW8240 | ND | 0.006 | 0.008 | mg/kg | | 0 | 2 |
| Carbon disulfide | SO | Pond G | G-01 | SW8240 | ND | 0.005625 | 0.0075 | mg/kg | | 0 | 2 |
| Carbon disulfide | SO | Pond G | G-02 | SW8240 | > | 0.015 | 0.0073 | mg/kg | @ | 0 | 2 |
| Chromium | SO | Pond G | G-03 | SW6010 | > | 11 | 5.4 | mg/kg | @ | 0 | 2 |
| Chromium | SO | Pond G | G-02 | SW6010 | > | 9.3 | 4.3 | mg/kg | @ | 0 | 2 |
| Chromium | SO | Pond G | G-01 | SW6010 | > | 10 | 4.5 | mg/kg | @ | 0 | 2 |
| Chromium | SO | Pond G | G-04 | SW6010 | > | 14 | 4.3 | mg/kg | @ | 0 | 2 |
| Chromium | SO | Pond G | G-02 | SW6010 | > | 14 | 4.8 | mg/kg | @ | 2 | 4 |
| Chromium | SO | Pond G | G-06 | SW6010 | > | 11 | 4 | mg/kg | @ | 0 | 2 |
| Chromium | SO | Pond G | G-05 | SW6010 | > | 16 | 4.2 | mg/kg | @ | 2 | 4 |
| Chromium | SO | Pond G | G-05 | SW6010 | > | 8.5 | 4.5 | mg/kg | @ | 0 | 2 |
| Cobalt | SO | Pond G | G-01 | SW6010 | ND | 3.375 | 4.5 | mg/kg | | 0 | 2 |
| Cobalt | SO | Pond G | G-06 | SW6010 | ND | 3 | 4 | mg/kg | | 0 | 2 |
| Cobalt | SO | Pond G | G-05 | SW6010 | > | 4.6 | 4.2 | mg/kg | @ | 2 | 4 |
| Cobalt | SO | Pond G | G-05 | SW6010 | ND | 3.375 | 4.5 | mg/kg | | 0 | 2 |
| Cobalt | SO | Pond G | G-04 | SW6010 | > | 4.4 | 4.3 | mg/kg | @ | 0 | 2 |
| Cobalt | SO | Pond G | G-03 | SW6010 | ND | 4.05 | 5.4 | mg/kg | | 0 | 2 |
| Cobalt | SO | Pond G | G-02 | SW6010 | ND | 3.6 | 4.8 | mg/kg | | 2 | 4 |
| Cobalt | SO | Pond G | G-02 | SW6010 | ND | 3.225 | 4.3 | mg/kg | | 0 | 2 |
| Copper | SO | Pond G | G-03 | SW6010 | ND | 8.25 | 11 | mg/kg | | 0 | 2 |
| Copper | SO | Pond G | G-02 | SW6010 | ND | 7.2 | 9.6 | mg/kg | | 2 | 4 |
| Copper | SO | Pond G | G-02 | SW6010 | ND | 6.525 | 8.7 | mg/kg | | 0 | 2 |
| Copper | SO | Pond G | G-04 | SW6010 | ND | 6.45 | 8.6 | mg/kg | | 0 | 2 |
| Copper | SO | Pond G | G-05 | SW6010 | ND | 6.75 | 9 | mg/kg | | 0 | 2 |
| Copper | SO | Pond G | G-01 | SW6010 | ND | 6.75 | 9 | mg/kg | | 0 | 2 |
| Copper | SO | Pond G | G-05 | SW6010 | > | 9.8 | 8.3 | mg/kg | @ | 2 | 4 |
| Copper | SO | Pond G | G-06 | SW6010 | ND | 6 | 8 | mg/kg | | 0 | 2 |
| Cyanide | SO | Pond G | G-02 | SW9012 | < | 0.28 | 0.28 | mg/kg | | 0 | 2 |
| Cyanide | SO | Pond G | G-05 | SW9012 | < | 0.29 | 0.29 | mg/kg | | 2 | 4 |
| Cyanide | SO | Pond G | G-01 | SW9012 | > | 0.59 | 0.27 | mg/kg | @ | 0 | 2 |
| Cyanide | SO | Pond G | G-02 | SW9012 | < | 0.33 | 0.33 | mg/kg | | 2 | 4 |
| Cyanide | SO | Pond G | G-03 | SW9012 | < | 0.3 | 0.3 | mg/kg | | 0 | 2 |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cyanide | SO | Pond G | G-06 | SW9012 | > | 0.61 | 0.29 | mg/kg | @ | 0 | 2 |
| Cyanide | SO | Pond G | G-04 | SW9012 | > | 0.61 | 0.36 | mg/kg | @ | 0 | 2 |
| Cyanide | SO | Pond G | G-05 | SW9012 | < | 0.31 | 0.31 | mg/kg | | 0 | 2 |
| Cyclohexenone | SO | Pond G | G-05 | SW8270 | > | 1.2 | . | mg/kg | | 2 | 4 |
| Di-n-octylphthalate | SO | Pond G | G-03 | SW8270 | < | 1.6 | 1.6 | mg/kg | | 0 | 2 |
| Di-n-octylphthalate | SO | Pond G | G-02 | SW8270 | < | 1.4 | 1.4 | mg/kg | | 0 | 2 |
| Di-n-octylphthalate | SO | Pond G | G-01 | SW8270 | < | 1.5 | 1.5 | mg/kg | | 0 | 2 |
| Di-n-octylphthalate | SO | Pond G | G-04 | SW8270 | < | 1.5 | 1.5 | mg/kg | | 0 | 2 |
| Di-n-octylphthalate | SO | Pond G | G-02 | SW8270 | < | 0.23 | 1.5 | mg/kg | J | 2 | 4 |
| Di-n-octylphthalate | SO | Pond G | G-06 | SW8270 | < | 1.3 | 1.3 | mg/kg | | 0 | 2 |
| Di-n-octylphthalate | SO | Pond G | G-05 | SW8270 | < | 1.4 | 1.4 | mg/kg | | 2 | 4 |
| Di-n-octylphthalate | SO | Pond G | G-05 | SW8270 | < | 1.6 | 1.6 | mg/kg | | 0 | 2 |
| Endosulfan sulfate | SO | Pond G | G-01 | SW8080 | < | 0.00019 | 0.0074 | mg/kg | JX | 0 | 2 |
| Endosulfan sulfate | SO | Pond G | G-04 | SW8080 | < | 0.0012 | 0.0075 | mg/kg | JC | 0 | 2 |
| Endosulfan sulfate | SO | Pond G | G-06 | SW8080 | < | 0.0009 | 0.0066 | mg/kg | JC | 0 | 2 |
| Endosulfan sulfate | SO | Pond G | G-05 | SW8080 | < | 0.00075 | 0.0072 | mg/kg | JX | 2 | 4 |
| Endosulfan sulfate | SO | Pond G | G-05 | SW8080 | < | 0.0012 | 0.0079 | mg/kg | JC | 0 | 2 |
| Endosulfan sulfate | SO | Pond G | G-03 | SW8080 | < | 0.0012 | 0.0078 | mg/kg | JC | 0 | 2 |
| Endosulfan sulfate | SO | Pond G | G-02 | SW8080 | < | 0.0021 | 0.0077 | mg/kg | JC | 2 | 4 |
| Endosulfan sulfate | SO | Pond G | G-02 | SW8080 | < | 0.0007 | 0.0072 | mg/kg | JX | 0 | 2 |
| gamma-BHC | SO | Pond G | G-05 | SW8080 | < | 0.0016 | 0.0016 | mg/kg | | 0 | 2 |
| gamma-BHC | SO | Pond G | G-06 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 0 | 2 |
| gamma-BHC | SO | Pond G | G-05 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 2 | 4 |
| gamma-BHC | SO | Pond G | G-04 | SW8080 | < | 0.0015 | 0.0015 | mg/kg | | 0 | 2 |
| gamma-BHC | SO | Pond G | G-03 | SW8080 | > | 0.003 | 0.0016 | mg/kg | C@ | 0 | 2 |
| gamma-BHC | SO | Pond G | G-02 | SW8080 | > | 0.0031 | 0.0014 | mg/kg | X@ | 0 | 2 |
| gamma-BHC | SO | Pond G | G-02 | SW8080 | > | 0.0027 | 0.0015 | mg/kg | X@ | 2 | 4 |
| gamma-BHC | SO | Pond G | G-01 | SW8080 | < | 0.0015 | 0.0015 | mg/kg | | 0 | 2 |
| Heptachlor | SO | Pond G | G-03 | SW8080 | < | 0.0016 | 0.0016 | mg/kg | | 0 | 2 |
| Heptachlor | SO | Pond G | G-02 | SW8080 | < | 0.0015 | 0.0015 | mg/kg | | 2 | 4 |
| Heptachlor | SO | Pond G | G-02 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| Heptachlor | SO | Pond G | G-04 | SW8080 | > | 0.0033 | 0.0015 | mg/kg | X@ | 0 | 2 |
| Heptachlor | SO | Pond G | G-01 | SW8080 | < | 0.0015 | 0.0015 | mg/kg | | 0 | 2 |
| Heptachlor | SO | Pond G | G-06 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 0 | 2 |
| Heptachlor | SO | Pond G | G-05 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 2 | 4 |
| Heptachlor | SO | Pond G | G-05 | SW8080 | < | 0.0016 | 0.0016 | mg/kg | | 0 | 2 |
| Isodrin | SO | Pond G | G-01 | SW8080 | < | 0.0015 | 0.0015 | mg/kg | | 0 | 2 |
| Isodrin | SO | Pond G | G-05 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 2 | 4 |
| Isodrin | SO | Pond G | G-06 | SW8080 | < | 0.0013 | 0.0013 | mg/kg | | 0 | 2 |
| Isodrin | SO | Pond G | G-04 | SW8080 | < | 0.0015 | 0.0015 | mg/kg | | 0 | 2 |
| Isodrin | SO | Pond G | G-05 | SW8080 | > | 0.0047 | 0.0016 | mg/kg | X@ | 0 | 2 |
| Isodrin | SO | Pond G | G-02 | SW8080 | < | 0.0014 | 0.0014 | mg/kg | | 0 | 2 |
| Isodrin | SO | Pond G | G-02 | SW8080 | < | 0.0015 | 0.0015 | mg/kg | | 2 | 4 |
| Isodrin | SO | Pond G | G-03 | SW8080 | < | 0.0016 | 0.0016 | mg/kg | | 0 | 2 |
| Lead | SO | Pond G | G-03 | SW7421 | > | 4.5 | 0.37 | mg/kg | | 0 | 2 |
| Lead | SO | Pond G | G-02 | SW7421 | > | 2.8 | 0.33 | mg/kg | | 0 | 2 |
| Lead | SO | Pond G | G-01 | SW7421 | > | 3.9 | 0.38 | mg/kg | | 0 | 2 |
| Lead | SO | Pond G | G-04 | SW7421 | > | 120 | 13 | mg/kg | | 0 | 2 |
| Lead | SO | Pond G | G-02 | SW7421 | > | 5.3 | 0.4 | mg/kg | | 2 | 4 |
| Lead | SO | Pond G | G-06 | SW7421 | > | 4.8 | 0.29 | mg/kg | | 0 | 2 |
| Lead | SO | Pond G | G-05 | SW7421 | > | 5.7 | 0.35 | mg/kg | | 2 | 4 |
| Lead | SO | Pond G | G-05 | SW7421 | > | 3.9 | 0.38 | mg/kg | | 0 | 2 |
| Methylene chloride | SO | Pond G | G-01 | SW8240 | ND | 0.005625 | 0.0075 | mg/kg | | 0 | 2 |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Methylene chloride | SO | Pond G | G-04 | SW8240 | > | 0.015 | 0.0075 | mg/kg | @ | 0 | 2 |
| Methylene chloride | SO | Pond G | G-06 | SW8240 | > | 0.031 | 0.0067 | mg/kg | @ | 0 | 2 |
| Methylene chloride | SO | Pond G | G-05 | SW8240 | ND | 0.0054 | 0.0072 | mg/kg | | 2 | 4 |
| Methylene chloride | SO | Pond G | G-05 | SW8240 | > | 0.02 | 0.008 | mg/kg | @ | 0 | 2 |
| Methylene chloride | SO | Pond G | G-03 | SW8240 | > | 0.031 | 0.0079 | mg/kg | @ | 0 | 2 |
| Methylene chloride | SO | Pond G | G-02 | SW8240 | > | 0.0355 | 0.0077 | mg/kg | @ | 2 | 4 |
| Methylene chloride | SO | Pond G | G-02 | SW8240 | ND | 0.0143167 | 0.0073 | mg/kg | | 0 | 2 |
| Nickel | SO | Pond G | G-05 | SW6010 | > | 9.3 | 8.3 | mg/kg | @ | 2 | 4 |
| Nickel | SO | Pond G | G-06 | SW6010 | ND | 6 | 8 | mg/kg | | 0 | 2 |
| Nickel | SO | Pond G | G-05 | SW6010 | ND | 6.75 | 9 | mg/kg | | 0 | 2 |
| Nickel | SO | Pond G | G-03 | SW6010 | ND | 8.25 | 11 | mg/kg | | 0 | 2 |
| Nickel | SO | Pond G | G-02 | SW6010 | ND | 7.2 | 9.6 | mg/kg | | 2 | 4 |
| Nickel | SO | Pond G | G-02 | SW6010 | ND | 6.525 | 8.7 | mg/kg | | 0 | 2 |
| Nickel | SO | Pond G | G-04 | SW6010 | > | 9 | 8.6 | mg/kg | @ | 0 | 2 |
| Nickel | SO | Pond G | G-01 | SW6010 | > | 9.7 | 9 | mg/kg | @ | 0 | 2 |
| Sulfide | SO | Pond G | G-01 | SW9030 | > | 46 | 36 | mg/kg | @ | 0 | 2 |
| Sulfide | SO | Pond G | G-03 | SW9030 | > | 47 | 37 | mg/kg | @ | 0 | 2 |
| Sulfide | SO | Pond G | G-02 | SW9030 | > | 48 | 38 | mg/kg | @ | 2 | 4 |
| Sulfide | SO | Pond G | G-04 | SW9030 | > | 100 | 36 | mg/kg | @ | 0 | 2 |
| Sulfide | SO | Pond G | G-05 | SW9030 | > | 82 | 39 | mg/kg | @ | 0 | 2 |
| Sulfide | SO | Pond G | G-06 | SW9030 | > | 92 | 32 | mg/kg | @ | 0 | 2 |
| Sulfide | SO | Pond G | G-02 | SW9030 | < | 36 | 36 | mg/kg | | 0 | 2 |
| Sulfide | SO | Pond G | G-05 | SW9030 | > | 45 | 35 | mg/kg | @ | 2 | 4 |
| Toluene | SO | Pond G | G-02 | SW8240 | < | 0.0074 | 0.0077 | mg/kg | | 2 | 4 |
| Toluene | SO | Pond G | G-02 | SW8240 | < | 0.0073 | 0.0073 | mg/kg | | 0 | 2 |
| Toluene | SO | Pond G | G-01 | SW8240 | < | 0.0075 | 0.0075 | mg/kg | | 0 | 2 |
| Toluene | SO | Pond G | G-03 | SW8240 | < | 0.0044 | 0.0079 | mg/kg | J | 0 | 2 |
| Toluene | SO | Pond G | G-04 | SW8240 | < | 0.0026 | 0.0075 | mg/kg | J | 0 | 2 |
| Toluene | SO | Pond G | G-06 | SW8240 | < | 0.0028 | 0.0067 | mg/kg | J | 0 | 2 |
| Toluene | SO | Pond G | G-05 | SW8240 | < | 0.00058 | 0.0072 | mg/kg | J | 2 | 4 |
| Toluene | SO | Pond G | G-05 | SW8240 | < | 0.0041 | 0.008 | mg/kg | J | 0 | 2 |
| Total organic carbon | SO | Pond G | G-05 | | > | 4700 | 1100 | mg/kg | @ | 2 | 4 |
| Total organic carbon | SO | Pond G | G-05 | | > | 4900 | 1100 | mg/kg | @ | 0 | 2 |
| Vanadium | SO | Pond G | G-02 | SW6010 | > | 22 | 9.6 | mg/kg | @ | 2 | 4 |
| Vanadium | SO | Pond G | G-06 | SW6010 | > | 18 | 8 | mg/kg | @ | 0 | 2 |
| Vanadium | SO | Pond G | G-01 | SW6010 | > | 20 | 9 | mg/kg | @ | 0 | 2 |
| Vanadium | SO | Pond G | G-05 | SW6010 | > | 16 | 9 | mg/kg | @ | 0 | 2 |
| Vanadium | SO | Pond G | G-04 | SW6010 | > | 29 | 8.6 | mg/kg | @ | 0 | 2 |
| Vanadium | SO | Pond G | G-03 | SW6010 | > | 23 | 11 | mg/kg | @ | 0 | 2 |
| Vanadium | SO | Pond G | G-05 | SW6010 | > | 29 | 8.3 | mg/kg | @ | 2 | 4 |
| Vanadium | SO | Pond G | G-02 | SW6010 | > | 17 | 8.7 | mg/kg | @ | 0 | 2 |
| Zinc | SO | Pond G | G-06 | SW6010 | > | 24 | 8 | mg/kg | @ | 0 | 2 |
| Zinc | SO | Pond G | G-03 | SW6010 | > | 29 | 11 | mg/kg | @ | 0 | 2 |
| Zinc | SO | Pond G | G-05 | SW6010 | > | 43 | 8.3 | mg/kg | | 2 | 4 |
| Zinc | SO | Pond G | G-04 | SW6010 | > | 44 | 8.6 | mg/kg | | 0 | 2 |
| Zinc | SO | Pond G | G-05 | SW6010 | > | 23 | 9 | mg/kg | @ | 0 | 2 |
| Zinc | SO | Pond G | G-02 | SW6010 | > | 24 | 8.7 | mg/kg | @ | 0 | 2 |
| Zinc | SO | Pond G | G-02 | SW6010 | > | 32 | 9.6 | mg/kg | @ | 2 | 4 |
| Zinc | SO | Pond G | G-01 | SW6010 | > | 29 | 9 | mg/kg | @ | 0 | 2 |
| 4,4'-DDD | WG | Pond G | MW-06 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| 4,4'-DDD | WG | Pond G | MW-04 | SW8080 | > | 0.000047 | 9.50E-06 | mg/L | @ | . | . |
| 4,4'-DDD | WG | Pond G | MW-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| 4,4'-DDD | WG | Pond G | MW-06 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4,4'-DDD | WG | Pond G | MW-06 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| alpha-BHC | WG | Pond G | MW-04 | SW8080 | > | 0.0001 | 9.50E-06 | mg/L | X | . | . |
| alpha-BHC | WG | Pond G | MW-06 | SW8080 | > | 0.000013 | 9.50E-06 | mg/L | @ | . | . |
| alpha-BHC | WG | Pond G | MW-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| alpha-BHC | WG | Pond G | MW-06 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| alpha-BHC | WG | Pond G | MW-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| alpha-BHC | WG | Pond G | MW-06 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Dieldrin | WG | Pond G | MW-04 | SW8080 | > | 0.000016 | 9.50E-06 | mg/L | G@ | . | . |
| Dieldrin | WG | Pond G | MW-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Dieldrin | WG | Pond G | MW-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Dieldrin | WG | Pond G | MW-06 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Dieldrin | WG | Pond G | MW-06 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Dieldrin | WG | Pond G | MW-06 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Endosulfan I | WG | Pond G | MW-06 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Endosulfan I | WG | Pond G | MW-06 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Endosulfan I | WG | Pond G | MW-06 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Endosulfan I | WG | Pond G | MW-04 | SW8080 | > | 0.000024 | 9.50E-06 | mg/L | @ | . | . |
| Endosulfan I | WG | Pond G | MW-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Endosulfan I | WG | Pond G | MW-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Endosulfan sulfate | WG | Pond G | MW-06 | SW8080 | ND | 0.000024 | 0.000048 | mg/L | | . | . |
| Endosulfan sulfate | WG | Pond G | MW-06 | SW8080 | < | 7.30E-06 | 0.000048 | mg/L | JX | . | . |
| Endosulfan sulfate | WG | Pond G | MW-04 | SW8080 | ND | 0.000024 | 0.000048 | mg/L | | . | . |
| Endosulfan sulfate | WG | Pond G | MW-04 | SW8080 | < | 0.000038 | 0.000048 | mg/L | J | . | . |
| Endosulfan sulfate | WG | Pond G | MW-04 | SW8080 | ND | 0.000024 | 0.000048 | mg/L | | . | . |
| Endosulfan sulfate | WG | Pond G | MW-06 | SW8080 | < | 0.000018 | 0.000048 | mg/L | J | . | . |
| Endrin | WG | Pond G | MW-06 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Endrin | WG | Pond G | MW-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Endrin | WG | Pond G | MW-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Endrin | WG | Pond G | MW-06 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Endrin | WG | Pond G | MW-06 | SW8080 | > | 0.000018 | 9.50E-06 | mg/L | X@ | . | . |
| Endrin aldehyde | WG | Pond G | MW-06 | SW8080 | ND | 9.50E-06 | 0.000019 | mg/L | | . | . |
| Endrin aldehyde | WG | Pond G | MW-04 | SW8080 | < | 2.90E-06 | 0.000019 | mg/L | J | . | . |
| Endrin aldehyde | WG | Pond G | MW-04 | SW8080 | > | 0.00004 | 0.000019 | mg/L | G@ | . | . |
| Endrin aldehyde | WG | Pond G | MW-06 | SW8080 | ND | 9.50E-06 | 0.000019 | mg/L | | . | . |
| Endrin aldehyde | WG | Pond G | MW-04 | SW8080 | ND | 9.50E-06 | 0.000019 | mg/L | | . | . |
| Endrin aldehyde | WG | Pond G | MW-06 | SW8080 | ND | 9.50E-06 | 0.000019 | mg/L | | . | . |
| gamma-BHC | WG | Pond G | MW-04 | SW8080 | > | 0.000059 | 9.50E-06 | mg/L | X | . | . |
| gamma-BHC | WG | Pond G | MW-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| gamma-BHC | WG | Pond G | MW-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| gamma-BHC | WG | Pond G | MW-06 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| gamma-BHC | WG | Pond G | MW-06 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| gamma-BHC | WG | Pond G | MW-06 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| gamma-Chlordane | WG | Pond G | MW-06 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| gamma-Chlordane | WG | Pond G | MW-06 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| gamma-Chlordane | WG | Pond G | MW-04 | SW8080 | > | 0.000016 | 9.50E-06 | mg/L | G@ | . | . |
| gamma-Chlordane | WG | Pond G | MW-04 | SW8080 | > | 0.000072 | 9.50E-06 | mg/L | X | . | . |
| Heptachlor | WG | Pond G | MW-06 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Heptachlor | WG | Pond G | MW-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Heptachlor | WG | Pond G | MW-06 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Heptachlor | WG | Pond G | MW-06 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Heptachlor | WG | Pond G | MW-04 | SW8080 | < | 8.00E-06 | 9.50E-06 | mg/L | J | . | . |
| Heptachlor | WG | Pond G | MW-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Heptachlor epoxide | WG | Pond G | MW-04 | SW8080 | > | 0.00037 | 9.50E-06 | mg/L | G | . | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Heptachlor epoxide | WG | Pond G | MW-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Heptachlor epoxide | WG | Pond G | MW-06 | SW8080 | < | 4.50E-06 | 9.50E-06 | mg/L | J | . | . |
| Heptachlor epoxide | WG | Pond G | MW-06 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Heptachlor epoxide | WG | Pond G | MW-04 | SW8080 | > | 0.000043 | 9.50E-06 | mg/L | @ | . | . |
| Isodrin | WG | Pond G | MW-06 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Isodrin | WG | Pond G | MW-04 | SW8080 | > | 0.000015 | 9.50E-06 | mg/L | G@ | . | . |
| Isodrin | WG | Pond G | MW-04 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Isodrin | WG | Pond G | MW-06 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| Methoxychlor | WG | Pond G | MW-04 | SW8080 | < | 0.000016 | 0.000048 | mg/L | JX | . | . |
| alpha-BHC | WS | Pond G | G-01 | SW8080 | < | 7.60E-06 | 9.50E-06 | mg/L | J | . | . |
| alpha-BHC | WS | Pond G | G-3 | SW8080 | > | 0.0002 | . | mg/L | J | . | . |
| Arsenic | WS | Pond G | G-5 | SW7060 | ND | 0.003 | 0.006 | mg/L | | . | . |
| Arsenic | WS | Pond G | G-1 | SW7060 | > | 0.0072 | . | mg/L | @ | . | . |
| Arsenic | WS | Pond G | G-2 | SW7060 | > | 0.0055 | . | mg/L | @ | . | . |
| Arsenic | WS | Pond G | G-3 | SW7060 | > | 0.0052 | . | mg/L | @ | . | . |
| Arsenic | WS | Pond G | G-4 | SW7060 | ND | 0.0015 | 0.003 | mg/L | | . | . |
| Barium | WS | Pond G | G-3 | SW6010 | > | 0.036 | . | mg/L | @ | . | . |
| Barium | WS | Pond G | G-1 | SW6010 | > | 0.033 | . | mg/L | @ | . | . |
| Barium | WS | Pond G | G-5 | SW6010 | > | 0.035 | . | mg/L | @ | . | . |
| Barium | WS | Pond G | G-2 | SW6010 | > | 0.04 | . | mg/L | @ | . | . |
| Barium | WS | Pond G | G-4 | SW6010 | > | 0.036 | . | mg/L | @ | . | . |
| beta-BHC | WS | Pond G | G-3 | SW8080 | > | 0.0006 | . | mg/L | J | . | . |
| beta-BHC | WS | Pond G | G-01 | SW8080 | ND | 4.75E-06 | 9.50E-06 | mg/L | | . | . |
| bis(2-Ethylhexyl)phthalate | WS | Pond G | G-5 | SW8270 | > | 0.01 | . | mg/L | JB | . | . |
| bis(2-Ethylhexyl)phthalate | WS | Pond G | G-4 | SW8270 | > | 0.005 | . | mg/L | JB | . | . |
| bis(2-Ethylhexyl)phthalate | WS | Pond G | G-1 | SW8270 | > | 0.006 | . | mg/L | JB | . | . |
| bis(2-Ethylhexyl)phthalate | WS | Pond G | G-3 | SW8270 | > | 0.005 | . | mg/L | JB | . | . |
| bis(2-Ethylhexyl)phthalate | WS | Pond G | G-2 | SW8270 | > | 0.008 | . | mg/L | JB | . | . |
| Boron | WS | Pond G | G-5 | SW6010 | > | 0.27 | . | mg/L | @ | . | . |
| Boron | WS | Pond G | G-4 | SW6010 | > | 0.33 | . | mg/L | @ | . | . |
| Boron | WS | Pond G | G-3 | SW6010 | > | 0.36 | . | mg/L | @ | . | . |
| Boron | WS | Pond G | G-2 | SW6010 | > | 0.36 | . | mg/L | @ | . | . |
| Boron | WS | Pond G | G-1 | SW6010 | > | 0.33 | . | mg/L | @ | . | . |
| Calcium | WS | Pond G | G-5 | SW6010 | > | 390 | . | mg/L | | . | . |
| Calcium | WS | Pond G | G-4 | SW6010 | > | 400 | . | mg/L | | . | . |
| Calcium | WS | Pond G | G-3 | SW6010 | > | 390 | . | mg/L | | . | . |
| Calcium | WS | Pond G | G-2 | SW6010 | > | 440 | . | mg/L | | . | . |
| Calcium | WS | Pond G | G-1 | SW6010 | > | 37 | . | mg/L | | . | . |
| Endosulfan II | WS | Pond G | G-01 | SW8080 | < | 9.00E-07 | 0.000029 | mg/L | J | . | . |
| gamma-BHC | WS | Pond G | G-01 | SW8080 | > | 9.90E-06 | 9.50E-06 | mg/L | @ | . | . |
| Hardness, as CaC03 | WS | Pond G | G-01 | E130.2 | > | 2000 | 120 | mg/L | | . | . |
| Lead | WS | Pond G | G-4 | SW7421 | > | 0.0029 | . | mg/L | @ | . | . |
| Lead | WS | Pond G | G-5 | SW7421 | > | 0.0026 | . | mg/L | @ | . | . |
| Lead | WS | Pond G | G-1 | SW7421 | > | 0.0027 | . | mg/L | | . | . |
| Lead | WS | Pond G | G-2 | SW7421 | > | 0.0032 | . | mg/L | @ | . | . |
| Lead | WS | Pond G | G-3 | SW7421 | > | 0.003 | . | mg/L | @ | . | . |
| Lead (organic) | WS | Pond G | G-2 | E239.1 | > | 0.27 | . | mg/L | @ | . | . |
| Lead (organic) | WS | Pond G | G-3 | E239.1 | ND | 0.05 | 0.1 | mg/L | | . | . |
| Lead (organic) | WS | Pond G | G-1 | E239.1 | > | 0.31 | . | mg/L | @ | . | . |
| Lead (organic) | WS | Pond G | G-4 | E239.1 | > | 0.14 | . | mg/L | @ | . | . |
| Lead (organic) | WS | Pond G | G-5 | E239.1 | > | 0.14 | . | mg/L | @ | . | . |
| Magnesium | WS | Pond G | G-1 | SW6010 | > | 200 | . | mg/L | | . | . |
| Magnesium | WS | Pond G | G-5 | SW6010 | > | 210 | . | mg/L | | . | . |

| analyte | matrix | site_id | loc_id | method | rslt_flag | rslt | rl | units | foot | top_dpth | bot_dpth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Magnesium | WS | Pond G | G-3 | SW6010 | > | 220 | . | mg/L | | . | . |
| Magnesium | WS | Pond G | G-4 | SW6010 | > | 220 | . | mg/L | | . | . |
| Magnesium | WS | Pond G | G-2 | SW6010 | > | 240 | . | mg/L | | . | . |
| Manganese | WS | Pond G | G-3 | SW6010 | > | 0.064 | . | mg/L | | . | . |
| Manganese | WS | Pond G | G-2 | SW6010 | > | 0.071 | . | mg/L | | . | . |
| Manganese | WS | Pond G | G-4 | SW6010 | > | 0.072 | . | mg/L | | . | . |
| Manganese | WS | Pond G | G-1 | SW6010 | > | 0.064 | . | mg/L | | . | . |
| Manganese | WS | Pond G | G-5 | SW6010 | > | 0.061 | . | mg/L | | . | . |
| Mercury | WS | Pond G | G-3 | SW7470 | > | 0.00022 | . | mg/L | @ | . | . |
| Mercury | WS | Pond G | G-4 | SW7470 | > | 0.00022 | . | mg/L | @ | . | . |
| Mercury | WS | Pond G | G-2 | SW7470 | > | 0.00022 | . | mg/L | @ | . | . |
| Mercury | WS | Pond G | G-1 | SW7470 | > | 0.00022 | . | mg/L | @ | . | . |
| Mercury | WS | Pond G | G-5 | SW7470 | > | 0.00022 | . | mg/L | @ | . | . |
| Potassium | WS | Pond G | G-1 | SW6010 | > | 14 | . | mg/L | | . | . |
| Potassium | WS | Pond G | G-2 | SW6010 | > | 17 | . | mg/L | | . | . |
| Potassium | WS | Pond G | G-5 | SW6010 | > | 14 | . | mg/L | | . | . |
| Potassium | WS | Pond G | G-4 | SW6010 | > | 15 | . | mg/L | | . | . |
| Potassium | WS | Pond G | G-3 | SW6010 | > | 14 | . | mg/L | | . | . |
| Silicon | WS | Pond G | G-4 | SW6010 | > | 15 | . | mg/L | | . | . |
| Silicon | WS | Pond G | G-3 | SW6010 | > | 16 | . | mg/L | | . | . |
| Silicon | WS | Pond G | G-2 | SW6010 | > | 16 | . | mg/L | | . | . |
| Silicon | WS | Pond G | G-5 | SW6010 | > | 15 | . | mg/L | | . | . |
| Silicon | WS | Pond G | G-1 | SW6010 | > | 14 | . | mg/L | | . | . |
| Sodium | WS | Pond G | G-2 | SW6010 | > | 740 | . | mg/L | | . | . |
| Sodium | WS | Pond G | G-1 | SW6010 | > | 620 | . | mg/L | | . | . |
| Sodium | WS | Pond G | G-3 | SW6010 | > | 660 | . | mg/L | | . | . |
| Sodium | WS | Pond G | G-5 | SW6010 | > | 630 | . | mg/L | | . | . |
| Sodium | WS | Pond G | G-4 | SW6010 | > | 660 | . | mg/L | | . | . |
| Total dissolved solids | WS | Pond G | G-01 | E160.1 | > | 4600 | 10 | mg/L | | . | . |
| Vanadium | WS | Pond G | G-5 | SW6010 | > | 0.0033 | . | mg/L | @ | . | . |
| Vanadium | WS | Pond G | G-4 | SW6010 | > | 0.0047 | . | mg/L | @ | . | . |
| Vanadium | WS | Pond G | G-2 | SW6010 | > | 0.0045 | . | mg/L | @ | . | . |
| Vanadium | WS | Pond G | G-1 | SW6010 | ND | 0.001 | 0.002 | mg/L | | . | . |
| Vanadium | WS | Pond G | G-3 | SW6010 | ND | 0.0015 | 0.003 | mg/L | | . | . |
| Zinc | WS | Pond G | G-3 | SW6010 | > | 0.0063 | . | mg/L | @ | . | . |
| Zinc | WS | Pond G | G-2 | SW6010 | > | 0.0057 | . | mg/L | @ | . | . |
| Zinc | WS | Pond G | G-4 | SW6010 | > | 0.014 | . | mg/L | @ | . | . |
| Zinc | WS | Pond G | G-5 | SW6010 | > | 0.0072 | . | mg/L | @ | . | . |
| Zinc | WS | Pond G | G-1 | SW6010 | > | 0.0062 | . | mg/L | @ | . | . |

Column Headings:

analyte - Contaminant

matrix - Matrix from which sample was collected

site_id - Site from which sample was collected

loc_id - Area where sample was collected at the site

method - Analytical method

rslt_flag - Analytical result flag

rslt - Sample concentration result

rl - Sample reporting limit

units - Sample units

foot - Sample foot note

top_dpth - Top sample depth

bot_dpth - Bottom sample depth

| analyte | samp_id | matrix | site_id | method | batch_id | sample_type | rslt_flag | rslt | rl | units | foot |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4,4'-DDD | Method Blank | L | | SW8080 | CHGC1_304131301 | MB | > | 0.00009 | 0.00001 | mg/L | X@ |
| 4,4'-DDD | 9304-MWS-05-01 | WG | Pond D/E/F | SW8080 | CHGC1_304131301 | N | > | 0.000017 | 9.50E-06 | mg/L | X@ |
| 4,4'-DDD | 9304-MW-04-01 | WG | Pond G | SW8080 | CHGC1_304131301 | N | > | 0.000018 | 9.50E-06 | mg/L | @ |
| 4,4'-DDT | Method Blank | L | | SW8080 | CHGC5_304161201 | MB | < | 0.000095 | 0.00002 | mg/L | JX |
| 4,4'-DDT | 9304-MW-15-02 | WG | Pond D/E/F | SW8080 | CHGC5_304161201 | FD | > | 0.00002 | 1.9E-05 | mg/L | X@ |
| 4,4'-DDT | 9304-MW-14-02 | WG | Pond D/E/F | SW8080 | CHGC5_304161201 | FD | > | 0.000024 | 1.9E-05 | mg/L | X@ |
| 4,4'-DDT | 9304-MW-14-01 | WG | Pond D/E/F | SW8080 | CHGC5_304161201 | N | > | 0.000023 | 1.9E-05 | mg/L | X@ |
| 4,4'-DDT | 9304-MW-13-01 | WG | Pond A/B | SW8080 | CHGC5_304161201 | N | > | 0.000021 | 1.9E-05 | mg/L | X@ |
| Antimony | Method Blank | S | | SW6010 | EMJA61303171001 | MB | < | 16 | 10 | mg/kg | @ |
| Antimony | 9303-SLS-06-01 | SO | Lake S | SW6010 | EMJA61303171001 | N | < | -27 | 33 | mg/kg | @ |
| Antimony | 9303-SLS-05-01 | SO | Lake S | SW6010 | EMJA61303171001 | N | < | -15 | 36 | mg/kg | @ |
| Antimony | Method Blank | L | | SW6010 | EMJA61303231602 | MB | < | 0.4 | 0.1 | mg/L | @ |
| Antimony | 9303-MWS-16-01 | WG | Lake H | SW6010 | EMJA61303231602 | N | < | -0.45 | 0.1 | mg/L | @ |
| Antimony | Method Blank | L | | SW6010 | EMJA61303301001 | MB | < | 0.4 | 0.1 | mg/L | @ |
| Antimony | 9303-MWS-09-01 | WG | Lake S | SW6010 | EMJA61303301001 | N | < | -0.77 | 1 | mg/L | @ |
| Antimony | 9303-MWS-05-01 | WG | Pond D/E/F | SW6010 | EMJA61303301001 | N | < | 0.34 | 1 | mg/L | @ |
| Antimony | 9303-MWD-05-01 | WG | Pond A/B | SW6010 | EMJA61303301001 | N | < | -0.6 | 1 | mg/L | @ |
| Antimony | 9303-MWD-04-01 | WG | Pond D/E/F | SW6010 | EMJA61303301001 | N | < | -0.6 | 1 | mg/L | @ |
| Antimony | 9303-MW-18-01 | WG | Lake S | SW6010 | EMJA61303301001 | N | < | -0.35 | 1 | mg/L | @ |
| Antimony | 9303-MW-15-01 | WG | Pond D/E/F | SW6010 | EMJA61303301001 | N | < | -0.4 | 1 | mg/L | @ |
| Antimony | 9303-MW-14-01 | WG | Pond D/E/F | SW6010 | EMJA61303301001 | N | < | -0.23 | 1 | mg/L | @ |
| Antimony | 9303-MW-13-01 | WG | Pond A/B | SW6010 | EMJA61303301001 | N | < | -0.95 | 1 | mg/L | @ |
| Antimony | 9303-MW-12-02 | WG | Pond A/B | SW6010 | EMJA61303301001 | FD | < | -0.15 | 1 | mg/L | @ |
| Antimony | 9303-MW-12-01 | WG | Pond A/B | SW6010 | EMJA61303301001 | N | < | 0.053 | 1 | mg/L | @ |
| Antimony | Method Blank | L | | SW6010 | EMJA61303301002 | MB | < | 0.09 | 0.1 | mg/L | @ |
| Antimony | 9303-MW-16-01 | WG | Lake H | SW6010 | EMJA61303301002 | N | < | -0.34 | 1 | mg/L | @ |
| Arsenic | Method Blank | L | | SW7060 | AAZ3__304010901 | MB | < | 0.0036 | 0.004 | mg/L | |
| Arsenic | 9303-MW-17-03 | WQ | Lake H | SW7060 | AAZ3__304010901 | EB | < | 0.0008 | 0.004 | mg/L | |
| Arsenic | 9303-MWD-05-01 | WG | Pond A/B | SW7060 | AAZ3__304010901 | N | < | 0.0024 | 0.016 | mg/L | @ |
| Arsenic | 9303-MWD-04-01 | WG | Pond D/E/F | SW7060 | AAZ3__304010901 | N | < | -0.011 | 0.016 | mg/L | @ |
| Arsenic | 9303-MW-18-01 | WG | Lake S | SW7060 | AAZ3__304010901 | N | < | 0.0024 | 0.016 | mg/L | @ |
| Arsenic | 9303-MW-17-01 | WG | Lake H | SW7060 | AAZ3__304010901 | N | < | -0.0032 | 0.016 | mg/L | @ |
| Arsenic | 9303-MW-15-01 | WG | Pond D/E/F | SW7060 | AAZ3__304010901 | N | < | -0.023 | 0.016 | mg/L | @ |
| Arsenic | 9303-MW-14-01 | WG | Pond D/E/F | SW7060 | AAZ3__304010901 | N | < | -0.029 | 0.016 | mg/L | @ |
| Arsenic | 9303-MW-13-01 | WG | Pond A/B | SW7060 | AAZ3__304010901 | N | < | -0.033 | 0.016 | mg/L | @ |
| Arsenic | 9303-MW-12-02 | WG | Pond A/B | SW7060 | AAZ3__304010901 | FD | < | -0.032 | 0.016 | mg/L | @ |
| Arsenic | 9303-MW-12-01 | WG | Pond A/B | SW7060 | AAZ3__304010901 | N | < | -0.011 | 0.016 | mg/L | @ |
| Arsenic | 9303-MW-11-01 | WG | Pond A/B | SW7060 | AAZ3__304010901 | N | < | -0.031 | 0.016 | mg/L | @ |
| Arsenic | Method Blank | L | | SW7060 | AAZ4__303260902 | MB | < | 0.0092 | 0.004 | mg/L | @ |
| Arsenic | 9303-MWS-16-01 | WG | Lake H | SW7060 | AAZ4__303260902 | N | < | -0.019 | 0.004 | mg/L | @ |
| Beryllium | Method Blank | L | | SW6010 | EMJA61303231602 | MB | < | 0.00064 | 0.002 | mg/L | |
| Beryllium | 9303-MWS-16-01 | WG | Lake H | SW6010 | EMJA61303231602 | N | < | -0.00092 | 0.002 | mg/L | |
| Beryllium | Method Blank | L | | SW6010 | EMJA61303291001 | MB | < | 0.00225 | 0.002 | mg/L | @ |
| Beryllium | 9303-MW-17-03 | WQ | Lake H | SW6010 | EMJA61303291001 | EB | < | 0.00345 | 0.002 | mg/L | @ |
| Beryllium | 9303-MWS-09-01 | WG | Lake S | SW6010 | EMJA61303291001 | N | < | 0.0011 | 0.002 | mg/L | @ |
| Beryllium | 9303-MWS-05-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | 0.00035 | 0.002 | mg/L | @ |
| Beryllium | 9303-MWD-05-01 | WG | Pond A/B | SW6010 | EMJA61303291001 | N | < | 0.0018 | 0.002 | mg/L | @ |
| Beryllium | 9303-MWD-04-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | 0.00046 | 0.002 | mg/L | @ |
| Beryllium | 9303-MW-17-01 | WG | Lake H | SW6010 | EMJA61303291001 | N | > | 0.0021 | 0.002 | mg/L | @ |

| analyte | samp_id | matrix | site_id | method | batch_id | sample_type | rslt_flag | rslt | rl | units | fr |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Beryllium | 9303-MW-14-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | -0.00023 | 0.002 | mg/L | |
| Beryllium | 9303-MW-12-01 | WG | Pond A/B | SW6010 | EMJA61303291001 | N | < | 0.00016 | 0.002 | mg/L | @ |
| Beryllium | Method Blank | S | | SW6010 | EMJA61304061701 | MB | < | 0.135 | 0.2 | mg/kg | @ |
| Beryllium | 9303-SEDE-01-01 | SE | Pond E | SW6010 | EMJA61304061701 | N | < | 0.082 | 0.22 | mg/kg | @ |
| Cadmium | Method Blank | S | | SW6010 | EMJA61303171001 | MB | < | 0.34 | 0.5 | mg/kg | @ |
| Cadmium | 9303-SLS-05-01 | SO | Lake S | SW6010 | EMJA61303171001 | N | < | 0.25 | 0.45 | mg/kg | @ |
| Cadmium | Method Blank* | L | | SW6010 | EMJA61303291001 | MB | < | 0.01 | 0.005 | mg/L | @ |
| Cadmium | 9303-MW-17-03 | WQ | Lake H | SW6010 | EMJA61303291001 | EB | < | 0.0156 | 0.005 | mg/L | @ |
| Cadmium | 9303-MWS-09-01 | WG | Lake S | SW6010 | EMJA61303291001 | N | > | 0.0052 | 0.005 | mg/L | @ |
| Cadmium | 9303-MWD-05-01 | WG | Pond A/B | SW6010 | EMJA61303291001 | N | > | 0.0098 | 0.005 | mg/L | @ |
| Cadmium | 9303-MWD-04-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | 0.004 | 0.005 | mg/L | @ |
| Cadmium | 9303-MW-18-01 | WG | Lake S | SW6010 | EMJA61303291001 | N | < | -0.0035 | 0.005 | mg/L | @ |
| Cadmium | 9303-MW-14-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | > | 0.0054 | 0.005 | mg/L | @ |
| Cadmium | 9303-MW-12-02 | WG | Pond A/B | SW6010 | EMJA61303291001 | FD | > | 0.0079 | 0.005 | mg/L | @ |
| Chromium | Method Blank | L | | SW6010 | EMJA61303231602 | MB | < | 0.056 | 0.01 | mg/L | @ |
| Chromium | 9303-MWS-16-01 | WG | Lake H | SW6010 | EMJA61303231602 | N | < | -0.022 | 0.01 | mg/L | @ |
| Chromium | Method Blank | L | | SW6010 | EMJA61303291001 | MB | < | 0.00165 | 0.01 | mg/L | @ |
| Chromium | 9303-MW-17-03 | WQ | Lake H | SW6010 | EMJA61303291001 | EB | < | 0.00385 | 0.01 | mg/L | @ |
| Chromium | 9303-MWS-05-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | -0.012 | 0.01 | mg/L | @ |
| Chromium | 9303-MWD-04-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | 0.00047 | 0.01 | mg/L | @ |
| Chromium | 9303-MW-15-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | -0.012 | 0.01 | mg/L | @ |
| Chromium | 9303-MW-14-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | -0.013 | 0.01 | mg/L | @ |
| Chromium | 9303-MW-13-01 | WG | Pond A/B | SW6010 | EMJA61303291001 | N | < | -0.0077 | 0.01 | mg/L | @ |
| Chromium | 9303-MW-12-02 | WG | Pond A/B | SW6010 | EMJA61303291001 | FD | < | -0.011 | 0.01 | mg/L | @ |
| Chromium | 9303-MW-12-01 | WG | Pond A/B | SW6010 | EMJA61303291001 | N | < | -0.013 | 0.01 | mg/L | @ |
| Chromium | 9303-MW-11-01 | WG | Pond A/B | SW6010 | EMJA61303291001 | N | < | -0.0078 | 0.01 | mg/L | @ |
| Cobalt | Method Blank | L | | SW6010 | EMJA61303231602 | MB | < | 0.004 | 0.01 | mg/L | @ |
| Cobalt | 9303-MWS-16-01 | WG | Lake H | SW6010 | EMJA61303231602 | N | < | -0.0046 | 0.01 | mg/L | @ |
| Cobalt | Method Blank | L | | SW6010 | EMJA61303291001 | MB | < | 0.00005 | 0.01 | mg/L | |
| Cobalt | 9303-MW-17-03 | WQ | Lake H | SW6010 | EMJA61303291001 | EB | < | 0.0176 | 0.01 | mg/L | @ |
| Cobalt | 9303-MWS-09-01 | WG | Lake S | SW6010 | EMJA61303291001 | N | < | -0.0012 | 0.01 | mg/L | @ |
| Cobalt | 9303-MWS-05-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | -0.0068 | 0.01 | mg/L | @ |
| Cobalt | 9303-MWD-04-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | -0.0028 | 0.01 | mg/L | @ |
| Cobalt | 9303-MW-15-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | -0.0055 | 0.01 | mg/L | @ |
| Cobalt | 9303-MW-14-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | -0.00006 | 0.01 | mg/L | |
| Cobalt | 9303-MW-13-01 | WG | Pond A/B | SW6010 | EMJA61303291001 | N | < | -0.0055 | 0.01 | mg/L | @ |
| Cobalt | 9303-MW-12-02 | WG | Pond A/B | SW6010 | EMJA61303291001 | FD | < | -0.01 | 0.01 | mg/L | @ |
| Cobalt | 9303-MW-12-01 | WG | Pond A/B | SW6010 | EMJA61303291001 | N | < | -0.0088 | 0.01 | mg/L | @ |
| Cobalt | 9303-MWD-05-01 | WG | Pond A/B | SW6010 | EMJA61303291001 | N | < | 0.0069 | 0.01 | mg/L | @ |
| Cobalt | Method Blank | S | | SW6010 | EMJA61304061701 | MB | < | 2.75 | 1 | mg/kg | @ |
| Cobalt | 9303-SEDE-01-01 | SE | Pond E | SW6010 | EMJA61304061701 | N | > | 1.8 | 1.1 | mg/kg | @ |
| Cobalt | 9303-SEDA-01-01 | SE | Pond A | SW6010 | EMJA61304061701 | N | > | 2 | 1.1 | mg/kg | @ |
| Copper | Method Blank | S | | SW6010 | EMJA61303181801 | MB | < | 8.5 | 2 | mg/kg | @ |
| Copper | 9303-SLS-06-01 | SO | Lake S | SW6010 | EMJA61303181801 | N | > | 7.1 | 1.7 | mg/kg | @ |
| Copper | 9303-SLS-05-01 | SO | Lake S | SW6010 | EMJA61303181801 | N | > | 8.4 | 1.9 | mg/kg | @ |
| Copper | Method Blank | L | | SW6010 | EMJA61303231602 | MB | < | 0.0292 | 0.02 | mg/L | @ |
| Copper | 9303-MWS-16-01 | WG | Lake H | SW6010 | EMJA61303231602 | N | < | -0.0012 | 0.02 | mg/L | @ |
| Copper | Method Blank | L | | SW6010 | EMJA61303291001 | MB | < | 0.0296 | 0.02 | mg/L | @ |
| Copper | 9303-MW-17-03 | WQ | Lake H | SW6010 | EMJA61303291001 | EB | < | 0.038 | 0.02 | mg/L | @ |

| analyte | samp_id | matrix | site_id | method | batch_id | sample_type | rslt_flag | rslt | rl | units | foot |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Copper | 9303-MWS-09-01 | WG | Lake S | SW6010 | EMJA61303291001 | N | < | -0.0067 | 0.02 | mg/L | @ |
| Copper | 9303-MWS-05-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | -0.0094 | 0.02 | mg/L | @ |
| Copper | 9303-MWD-05-01 | WG | Pond A/B | SW6010 | EMJA61303291001 | N | < | 0.0037 | 0.02 | mg/L | @ |
| Copper | 9303-MWD-04-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | -0.011 | 0.02 | mg/L | @ |
| Copper | 9303-MW-18-01 | WG | Lake S | SW6010 | EMJA61303291001 | N | < | -0.00076 | 0.02 | mg/L | |
| Copper | 9303-MW-17-01 | WG | Lake H | SW6010 | EMJA61303291001 | N | < | -0.0013 | 0.02 | mg/L | @ |
| Copper | 9303-MW-16-01 | WG | Lake H | SW6010 | EMJA61303291001 | N | < | 0.014 | 0.02 | mg/L | @ |
| Copper | 9303-MW-15-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | -0.012 | 0.02 | mg/L | @ |
| Copper | 9303-MW-14-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | -0.01 | 0.02 | mg/L | @ |
| Copper | 9303-MW-13-01 | WG | Pond A/B | SW6010 | EMJA61303291001 | N | < | -0.01 | 0.02 | mg/L | @ |
| Copper | 9303-MW-12-02 | WG | Pond A/B | SW6010 | EMJA61303291001 | FD | < | -0.011 | 0.02 | mg/L | @ |
| Copper | 9303-MW-12-01 | WG | Pond A/B | SW6010 | EMJA61303291001 | N | < | -0.011 | 0.02 | mg/L | @ |
| Copper | 9303-MW-11-01 | WG | Pond A/B | SW6010 | EMJA61303291001 | N | < | -0.01 | 0.02 | mg/L | @ |
| Cyanide | Method Blank | S | | SW9012 | WLTRAC30316140 | MB | < | 0.0108 | 0.25 | mg/kg | @ |
| Cyanide | 9303-SLS-06-01 | SO | Lake S | SW9012 | WLTRAC30316140 | N | < | -0.14 | 0.33 | mg/kg | @ |
| Cyanide | 9303-SLS-05-01 | SO | Lake S | SW9012 | WLTRAC30316140 | N | < | -0.13 | 0.39 | mg/kg | @ |
| Cyanide | Method Blank | L | | SW9012 | WLTRAC30324140 | MB | < | 0.0115 | 0.01 | mg/L | @ |
| Cyanide | 9303-MWS-16-01 | WG | Lake H | SW9012 | WLTRAC30324140 | N | < | 0.0077 | 0.01 | mg/L | @ |
| Cyanide | 9303-MWS-09-01 | WG | Lake S | SW9012 | WLTRAC30330090 | AD | < | 0.0017 | 0.01 | mg/L | @ |
| Cyanide | Method Blank | L | | SW9012 | WLTRAC30330090 | MB | < | 0.0075 | 0.01 | mg/L | @ |
| Cyanide | 9303-MW-17-03 | WQ | Lake H | SW9012 | WLTRAC30330090 | EB | < | 0.0055 | 0.01 | mg/L | @ |
| Cyanide | 9303-MWS-09-01 | WG | Lake S | SW9012 | WLTRAC30330090 | N | < | 0.0016 | 0.01 | mg/L | @ |
| Cyanide | 9303-MWD-05-01 | WG | Pond A/B | SW9012 | WLTRAC30330090 | N | < | 0.0023 | 0.01 | mg/L | @ |
| Cyanide | 9303-MW-18-01 | WG | Lake S | SW9012 | WLTRAC30330090 | N | < | 0.0021 | 0.01 | mg/L | @ |
| Cyanide | 9303-MW-17-01 | WG | Lake H | SW9012 | WLTRAC30330090 | N | < | 0.0048 | 0.01 | mg/L | @ |
| Cyanide | 9303-MW-16-01 | WG | Lake H | SW9012 | WLTRAC30330090 | N | < | 0.0031 | 0.01 | mg/L | @ |
| Cyanide | 9303-MW-15-01 | WG | Pond D/E/F | SW9012 | WLTRAC30330090 | N | < | 0.0059 | 0.01 | mg/L | @ |
| Cyanide | 9303-MW-14-01 | WG | Pond D/E/F | SW9012 | WLTRAC30330090 | N | < | 0.0055 | 0.01 | mg/L | @ |
| Cyanide | 9303-MW-13-01 | WG | Pond A/B | SW9012 | WLTRAC30330090 | N | < | 0.0011 | 0.01 | mg/L | @ |
| Cyanide | 9303-MWS-05-01 | WG | Pond D/E/F | SW9012 | WLTRAC30401110 | AD | < | 0.0043 | 0.01 | mg/L | @ |
| Cyanide | Method Blank | L | | SW9012 | WLTRAC30401110 | MB | < | 0.01 | 0.01 | mg/L | @ |
| Cyanide | 9303-MWS-05-01 | WG | Pond D/E/F | SW9012 | WLTRAC30401110 | N | < | 0.0045 | 0.01 | mg/L | @ |
| Cyanide | 9303-MWD-04-01 | WG | Pond D/E/F | SW9012 | WLTRAC30401110 | N | < | 0.0006 | 0.01 | mg/L | @ |
| Endosulfan su | 9303-WE-01-03 | WS | Pond E | SW8080 | CHGC6_303221201 | EB | < | 0.000165 | 4.8E-05 | mg/L | J |
| Endosulfan su | 9303-WF-01-01 | WS | Pond F | SW8080 | CHGC6_303221201 | N | < | 0.000016 | 4.8E-05 | mg/L | JB |
| Endosulfan su | 9303-WE-01-02 | WS | Pond E | SW8080 | CHGC6_303221201 | FD | < | 0.000015 | 4.8E-05 | mg/L | JB |
| Endrin | Method Blank | L | | SW8080 | CHGC1_303251201 | MB | < | 1.00E-05 | 0.00001 | mg/L | JX |
| Endrin | 9303-MWS-16-01 | WG | Lake H | SW8080 | CHGC1_303251201 | N | < | 2.10E-06 | 9.70E-06 | mg/L | JX |
| Endrin | 9303-MW-18-01 | WG | Lake S | SW8080 | CHGC1_303251201 | N | < | 8.30E-06 | 9.50E-06 | mg/L | JX |
| Endrin | 9303-MW-17-01 | WG | Lake H | SW8080 | CHGC1_303251201 | N | < | 4.30E-06 | 9.50E-06 | mg/L | J |
| Endrin | 9303-MW-15-01 | WG | Pond D/E/F | SW8080 | CHGC1_303251201 | N | < | 2.40E-06 | 9.70E-06 | mg/L | JX |
| Endrin | 9303-MW-13-01 | WG | Pond A/B | SW8080 | CHGC1_303251201 | N | < | 5.00E-06 | 9.50E-06 | mg/L | JX |
| Endrin | 9303-MW-12-02 | WG | Pond A/B | SW8080 | CHGC1_303251201 | FD | < | 1.90E-06 | 9.60E-06 | mg/L | JX |
| Endrin | Method Blank | L | | SW8080 | CHGC1_304131301 | MB | < | 2.65E-05 | 0.00001 | mg/L | J |
| Endrin | 9304-MWS-04-01 | WG | Pond D/E/F | SW8080 | CHGC1_304131301 | N | < | 5.20E-06 | 9.50E-06 | mg/L | JB |
| Endrin | 9304-MW-04-01 | WG | Pond G | SW8080 | CHGC1_304131301 | N | < | 9.30E-06 | 9.50E-06 | mg/L | JB |
| Endrin | Method Blank | S | | SW8080 | CHGC5_303171201 | MB | < | 0.00065 | 0.00033 | mg/kg | JX |
| Endrin | 9303-SLS-06-01 | SO | Lake S | SW8080 | CHGC5_303171201 | N | > | 0.00053 | 0.00048 | mg/kg | X@ |
| Endrin | Method Blank | L | | SW8080 | CHGC5_304161201 | MB | > | 0.000085 | 0.00001 | mg/L | @ |

| analyte | samp_id | matrix | site_id | method | batch_id | sample_type | rslt_flag | rslt | rl | units | fo |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Endrin | 9304-MW-15-02 | WG | Pond D/E/F | SW8080 | CHGC5_304161201 | FD | > | 0.000013 | 9.50E-06 | mg/L | XB@ |
| Endrin | 9304-MW-15-01 | WG | Pond D/E/F | SW8080 | CHGC5_304161201 | N | > | 0.000024 | 9.50E-06 | mg/L | B@ |
| Endrin | 9304-MW-14-02 | WG | Pond D/E/F | SW8080 | CHGC5_304161201 | FD | > | 0.000013 | 9.50E-06 | mg/L | XB@ |
| Endrin | 9304-MW-14-01 | WG | Pond D/E/F | SW8080 | CHGC5_304161201 | N | > | 0.000013 | 9.50E-06 | mg/L | XB@ |
| Endrin | 9304-MW-13-01 | WG | Pond A/B | SW8080 | CHGC5_304161201 | N | > | 0.000013 | 9.50E-06 | mg/L | B@ |
| Endrin | Method Blank | L | | SW8080 | CHGC6_303221201 | MB | > | 0.000055 | 0.00001 | mg/L | X@ |
| Endrin | 9303-WE-01-03 | WS | Pond E | SW8080 | CHGC6_303221201 | EB | < | 0.000045 | 9.60E-06 | mg/L | JX |
| Endrin | 9303-WF-01-01 | WS | Pond F | SW8080 | CHGC6_303221201 | N | > | 0.00002 | 9.50E-06 | mg/L | X@ |
| Endrin | 9303-WE-01-02 | WS | Pond E | SW8080 | CHGC6_303221201 | FD | > | 0.000011 | 9.50E-06 | mg/L | X@ |
| Endrin | 9303-WE-01-01 | WS | Pond E | SW8080 | CHGC6_303221201 | N | > | 0.00001 | 9.50E-06 | mg/L | X@ |
| Endrin | 9303-WD-01-01 | WS | Pond D | SW8080 | CHGC6_303221201 | N | > | 9.70E-06 | 9.50E-06 | mg/L | X@ |
| Endrin | 9303-WB-01-01 | WS | Pond B | SW8080 | CHGC6_303221201 | N | < | 9.30E-06 | 9.50E-06 | mg/L | JX |
| Endrin | 9303-WA-01-01 | WS | Pond A | SW8080 | CHGC6_303221201 | N | = | 9.50E-06 | 9.50E-06 | mg/L | X@ |
| Heptachlor | 9303-MW-17-03 | WQ | Lake H | SW8080 | CHGC1_3032512 | EB | > | 0.0009 | 9.60E-06 | mg/L | X |
| Heptachlor | 9303-MWD-05-01 | WG | Pond A/B | SW8080 | CHGC1_3032512 | N | < | 4.60E-06 | 9.50E-06 | mg/L | JX |
| Heptachlor | 9303-MW-17-01 | WG | Lake H | SW8080 | CHGC1_303251201 | N | > | 0.000026 | 9.50E-06 | mg/L | G@ |
| Heptachlor | Method Blank | L | | SW8080 | CHGC6_303291202 | MB | < | 0.000041 | 0.00001 | mg/L | JX |
| Heptachlor | 9303-MWS-04-01 | WG | Pond D/E/F | SW8080 | CHGC6_303291202 | N | < | 5.90E-06 | 9.80E-06 | mg/L | JX |
| Heptachlor | 9303-MW-08-01 | WG | Pond A/B | SW8080 | CHGC6_303291202 | N | < | 4.20E-06 | 9.60E-06 | mg/L | JX |
| Heptachlor | 9303-MW-05-02 | WG | Pond A/B | SW8080 | CHGC6_303291202 | FD | > | 0.000037 | 9.80E-06 | mg/L | X@ |
| Heptachlor | 9303-MW-05-01 | WG | Pond A/B | SW8080 | CHGC6_303291202 | N | > | 0.000025 | 9.80E-06 | mg/L | X@ |
| Heptachlor ep | Method Blank | L | | SW8080 | CHGC1_303251201 | MB | > | 0.000085 | 0.00001 | mg/L | X@ |
| Heptachlor ep | 9303-MWS-16-01 | WG | Lake H | SW8080 | CHGC1_303251201 | N | < | 5.70E-06 | 9.70E-06 | mg/L | JX |
| Heptachlor ep | 9303-MW-18-01 | WG | Lake S | SW8080 | CHGC1_303251201 | N | > | 0.000015 | 9.50E-06 | mg/L | X |
| Heptachlor ep | 9303-MW-17-01 | WG | Lake H | SW8080 | CHGC1_303251201 | N | > | 0.000023 | 9.50E-06 | mg/L | X@ |
| Heptachlor ep | 9303-MW-16-01 | WG | Lake H | SW8080 | CHGC1_303251201 | N | > | 0.000022 | 9.50E-06 | mg/L | X@ |
| Heptachlor ep | 9303-MW-13-01 | WG | Pond A/B | SW8080 | CHGC1_303251201 | N | < | 6.40E-06 | 9.50E-06 | mg/L | JX |
| Heptachlor ep | 9303-MW-12-02 | WG | Pond A/B | SW8080 | CHGC1_303251201 | FD | < | 5.00E-06 | 9.60E-06 | mg/L | JX |
| Heptachlor ep | 9303-MW-11-01 | WG | Pond A/B | SW8080 | CHGC1_303251201 | N | < | 5.10E-06 | 9.80E-06 | mg/L | JX |
| Heptachlor ep | Method Blank | L | | SW8080 | CHGC6_303291202 | MB | < | 0.000048 | 0.00001 | mg/L | JX |
| Heptachlor ep | 9303-MWS-04-01 | WG | Pond D/E/F | SW8080 | CHGC6_303291202 | N | > | 0.000022 | 9.80E-06 | mg/L | X@ |
| Heptachlor ep | 9303-MW-07-01 | WG | Pond A/B | SW8080 | CHGC6_303291202 | N | > | 0.000036 | 9.80E-06 | mg/L | @ |
| Heptachlor ep | 9303-MW-06-01 | WG | Pond G | SW8080 | CHGC6_303291202 | N | > | 0.000018 | 9.50E-06 | mg/L | X@ |
| Heptachlor ep | 9303-MW-05-01 | WG | Pond A/B | SW8080 | CHGC6_303291202 | N | > | 0.000033 | 9.80E-06 | mg/L | @ |
| Heptachlor ep | 9303-MW-03-01 | WG | Pond D/E/F | SW8080 | CHGC6_303291202 | N | > | 0.000016 | 9.50E-06 | mg/L | @ |
| Heptachlor ep | 9303-MW-02-01 | WG | Pond C | SW8080 | CHGC6_303291202 | N | < | 8.50E-06 | 9.60E-06 | mg/L | J |
| Heptachlor ep | Method Blank | L | | SW8080 | CHGC6_304081201 | MB | < | 4.35E-05 | 0.00001 | mg/L | JX |
| Heptachlor ep | 9303-MWS-05-01 | WG | Pond D/E/F | SW8080 | CHGC6_304081201 | N | < | 8.10E-06 | 9.50E-06 | mg/L | J |
| Heptachlor ep | 9303-MWD-04-01 | WG | Pond D/E/F | SW8080 | CHGC6_304081201 | N | < | 8.10E-06 | 9.50E-06 | mg/L | JX |
| Lead | Method Blank | L | | SW7421 | AAZ1__304071401 | MB | < | 0.004 | 0.003 | mg/L | @ |
| Lead | 9303-MWS-05-01 | WG | Pond D/E/F | SW7421 | AAZ1__304071401 | N | < | -0.02 | 0.012 | mg/L | @ |
| Lead | 9303-MWD-04-01 | WG | Pond D/E/F | SW7421 | AAZ1__304071401 | N | < | -0.012 | 0.012 | mg/L | @ |
| Lead | Method Blank | L | | SW7421 | AAZ2__303231401 | MB | < | 0.0024 | 0.003 | mg/L | @ |
| Lead | 9303-MWS-16-01 | WG | Lake H | SW7421 | AAZ2__303231401 | N | < | -0.012 | 0.012 | mg/L | @ |
| Lead | C-03-03 | SO | Pond C | SW7421 | Z1___022017-001 | | | 2.6 | 0.27 | mg/kg | |
| Lead | C-03-02 | SO | Pond C | SW7421 | Z1___022017-001 | | | 1.7 | 0.31 | mg/kg | |
| Lead | C-02-02 | SO | Pond C | SW7421 | Z1___022017-001 | | | 1.6 | 0.38 | mg/kg | @ |
| Lead | C-01-02 | SO | Pond C | SW7421 | Z1___022017-001 | | | 2.2 | 0.29 | mg/kg | Z |
| Lead | BH-02-10 | SO | Pond D/E/F | SW7421 | Z1___022017-001 | | | 1.1 | 0.31 | mg/kg | @ |

Appendix B: Samples Eliminated Based on Blank Data

| analyte | samp_id | matrix | site_id | method | batch_id | sample_type | rslt_flag | rslt | rl | units | foot |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mercury | Method Blank | S | | SW7471 | AAZ3__304062001 | MB | < | 0.06 | 0.045 | mg/kg | @ |
| Mercury | 9303-SEDE-01-01 | SE | Pond E | SW7471 | AAZ3__304062001 | N | < | 0.0076 | 0.068 | mg/kg | @ |
| Mercury | 9303-DT-06-01 | SO | Ditch - FP | SW7471 | AAZ3__304062001 | N | < | 0.029 | 0.075 | mg/kg | @ |
| Mercury | Method Blank | S | | SW7471 | AAZ4__303081601 | MB | < | 0.072 | 0.045 | mg/kg | @ |
| Mercury | 9303-SLS-06-01 | SO | Lake S | SW7471 | AAZ4__303081601 | N | < | -0.031 | 0.062 | mg/kg | @ |
| Mercury | 9303-SLS-05-01 | SO | Lake S | SW7471 | AAZ4__303081601 | N | < | -0.029 | 0.074 | mg/kg | @ |
| Mercury | Method Blank | L | | SW7470 | AAZ4__303261901 | MB | < | 0.00016 | 0.00018 | mg/L | |
| Mercury | 9303-MWS-05-01 | WG | Pond D/E/F | SW7470 | AAZ4__303261901 | N | < | -0.00005 | 0.00018 | mg/L | |
| Mercury | 9303-MWD-04-01 | WG | Pond D/E/F | SW7470 | AAZ4__303261901 | N | < | -0.00005 | 0.00018 | mg/L | |
| Nickel | Method Blank | S | | SW6010 | EMJA61303171001 | MB | < | 6.5 | 2 | mg/kg | @ |
| Nickel | 9303-SLS-05-01 | SO | Lake S | SW6010 | EMJA61303171001 | N | > | 5.2 | 1.8 | mg/kg | @ |
| Nickel | Method Blank | L | | SW6010 | EMJA61303231602 | MB | < | 0.06 | 0.02 | mg/L | @ |
| Nickel | 9303-MWS-16-01 | WG | Lake H | SW6010 | EMJA61303231602 | N | < | -0.0072 | 0.02 | mg/L | @ |
| Nickel | Method Blank | L | | SW6010 | EMJA61303291001 | MB | < | 0.1 | 0.02 | mg/L | @ |
| Nickel | 9303-MW-17-03 | WQ | Lake H | SW6010 | EMJA61303291001 | EB | < | 0.084 | 0.02 | mg/L | @ |
| Nickel | 9303-MWS-09-01 | WG | Lake S | SW6010 | EMJA61303291001 | N | < | -0.0058 | 0.02 | mg/L | @ |
| Nickel | 9303-MWS-05-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | -0.046 | 0.02 | mg/L | @ |
| Nickel | 9303-MWD-05-01 | WG | Pond A/B | SW6010 | EMJA61303291001 | N | < | 0.002 | 0.02 | mg/L | @ |
| Nickel | 9303-MWD-04-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | -0.031 | 0.02 | mg/L | @ |
| Nickel | 9303-MW-18-01 | WG | Lake S | SW6010 | EMJA61303291001 | N | < | 0.00066 | 0.02 | mg/L | @ |
| Nickel | 9303-MW-17-01 | WG | Lake H | SW6010 | EMJA61303291001 | N | < | -0.012 | 0.02 | mg/L | @ |
| Nickel | 9303-MW-16-01 | WG | Lake H | SW6010 | EMJA61303291001 | N | < | 0.012 | 0.02 | mg/L | @ |
| Nickel | 9303-MW-15-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | -0.033 | 0.02 | mg/L | @ |
| Nickel | 9303-MW-14-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | -0.024 | 0.02 | mg/L | @ |
| Nickel | 9303-MW-13-01 | WG | Pond A/B | SW6010 | EMJA61303291001 | N | < | -0.048 | 0.02 | mg/L | @ |
| Nickel | 9303-MW-12-02 | WG | Pond A/B | SW6010 | EMJA61303291001 | FD | < | -0.015 | 0.02 | mg/L | @ |
| Nickel | 9303-MW-12-01 | WG | Pond A/B | SW6010 | EMJA61303291001 | N | < | -0.013 | 0.02 | mg/L | @ |
| Nickel | 9303-MW-11-01 | WG | Pond A/B | SW6010 | EMJA61303291001 | N | < | 0.0026 | 0.02 | mg/L | @ |
| Selenium | Method Blank | S | | SW7740 | AAZ4__303180801 | MB | < | 0.52 | 0.5 | mg/kg | @ |
| Selenium | 9303-SLS-05-01 | SO | Lake S | SW7740 | AAZ4__303180801 | N | < | 0.046 | 0.47 | mg/kg | @ |
| Selenium | Method Blank | L | | SW7740 | AAZ4__303290801 | MB | < | 0.003 | 0.005 | mg/L | @ |
| Selenium | 9303-MWS-16-01 | WG | Lake H | SW7740 | AAZ4__303290801 | N | < | -0.015 | 0.005 | mg/L | @ |
| Selenium | Method Blank | L | | SW7740 | AAZ4__304060701 | MB | < | 0.0072 | 0.005 | mg/L | @ |
| Selenium | 9303-MW-17-03 | WQ | Lake H | SW7740 | AAZ4__304060701 | EB | < | 0.0104 | 0.01 | mg/L | @ |
| Selenium | 9303-MWS-05-01 | WG | Pond D/E/F | SW7740 | AAZ4__304060701 | N | < | -0.015 | 0.01 | mg/L | @ |
| Selenium | 9303-MWD-04-01 | WG | Pond D/E/F | SW7740 | AAZ4__304060701 | N | < | -0.0032 | 0.01 | mg/L | @ |
| Selenium | 9303-MW-18-01 | WG | Lake S | SW7740 | AAZ4__304060701 | N | < | -0.013 | 0.01 | mg/L | @ |
| Selenium | 9303-MW-16-01 | WG | Lake H | SW7740 | AAZ4__304060701 | N | < | -0.014 | 0.01 | mg/L | @ |
| Selenium | 9303-MW-15-01 | WG | Pond D/E/F | SW7740 | AAZ4__304060701 | N | < | 0.0046 | 0.01 | mg/L | @ |
| Selenium | 9303-MW-14-01 | WG | Pond D/E/F | SW7740 | AAZ4__304060701 | N | < | 0.0062 | 0.01 | mg/L | @ |
| Selenium | 9303-MW-13-01 | WG | Pond A/B | SW7740 | AAZ4__304060701 | N | < | -0.0092 | 0.01 | mg/L | @ |
| Selenium | 9303-MW-12-02 | WG | Pond A/B | SW7740 | AAZ4__304060701 | FD | < | -0.0082 | 0.01 | mg/L | @ |
| Selenium | 9303-MW-11-01 | WG | Pond A/B | SW7740 | AAZ4__304060701 | N | < | -0.019 | 0.01 | mg/L | @ |
| Silver | Method Blank | S | | SW6010 | EMJA61303171001 | MB | < | 0.96 | 1 | mg/kg | @ |
| Silver | 9303-SLS-06-01 | SO | Lake S | SW6010 | EMJA61303171001 | N | < | -0.39 | 0.83 | mg/kg | @ |
| Silver | 9303-SLS-05-01 | SO | Lake S | SW6010 | EMJA61303171001 | N | < | -0.34 | 0.9 | mg/kg | @ |
| Silver | Method Blank | L | | SW6010 | EMJA61303231602 | MB | < | 0.0268 | 0.01 | mg/L | @ |
| Silver | 9303-MWS-16-01 | WG | Lake H | SW6010 | EMJA61303231602 | N | < | -0.015 | 0.01 | mg/L | @ |
| Silver | Method Blank | L | | SW6010 | EMJA61303291001 | MB | < | 0.019 | 0.01 | mg/L | @ |

| analyte | samp_id | matrix | site_id | method | batch_id | sample_type | rslt_flag | rslt | rl | units | fo |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Silver | 9303-MW-17-03 | WQ | Lake H | SW6010 | EMJA61303291001 | EB | < | 0.0044 | 0.01 | mg/L | @ |
| Silver | 9303-MWS-09-01 | WG | Lake S | SW6010 | EMJA61303291001 | N | < | -0.005 | 0.01 | mg/L | @ |
| Silver | 9303-MWS-05-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | -0.0074 | 0.01 | mg/L | @ |
| Silver | 9303-MWD-05-01 | WG | Pond A/B | SW6010 | EMJA61303291001 | N | < | -0.0062 | 0.01 | mg/L | @ |
| Silver | 9303-MWD-04-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | -0.0068 | 0.01 | mg/L | @ |
| Silver | 9303-MW-18-01 | WG | Lake S | SW6010 | EMJA61303291001 | N | < | -0.0017 | 0.01 | mg/L | @ |
| Silver | 9303-MW-17-01 | WG | Lake H | SW6010 | EMJA61303291001 | N | < | -0.0062 | 0.01 | mg/L | @ |
| Silver | 9303-MW-16-01 | WG | Lake H | SW6010 | EMJA61303291001 | N | < | -0.0062 | 0.01 | mg/L | @ |
| Silver | 9303-MW-15-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | -0.011 | 0.01 | mg/L | @ |
| Silver | 9303-MW-14-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | -0.0082 | 0.01 | mg/L | @ |
| Silver | 9303-MW-13-01 | WG | Pond A/B | SW6010 | EMJA61303291001 | N | < | -0.0082 | 0.01 | mg/L | @ |
| Silver | 9303-MW-12-02 | WG | Pond A/B | SW6010 | EMJA61303291001 | FD | < | -0.0088 | 0.01 | mg/L | @ |
| Silver | 9303-MW-12-01 | WG | Pond A/B | SW6010 | EMJA61303291001 | N | < | -0.0032 | 0.01 | mg/L | @ |
| Silver | 9303-MW-11-01 | WG | Pond A/B | SW6010 | EMJA61303291001 | N | < | -0.007 | 0.01 | mg/L | @ |
| Sulfide | Method Blank | L | | SW9030 | WLH2S_303190801 | MB | < | 0.145 | 1 | mg/L | @ |
| Sulfide | 9303-MWS-16-01 | WG | Lake H | SW9030 | WLH2S_303190801 | N | < | -0.0096 | 1 | mg/L | @ |
| Sulfide | 9303-MW-18-01 | WG | Lake S | SW9030 | WLH2S_303190801 | N | < | -0.048 | 1 | mg/L | @ |
| Sulfide | 9303-MW-15-01 | WG | Pond D/E/F | SW9030 | WLH2S_303190801 | N | < | -0.0096 | 1 | mg/L | @ |
| Sulfide | 9303-MW-13-01 | WG | Pond A/B | SW9030 | WLH2S_303190801 | N | < | 0.067 | 1 | mg/L | @ |
| Sulfide | 9303-MW-12-02 | WG | Pond A/B | SW9030 | WLH2S_303190801 | FD | < | -0.0096 | 1 | mg/L | @ |
| Sulfide | 9303-MW-11-01 | WG | Pond A/B | SW9030 | WLH2S_303190801 | N | < | -0.0096 | 1 | mg/L | @ |
| Sulfide | 9303-SLS-06-01 A | SO | Lake S | SW9030 | WLH2S_303191201 | AD | < | 14 | 36 | mg/kg | @ |
| Sulfide | Method Blank | S | | SW9030 | WLH2S_303191201 | MB | < | 96 | 25 | mg/kg | @ |
| Sulfide | 9303-SLS-06-01 | SO | Lake S | SW9030 | WLH2S_303191201 | N | < | -35 | 36 | mg/kg | @ |
| Sulfide | Method Blank | L | | SW9030 | WLH2S_303240801 | MB | < | 0.072 | 1 | mg/L | @ |
| Sulfide | 9303-MW-17-03 | WQ | Lake H | SW9030 | WLH2S_303240801 | EB | < | 0.95 | 1 | mg/L | @ |
| Sulfide | 9303-MW-17-01 | WG | Lake H | SW9030 | WLH2S_303240801 | N | < | -0.22 | 1 | mg/L | @ |
| Sulfide | 9303-MW-14-01 | WG | Pond D/E/F | SW9030 | WLH2S_303240801 | N | < | -0.037 | 1 | mg/L | @ |
| Sulfide | 9303-MW-12-01 | WG | Pond A/B | SW9030 | WLH2S_303240801 | N | < | -0.059 | 1 | mg/L | @ |
| Sulfide | 9303-MWS-09-01 | WG | Lake S | SW9030 | WLH2S_303240801 | N | < | 0.1 | 1 | mg/L | @ |
| Thallium | Method Blank | S | | SW7841 | AAZ1__303181601 | MB | < | 0.16 | 0.5 | mg/kg | @ |
| Thallium | 9303-SLS-06-01 | SO | Lake S | SW7841 | AAZ1__303181601 | N | < | 0.0094 | 0.47 | mg/kg | @ |
| Thallium | 9303-SLS-05-01 | SO | Lake S | SW7841 | AAZ1__303181601 | N | < | 0.018 | 0.47 | mg/kg | @ |
| Thallium | Method Blank | L | | SW7841 | AAZ1__303261501 | MB | < | 0.0024 | 0.005 | mg/L | |
| Thallium | 9303-MWS-16-01 | WG | Lake H | SW7841 | AAZ1__303261501 | N | < | -0.0048 | 0.02 | mg/L | @ |
| Thallium | 9303-MW-17-03 | WQ | Lake H | SW7841 | AAZ1__303291601 | EB | < | 0.0024 | 0.005 | mg/L | |
| Thallium | 9303-MWD-05-01 | WG | Pond A/B | SW7841 | AAZ1__303291601 | N | < | -0.0013 | 0.005 | mg/L | @ |
| Thallium | 9303-MW-17-01 | WG | Lake H | SW7841 | AAZ1__303291601 | N | < | 0.0014 | 0.01 | mg/L | @ |
| Thallium | Method Blank | L | | SW7841 | AAZ1__304011003 | MB | < | 0.0032 | 0.005 | mg/L | |
| Thallium | 9303-MW-15-01 | WG | Pond D/E/F | SW7841 | AAZ1__304011003 | N | < | -0.006 | 0.02 | mg/L | @ |
| Thallium | Method Blank | S | | SW7841 | AAZ2__304211401 | MB | < | 0.08 | 0.5 | mg/kg | @ |
| Thallium | 9303-SEDE-01-01 | SE | Pond E | SW7841 | AAZ2__304211401 | N | < | 0.061 | 0.76 | mg/kg | @ |
| Thallium | 9303-SEDA-01-01 | SE | Pond A | SW7841 | AAZ2__304211401 | N | < | 0.065 | 0.65 | mg/kg | @ |
| Thallium | Method Blank | S | | SW6010 | EMJA61303171001 | MB | < | 35.6 | 10 | mg/kg | @ |
| Thallium | 9303-SLS-06-01 | SO | Lake S | SW6010 | EMJA61303171001 | N | < | -6.4 | 8.3 | mg/kg | @ |
| Thallium | 9303-SLS-05-01 | SO | Lake S | SW6010 | EMJA61303171001 | N | < | 1.4 | 9 | mg/kg | @ |
| Thallium | Method Blank | L | | SW6010 | EMJA61303231602 | MB | < | 0.112 | 0.1 | mg/L | @ |
| Thallium | 9303-MWS-16-01 | WG | Lake H | SW6010 | EMJA61303231602 | N | < | -0.063 | 0.1 | mg/L | @ |
| Thallium | Method Blank | L | | SW6010 | EMJA61303291001 | MB | < | 0.136 | 0.1 | mg/L | @ |

| analyte | samp_id | matrix | site_id | method | batch_id | sample_type | rslt_flag | rslt | rl | units | foot |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Thallium | 9303-MW-17-03 | WQ | Lake H | SW6010 | EMJA61303291001 | EB | > | 0.55 | 0.1 | mg/L | @ |
| Thallium | 9303-MW-16-01 | WG | Lake H | SW6010 | EMJA61303291001 | N | < | 0.048 | 0.1 | mg/L | @ |
| Thallium | 9303-MWS-09-01 | WG | Lake S | SW6010 | EMJA61303291001 | N | > | 0.2 | 0.1 | mg/L | @ |
| Thallium | 9303-MWD-05-01 | WG | Pond A/B | SW6010 | EMJA61303291001 | N | > | 0.21 | 0.1 | mg/L | @ |
| Thallium | 9303-MW-17-01 | WG | Lake H | SW6010 | EMJA61303291001 | N | > | 0.3 | 0.1 | mg/L | @ |
| Thallium | Method Blank | S | | SW6010 | EMJA61304061701 | MB | < | 7 | 10 | mg/kg | @ |
| Thallium | 9303-SEDE-01-01 | SE | Pond E | SW6010 | EMJA61304061701 | N | < | 1.3 | 11 | mg/kg | @ |
| Thallium | 9303-SEDA-01-01 | SE | Pond A | SW6010 | EMJA61304061701 | N | < | 0.61 | 11 | mg/kg | @ |
| Thallium | 9303-DT-06-01 | SO | Ditch - FP | SW6010 | EMJA61304061701 | N | < | 0.11 | 12 | mg/kg | @ |
| Tin | Method Blank | S | | SW6010 | EMJA61303171001 | MB | < | 1.15 | 60 | mg/kg | @ |
| Tin | 9303-SLS-06-01 | SO | Lake S | SW6010 | EMJA61303171001 | N | < | -6.1 | 50 | mg/kg | @ |
| Tin | 9303-SLS-05-01 | SO | Lake S | SW6010 | EMJA61303171001 | N | < | -0.73 | 54 | mg/kg | @ |
| Tin | Method Blank | L | | SW6010 | EMJA61303231602 | MB | < | 0.09 | 0.6 | mg/L | @ |
| Tin | 9303-MWS-16-01 | WG | Lake H | SW6010 | EMJA61303231602 | N | < | -0.15 | 0.6 | mg/L | @ |
| Tin | Method Blank | L | | SW6010 | EMJA61303291001 | MB | < | 0.12 | 0.6 | mg/L | @ |
| Tin | 9303-MW-17-03 | WQ | Lake H | SW6010 | EMJA61303291001 | EB | < | 0.19 | 0.6 | mg/L | @ |
| Tin | 9303-MWS-09-01 | WG | Lake S | SW6010 | EMJA61303291001 | N | < | 0.0052 | 0.6 | mg/L | @ |
| Tin | 9303-MWS-05-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | 0.04 | 0.6 | mg/L | @ |
| Tin | 9303-MWD-05-01 | WG | Pond A/B | SW6010 | EMJA61303291001 | N | < | 0.049 | 0.6 | mg/L | @ |
| Tin | 9303-MWD-04-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | 0.018 | 0.6 | mg/L | @ |
| Tin | 9303-MW-18-01 | WG | Lake S | SW6010 | EMJA61303291001 | N | < | -0.03 | 0.6 | mg/L | @ |
| Tin | 9303-MW-17-01 | WG | Lake H | SW6010 | EMJA61303291001 | N | < | -0.018 | 0.6 | mg/L | @ |
| Tin | 9303-MW-16-01 | WG | Lake H | SW6010 | EMJA61303291001 | N | < | 0.055 | 0.6 | mg/L | @ |
| Tin | 9303-MW-15-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | 0.073 | 0.6 | mg/L | @ |
| Tin | 9303-MW-14-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | -0.028 | 0.6 | mg/L | @ |
| Tin | 9303-MW-13-01 | WG | Pond A/B | SW6010 | EMJA61303291001 | N | < | 0.038 | 0.6 | mg/L | @ |
| Tin | 9303-MW-12-02 | WG | Pond A/B | SW6010 | EMJA61303291001 | FD | < | -0.05 | 0.6 | mg/L | @ |
| Tin | 9303-MW-12-01 | WG | Pond A/B | SW6010 | EMJA61303291001 | N | < | 0.035 | 0.6 | mg/L | @ |
| Tin | 9303-MW-11-01 | WG | Pond A/B | SW6010 | EMJA61303291001 | N | < | 0.021 | 0.6 | mg/L | @ |
| Vanadium | Method Blank | L | | SW6010 | EMJA61303231602 | MB | < | 0.048 | 0.02 | mg/L | @ |
| Vanadium | 9303-MWS-16-01 | WG | Lake H | SW6010 | EMJA61303231602 | N | < | 0.011 | 0.02 | mg/L | @ |
| Vanadium | Method Blank | L | | SW6010 | EMJA61303291001 | MB | < | 0.00284 | 0.02 | mg/L | |
| Vanadium | 9303-MW-17-03 | WQ | Lake H | SW6010 | EMJA61303291001 | EB | < | 0.01 | 0.02 | mg/L | @ |
| Vanadium | 9303-MWD-04-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | -0.0015 | 0.02 | mg/L | @ |
| Vanadium | 9303-MW-14-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | 0.0019 | 0.02 | mg/L | @ |
| Zinc | Method Blank | L | | SW6010 | EMJA61303291001 | MB | < | 0.0064 | 0.02 | mg/L | @ |
| Zinc | 9303-MW-17-03 | WQ | Lake H | SW6010 | EMJA61303291001 | EB | < | 0.0068 | 0.02 | mg/L | @ |
| Zinc | 9303-MWS-05-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | 0.0007 | 0.02 | mg/L | @ |
| Zinc | 9303-MW-14-01 | WG | Pond D/E/F | SW6010 | EMJA61303291001 | N | < | 0.0054 | 0.02 | mg/L | @ |
| Zinc | 9303-MW-12-02 | WG | Pond A/B | SW6010 | EMJA61303291001 | FD | < | 0.0021 | 0.02 | mg/L | @ |
| Zinc | 9303-MW-12-01 | WG | Pond A/B | SW6010 | EMJA61303291001 | N | < | -0.0049 | 0.02 | mg/L | @ |
| Zinc | 9303-MW-11-01 | WG | Pond A/B | SW6010 | EMJA61303291001 | N | < | 0.0037 | 0.02 | mg/L | @ |
| alpha-BHC | 9303-WE-01-03 | WS | Pond E | SW8080 | CHGC6_303221201 | EB | > | 0.00044 | 9.60E-06 | mg/L | X |
| alpha-BHC | 9303-WE-01-02 | WS | Pond E | SW8080 | CHGC6_303221201 | FD | > | 0.00001 | 9.50E-06 | mg/L | @ |
| alpha-Chlorda | Method Blank | L | | SW8080 | CHGC5_304141201 | MB | < | 2.25E-05 | 0.00001 | mg/L | JX |
| alpha-Chlorda | 9304-MW-08-01 | WG | Pond A/B | SW8080 | CHGC5_304141201 | N | < | 2.80E-06 | 9.50E-06 | mg/L | JX |
| alpha-Chlorda | 9304-MW-03-01 | WG | Pond D/E/F | SW8080 | CHGC5_304141201 | N | < | 1.10E-06 | 9.50E-06 | mg/L | JX |
| beta-BHC | Method Blank | L | | SW8080 | CHGC5_304161201 | MB | > | 0.000055 | 0.00001 | mg/L | X@ |
| beta-BHC | 9304-MW-15-02 | WG | Pond D/E/F | SW8080 | CHGC5_304161201 | FD | > | 0.000019 | 9.50E-06 | mg/L | X@ |

Appendix B: Samples Eliminated Based on Blank Data

| analyte | samp_id | matrix | site_id | method | batch_id | sample_type | rslt_flag | rslt | rl | units | f |
|---|---|---|---|---|---|---|---|---|---|---|---|
| beta-BHC | 9304-MW-15-01 | WG | Pond D/E/F | SW8080 | CHGC5_304161201 | N | > | 0.000018 | 9.50E-06 | mg/L | X@ |
| beta-BHC | 9304-MW-14-02 | WG | Pond D/E/F | SW8080 | CHGC5_304161201 | FD | > | 0.00002 | 9.50E-06 | mg/L | X@ |
| beta-BHC | 9304-MW-14-01 | WG | Pond D/E/F | SW8080 | CHGC5_304161201 | N | > | 0.00002 | 9.50E-06 | mg/L | X@ |
| beta-BHC | 9304-MW-13-01 | WG | Pond A/B | SW8080 | CHGC5_304161201 | N | > | 0.00003 | 9.50E-06 | mg/L | X@ |
| delta-BHC | 9303-MW-17-01 | WG | Lake H | SW8080 | CHGC1_303251201 | N | > | 0.000021 | 9.50E-06 | mg/L | @ |
| delta-BHC | 9303-WE-01-03 | WS | Pond E | SW8080 | CHGC6_303221201 | EB | > | 0.00009 | 9.60E-06 | mg/L | X@ |
| delta-BHC | 9303-WF-01-01 | WS | Pond F | SW8080 | CHGC6_303221201 | N | > | 0.000029 | 9.50E-06 | mg/L | X@ |

Column Headings:

analyte - Contaminant

samp_id - Identification No. associated with that sample

site_id - Site from which sample was collected

matrix - Matrix from which sample was collected

method - Analytical method

batch_id - Identification No. associated with analytical batch of samples

samp_type - sample type

rslt_flag - Analytical result flag

rslt - Sample concentration result

rl - Sample reporting limit

units - Sample units

foot - Sample foot note

top_dpth - Top sample depth

bot_dpth - Bottom sample depth

# APPENDIX C

# OPERATIONS INFORMATION

# JOB SAFETY ANALYSIS
# VEHICLE OPERATIONS

| JOB STEPS - Vehicle Operations | |
|---|---|
| **JOB HAZARDS** | **CONTROL/SAFEGUARDS** |
| 1. Employee run over or hit by moving vehicle | 1. a. back up signals on equipment;<br>b. traffic safety vest for all field personnel;<br>c. foot traffic restricted in areas of operation;<br>d. establish standard hand signals for laborers assisting in vehicle operations.<br>e. turn off engine when leaving the vehicle. |
| 2. Physical hazards;<br>a. hit in head<br>b. foreign body in eye<br>c. foot injury | 2. a. hard hat;<br>b. safety glasses<br>c. steel toe boots |
| 3. Overhead utilities/overhead obstacles | 3. Minimum 20' distance, 10' distance if insulated |

# JOB SAFETY ANALYSIS
# SOIL GAS SURVEY

| JOB STEPS - Soil gas survey using Geo-Probe Drill Rig | |
|---|---|
| **JOB HAZARDS** | **CONTROL/SAFEGUARDS** |
| 1. Noise levels exceeding the OSHA personal exposure limit (PEL). | 1. Utilize earmuffs and/or ear plugs to effectively reduce noise levels. |
| 2. Vapors from suspect contaminants. | 2. a. Review hazard information/MSDS for the contaminants suspected to be on-site;<br>b. Perform required air monitoring;<br>c. Redirect exhaust fumes; if action levels are approached;<br>d. Reposition to upwind location.<br>e. Shut down Geo-Probe Unit if action levels are exceeded; and<br>f. No smoking in work zone. |
| 3. Underground pipelines and utility lines can be ruptured or damaged during active drilling operations. | 3. a. Have a dig-safe search conducted;<br>b. Obtain as built plans or blueprints to identify underground utilities/obstacles; and<br>c. Hand dig to 5' depth in questionable areas or suspect utilities. |
| 4. Moving parts such as the sampling rod on the unit may catch clothing. | 4. a. Secure loose clothing;<br>b. Do not wear reflective vest;<br>c. Check "kill switch" daily; and<br>d. Keep hands free from moving parts. |
| 5. High pressure hydraulic lines and air lines used on Geo-Probe Unit are hazardous when they are in need of repair or improperly assembled. | 5. All high pressure lines should have preventative maintenance check regularly in accordance with manufacturer's recommendations. |

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## DAILY AIR MONITORING INSTRUMENT CALIBRATION & REFERENCE STANDARD CHECKS

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## DAILY AIR MONITORING INSTRUMENT CALIBRATION & REFERENCE STANDARD CHECKS

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COMMENTS:

## DAILY AIR MONITORING INSTRUMENT CALIBRATION & REFERENCE STANDARD CHECKS

**Project/Task Name:** **Project/Task Numbers:**

**Form Completed By:** (print name) (signature) (date)

| DATE | TIME | AIR MONITORING INSTRUMENT | | | BATTERY CHECK | | REFERENCE (SPAN) GAS | | UNADJUSTED INSTRUMENT READING | CALIBRATION | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | TYPE | LAMP eV | SERIAL # | OK | LOW | TYPE | CONCENTRATION | | OK | ADJUSTMENT REQ'D |
| | | | | | | | | | | | |
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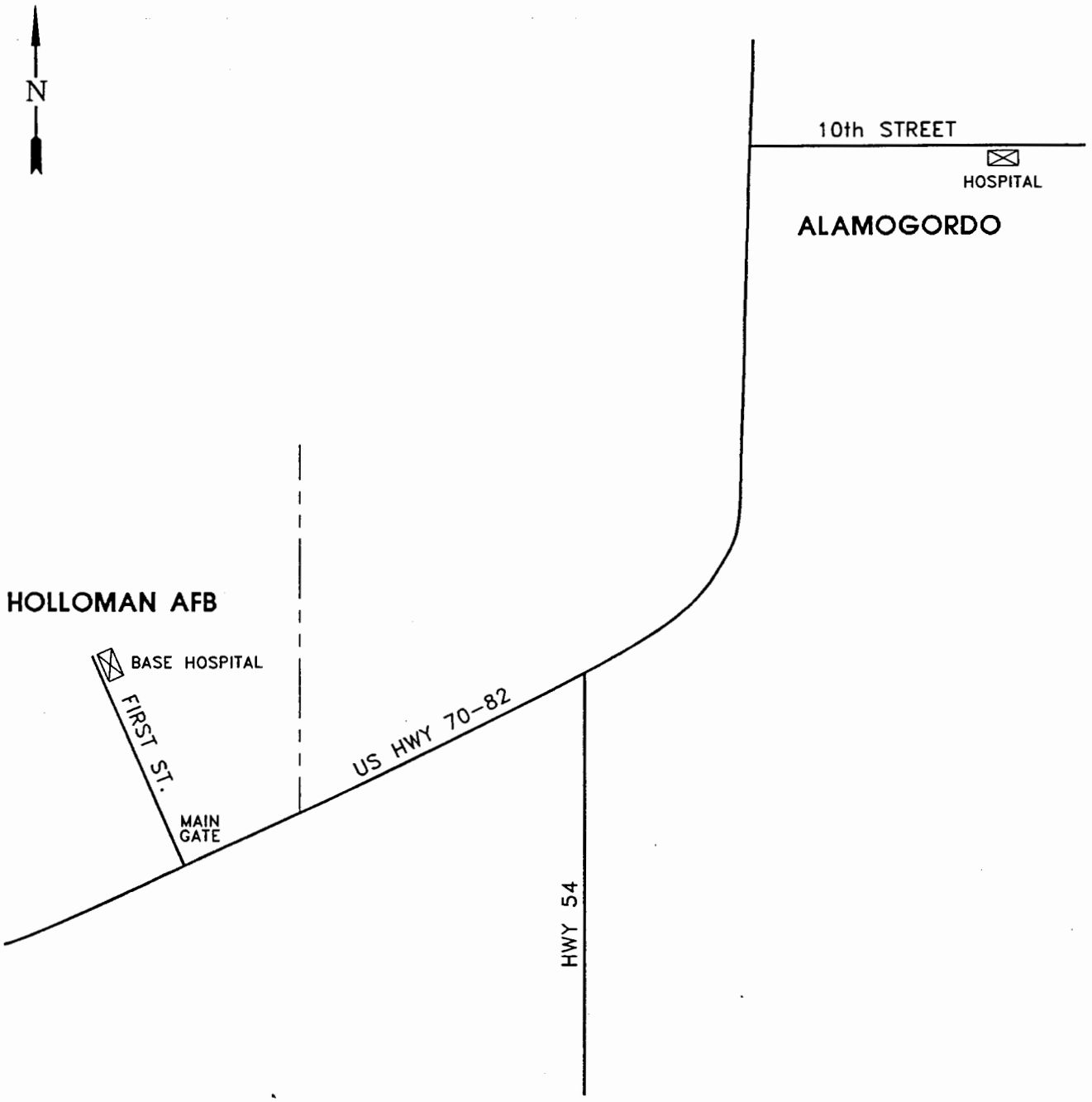
COMMENTS:

# APPENDIX D

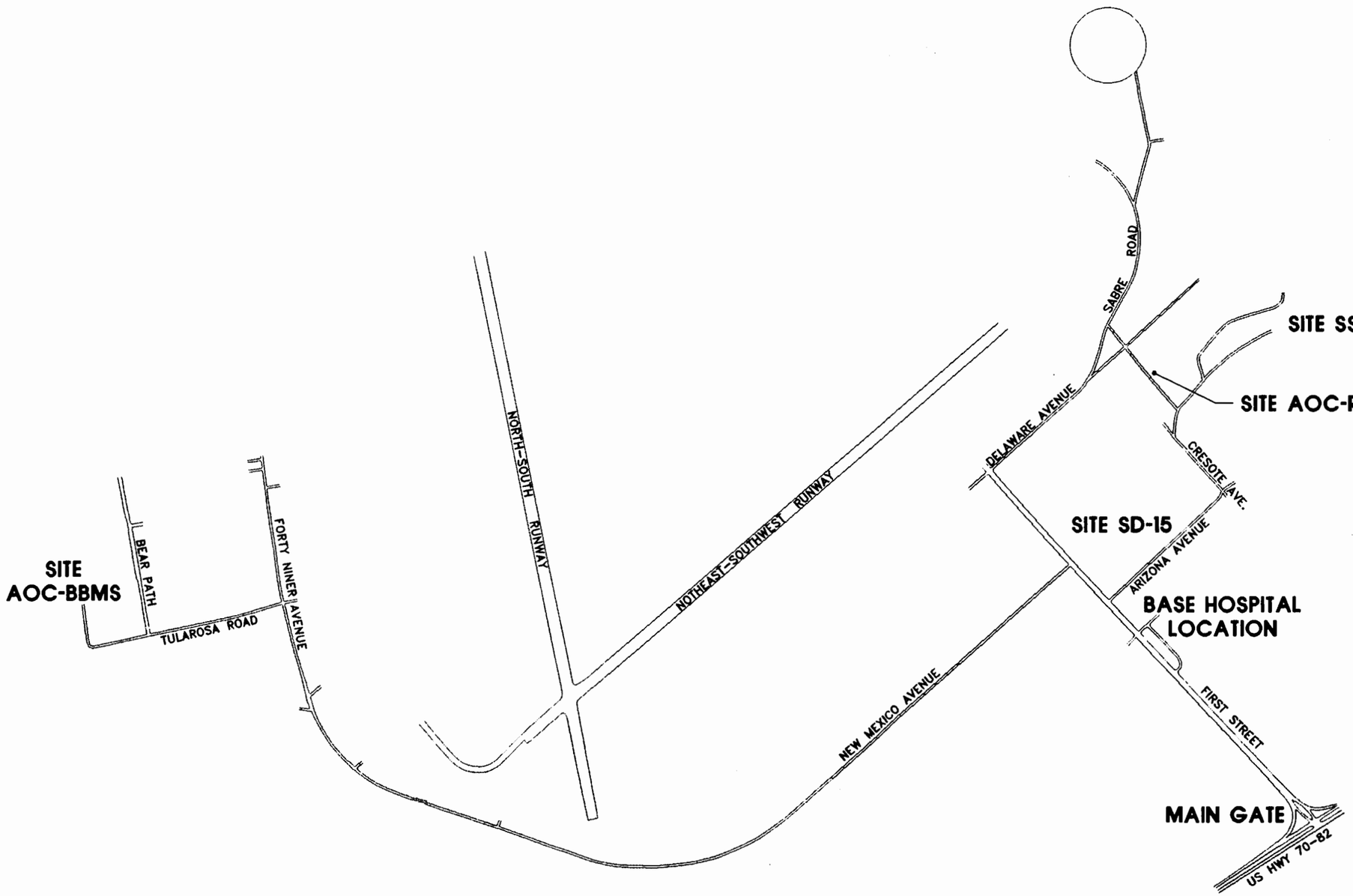
# MAPS AND FIGURES




NOT TO SCALE

# HOSPITAL LOCATION MAP

| | | | | | |
|---|---|---|---|---|---|
| CLIENT: HOLLOMAN AIR FORCE BASE | FILE: 2201-SL (1:1) | | PROJECT NO.: 83001-2201 | PM | PE/RG |
| | REV. | | | | |
| LOCATION: ALAMOGORDO, NEW MEXICO | DES. KG | DET. AJK | DATE: 12/9/94 | FIGURE: 1 | |




0 FEET 1,500
SCALE

# GENERAL SITE PLAN

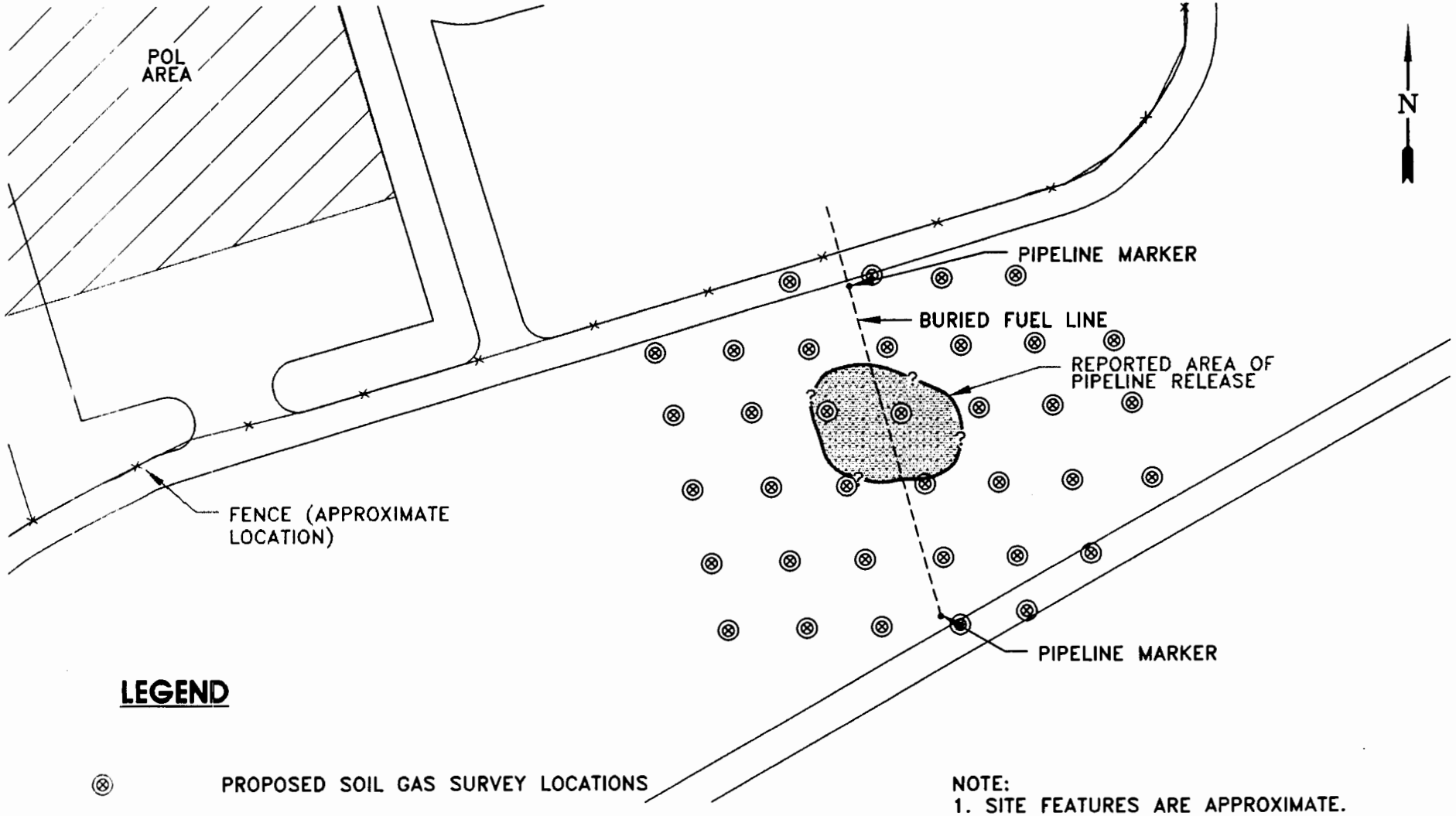
CLIENT:
HOLLOMAN AIR FORCE BASE
ALAMOGORDO, NEW MEXICO

LOCATION:
HOLLOMAN AFB
ALAMOGORDO, NEW MEXICO

| FILE: | PROJECT NO.: |
|---|---|
| 2201SMBA (1:1500) | 83001-2201 |

REV.:

| DES.: | DET.: | DATE: | FIGURE: |
|---|---|---|---|
| KG | AJK | 12/9/94 | 2 |
| PM: | | PE/RG: | |

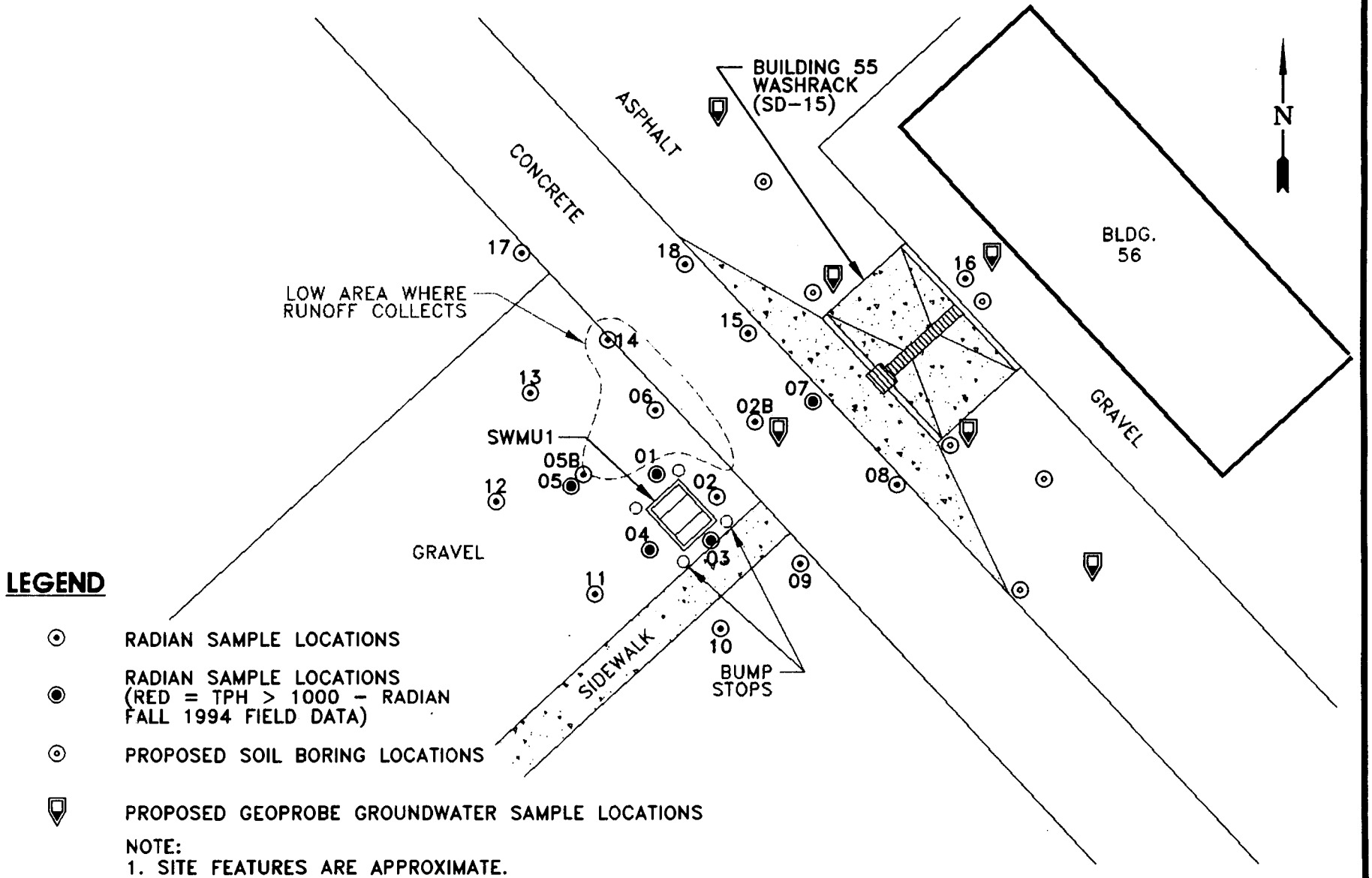



**LEGEND**

⊗ PROPOSED SOIL GAS SURVEY LOCATIONS

NOTE:
1. SITE FEATURES ARE APPROXIMATE.

| | | | | | | |
|---|---|---|---|---|---|---|
| PROJECT: SITE INVESTIGATION WAD NO. 3, 5, 9 | 0 FEET 100 SCALE | CLIENT: HOLLOMAN AIR FORCE BASE ALAMOGORDO, NEW MEXICO | | | **PROPOSED SAMPLE LOCATIONS** | |
| FILE: SS-06SM (1:100) | PROJECT NO.: 83001-2201 | LOCATION: SITE SS-06 JP-4 FUEL LINE SPILL NO. 1 | | | PM: | PE/RG: | FIGURE: 2-1 |
| REV.: | | DES.: KG | DET.: AJK | DATE: 12/23/94 | | |

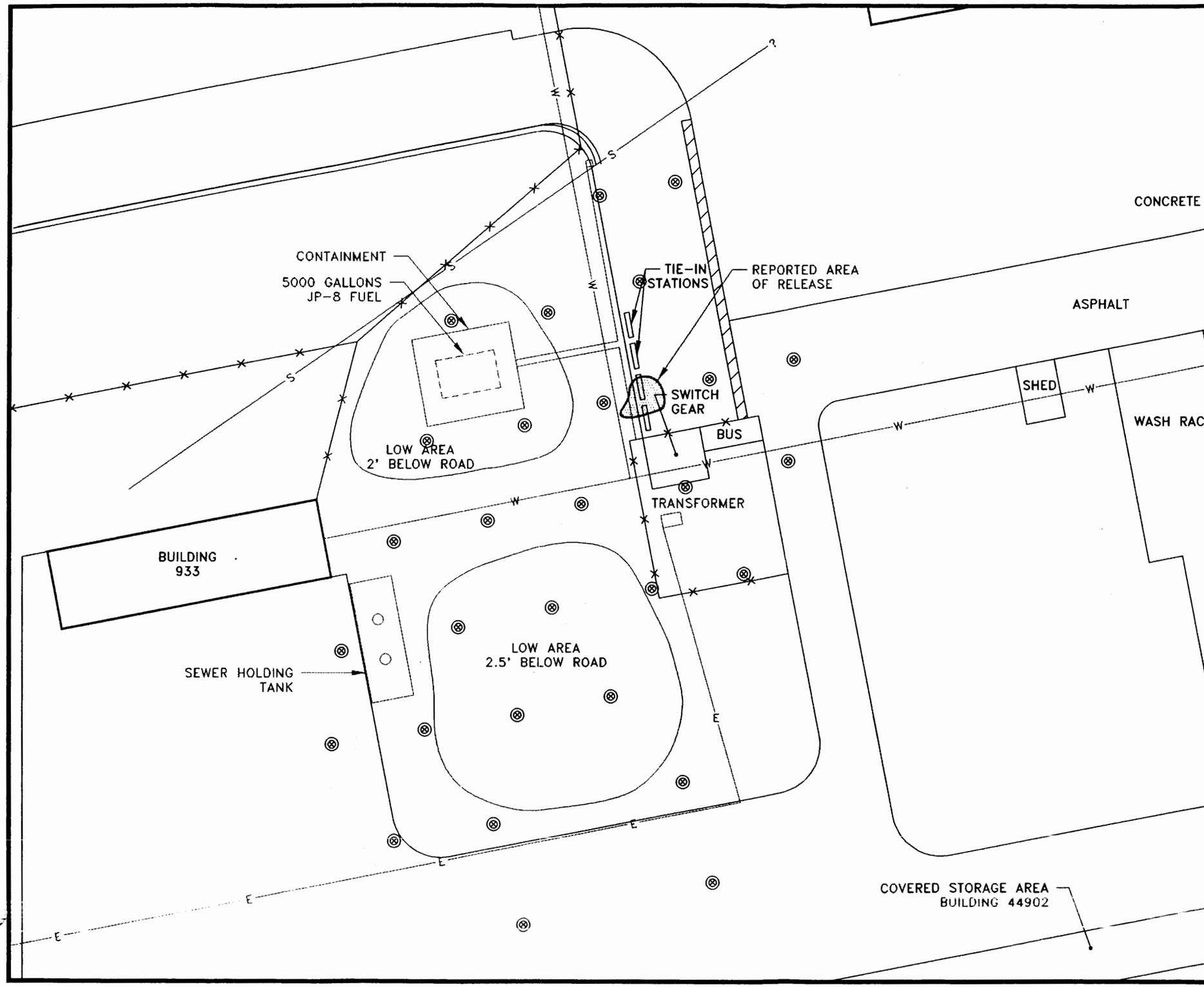



**LEGEND**

- RADIAN SAMPLE LOCATIONS
- RADIAN SAMPLE LOCATIONS (RED = TPH > 1000 – RADIAN FALL 1994 FIELD DATA)
- PROPOSED SOIL BORING LOCATIONS
- PROPOSED GEOPROBE GROUNDWATER SAMPLE LOCATIONS

NOTE:
1. SITE FEATURES ARE APPROXIMATE.

| | | | | | | |
|---|---|---|---|---|---|---|
| PROJECT: SITE INVESTIGATION | 0 FEET 30 SCALE | CLIENT: HOLLOMAN AIR FORCE BASE ALAMOGORDO, NEW MEXICO | | | **PROPOSED SAMPLE LOCATIONS** | |
| FILE: SD-15SM (1:30) | PROJECT NO.: 83001-2201 | LOCATION: SITE SD-15 REFRIGERATOR/HEAT SHOP WASHRACK | | | PM: | PE/RG: | FIGURE: **2-2** |
| REV.: | | DES.: KG | DET.: AJK | DATE: 12/15/94 | | | |




**LEGEND**

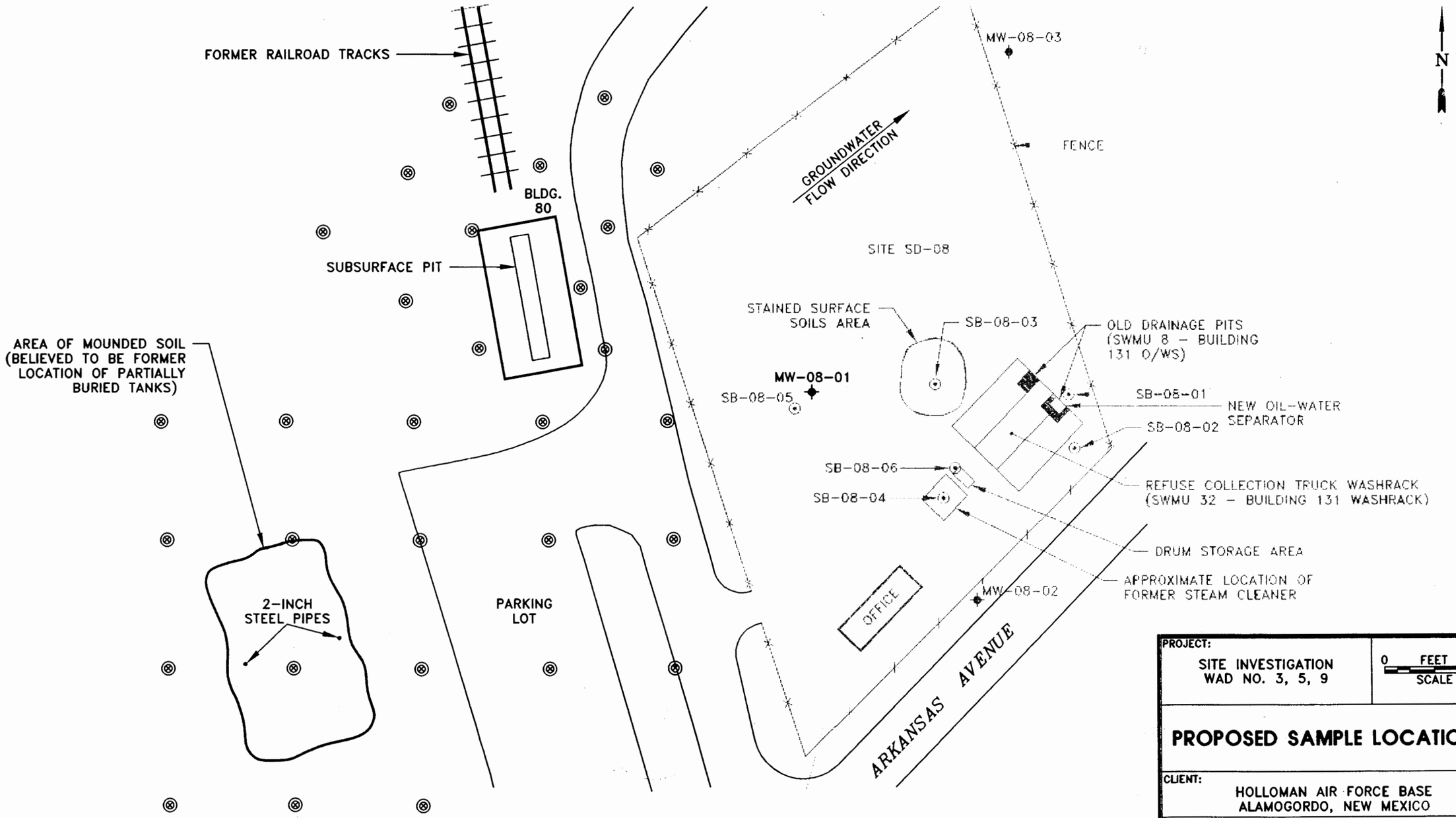
| | |
|---|---|
| S | SEWER LINE |
| W | WATER LINE |
| E | ELECTRICAL LINE |
| ⊗ | PROPOSED SOIL GAS SURVEY LOCATIONS |

NOTE:
1. SITE FEATURES ARE APPROXIMATE.

| | |
|---|---|
| PROJECT: SITE INVESTIGATION | 0 FEET 50 SCALE |

# PROPOSED SAMPLE LOCATIONS

| | | | |
|---|---|---|---|
| CLIENT: HOLLOMAN AIR FORCE BASE ALAMOGORDO, NEW MEXICO | | | |
| LOCATION: SITE AOC-BBMS BARE BASE MOBILITY SQUADRON/ GENERATOR RUN-UP AREA | | | |
| FILE: AOC-BBMS (1:50) | | PROJECT NO.: 83001-2201 | |
| REV.: | | | |
| DES.: KG | DET.: AJK | DATE: 12/23/94 | FIGURE: 2-3 |
| PM: | | PE/RG: | |




## LEGEND

- MONITORING WELL LOCATIONS
- MONITORING WELL LOCATION (RED = DETECTABLE CONCENTRATIONS OF BENZENE AND ETHYLBENZENE)
- SOIL BORING LOCATIONS
- PROPOSED SOIL GAS SURVEY LOCATIONS

NOTE:
1. SITE FEATURES ARE APPROXIMATE.

| | |
|---|---|
| PROJECT: SITE INVESTIGATION WAD NO. 3, 5, 9 | 0 FEET 40 SCALE |
| **PROPOSED SAMPLE LOCATIONS** | |
| CLIENT: HOLLOMAN AIR FORCE BASE ALAMOGORDO, NEW MEXICO | |
| LOCATION: SITE AOC-RR RAILROAD, BUILDING 80 | |
| FILE: AOC-RRSM (1:40) | PROJECT NO.: 83001-2201 |
| REV.: | |
| DES.: KG / DET.: AJK / DATE: 12/15/94 | FIGURE: 2-4 |
| PM: / PE/RG: | |