

**Compliance Restoration Program – Western Region 1
Final Preliminary Assessment/Site Investigation
Work Plan**

**162nd Combat Communications Group
North Highlands Air National Guard
North Highlands, California**

March 2013



**NGB/A7OR
Joint Base Andrews, Maryland**

**Compliance Restoration Program – Western Region 1
Final Preliminary Assessment/Site Investigation
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**162nd Combat Communications Group
North Highlands Air National Guard
North Highlands, California**

March 2013

**Prepared For:
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LIST OF ACRONYMS

| <u>Acronym</u> | <u>Definition</u> |
|----------------|---|
| °F | Degrees Fahrenheit |
| ANG | Air National Guard |
| AOC | Area of concern |
| ASTM | American Society for Testing and Materials |
| BB&E | BB&E Consulting Engineers & Professionals |
| bgs | Below ground surface |
| CCG | Combat Communications Group |
| CMSgt. | Chief Master Sergeant |
| CRP | Compliance Restoration Program |
| EBS | Environmental Baseline Survey |
| ECATS | Environmental Consulting and Training Services |
| EM | Environmental Manager |
| EPA | United States Environmental Protection Agency |
| ERM | ERM-West, Inc. |
| ERPIMS | Environmental Restoration Program Information Management System |
| IDW | Investigation-derived waste |
| mL | Milliliter |
| NFA | No Further Action |
| NGB | National Guard Bureau |
| OWS | Oil/water separator |
| PA | Preliminary assessment |
| PAH | Polycyclic aromatic hydrocarbon |
| PBC | Performance-based contracting |
| PID | Photoionization detector |
| QA | Quality assurance |
| QAPP | Quality Assurance Project Plan |
| QC | Quality control |
| QCP | Quality Control Plan |
| SI | Site investigation |
| TPH-D | Diesel-range total petroleum hydrocarbons |
| TPH-G | Gasoline-range total petroleum hydrocarbons |
| TPH-MO | Motor oil-range total petroleum hydrocarbons |

| | |
|-----|---------------------------|
| UST | Underground storage tank |
| VOC | Volatile organic compound |

EXECUTIVE SUMMARY

This *Final Preliminary Assessment/Site Investigation (PA/SI) Work Plan* (Work Plan) has been prepared for the 162nd Combat Communications Group (CCG) at the North Highlands Air National Guard (ANG) Station in North Highlands, California. This Work Plan provides a summary of the PA and describes the SI that will be conducted as part of Western Region 1 of the ANG's Compliance Restoration Program. The planned SI at the 162nd CCG will encompass the following area of concern (AOC):

- Former Hydraulic Lift (TU003).

The project objectives are to determine the presence or absence of contamination and either: (1) obtain a No Further Action (NFA) decision for the AOC at the North Highlands ANG Station, with regulatory concurrence from the Department of Toxic Substances Control and the California Regional Water Quality Control Board – Central Valley, or (2) identify the data quality objectives required for conducting a follow-on remedial investigation at the AOC if it does not meet the criteria for NFA.

The scope of work for the project includes: conducting PA activities to obtain additional information, such as as-built and shop drawings, and to identify any changes (i.e., physical, equipment or mission changes, leaks, spills) at the AOC; and performing SI activities and using the resulting information to make recommendations supporting NFA or additional remedial investigation activities. Note that the PA has already been completed for the project, and a summary of findings is included in this Work Plan.

SECTION 1.0

INTRODUCTION

This *Draft Final Preliminary Assessment/Site Investigation (PA/SI) Work Plan* (Work Plan) has been prepared for the 162nd Combat Communications Group (CCG) at the North Highlands Air National Guard (ANG) Station in North Highlands, California, and was completed under Contract DAHA92-01-D-0005, Delivery Order 0154, between ERM-West, Inc. (ERM) and the National Guard Bureau (NGB), Department of the Army and Air Force. The PA/SI will be conducted as part of Western Region 1 of the ANG's Compliance Restoration Program (CRP).

1.1 Project Objectives and Scope

This Work Plan provides a summary of the PA and a description of the planned SI at the 162nd CCG at the following area of concern (AOC):

- Former Hydraulic Lift (TU003).

The project objectives are to determine the presence or absence of contamination, and either: (1) obtain a No Further Action (NFA) decision for the AOC at the North Highlands ANG Station, with regulatory concurrence from the Department of Toxic Substances Control and the California Regional Water Quality Control Board – Central Valley Region; or (2) identify the data quality objectives required for conducting a follow-on remedial investigation at the AOC if it does not meet the criteria for NFA.

The scope of work for the project includes conducting PA/SI activities and using the resulting information to make recommendations supporting NFA or additional remedial investigation activities.

1.2 Site Description

The North Highlands ANG Station is located in North Highlands, California ([Figure 1-1](#)). The ANG Station is the home of the 162nd CCG of the California ANG and occupies approximately 8 acres 6 miles northeast

of downtown Sacramento, California, adjacent to the former McClellan Air Force Base. The ANG Station layout is shown in [Figure 1-2](#). The property is currently under a 30-year lease agreement with the City of Sacramento, expiring in June 2022. The property has been occupied by the 162nd CCG since 1950, when the ANG Station was constructed on land formerly used for agriculture.

Operations at the ANG Station include ground vehicle; aerospace ground equipment; and communication maintenance, and administrative activities. Wastes generated by these operations include waste oils, fuels, spent batteries, battery acid, paint thinners, and solvents.

1.3 Previous Investigation Activities

This section describes the prior investigation activities performed at the ANG Station.

1.3.1 2005 Environmental Baseline Survey

An Environmental Baseline Survey (EBS) was performed in 2005 to comply with City of Sacramento lease renewal agreements (Environmental Consulting and Training Services [ECATS] 2005). The EBS report involved review of available documents, interviews with ANG Station personnel, and visual inspection of the property and surrounding areas. The EBS report included discussions of the Old Aerospace Ground Equipment Area (Building 1) and the Area behind the Vehicle Maintenance (Building 4), but did not include the Former Hydraulic Lift Area.

The EBS concluded no data gaps existed and identified buildings that potentially contain asbestos and lead-based paint. The EBS also recommended that the ANG maintain communication with neighboring McClellan Air Force Base regarding any changes to the ongoing environmental remediation program at that facility.

1.3.2 2009 BB&E Trip Report and One Clean Program

The NGB and their consultant, BB&E Consulting Engineers & Professionals (BB&E), performed a site visit and records review for the ANG Station on 10 February 2009 as part of the CRP. The findings of this review were documented in the *PA/SI Trip Report – North Highlands ANG Station, North Highlands, California* (Trip Report)

(BB&E 2009). The Trip Report identified three AOCs. These AOCs were subsequently investigated during a preliminary investigation in 2009 conducted as part of the ANG's One Clean Program.

The objectives of the One Clean Program were to:

- Determine the presence or absence of environmental contamination at identified AOCs;
- Document the results of the investigation activities; and
- Provide recommendations for future activities to be conducted at the AOCs.

The field activities, screening levels, and results of the One Clean Program investigation are described in the *Final Site Investigation Report – One Clean Program, Air National Guard Western Region Facilities* (One Clean SI Report) (ERM 2009). Summaries of sampling results from the 2009 One Clean Program are provided in [Tables 1-1](#) through [1-3](#).

The One Clean SI Report summarized the findings for the three AOCs as follows:

- Former Septic Field and Drainage Basin – A septic field was used to dispose sanitary waste from the vehicle maintenance shop and vehicle wash rack from the 1950s through the mid- to late 1970s. The system consisted of a septic tank and clay tile pipes with open joints leading to a drainage basin lined with creosote-treated wood. The soil at the Former Septic Field and Drainage Basin was analyzed for volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), diesel-range total petroleum hydrocarbons (TPH-D), and gasoline-range total petroleum hydrocarbons (TPH-G), with no results greater than practical quantitation limits.
- Former Oil/Water Separator (OWS) at Building 9 – An OWS at Building 9 was upgraded in 1981, but no investigation had been completed in the area to evaluate potential impacts from the previous OWS. The soil at the Former OWS was analyzed for VOCs, PAHs, TPH-G, and TPH-D, with no results greater than practical quantitation limits.
- Former Hydraulic Lift at Building 4 – A hydraulic lift was removed from the vehicle maintenance bay at the facility, although no documentation of the removal was available. The soil at the former Hydraulic Lift at Building 4, analyzed for TPH-D and motor oil-range total petroleum hydrocarbons (TPH-MO), was identified as exhibiting

the potential for the presence and migration of TPH-MO. Sampling locations at this AOC are shown in [Figure 1-3](#). The range of hydrocarbons analyzed primarily includes motor oils and waste oils; therefore, the detections were categorized as TPH-MO. TPH-MO was detected at a concentration of 18 milligrams per kilogram in the sample collected from boring NH-HL1-1 at 1 foot below ground surface (bgs). No other analytes were detected at concentrations greater than practical quantitation limits.

Based on the analytical results, NFA was recommended for the Former Septic Field and Drainage Basin and the Former OWS at Building 9. Because of petroleum hydrocarbon impacts in shallow soil, additional investigation was recommended at the Former Hydraulic Lift.

1.4 Work Plan Structure

This Work Plan contains the following sections and appendices:

- [Section 1.0](#) - Introduction;
- [Section 2.0](#) - Project Management Approach;
- [Section 3.0](#) – Environmental Setting;
- [Section 4.0](#) – Investigative Approach;
- [Section 5.0](#) – Field Investigation Procedures;
- [Section 6.0](#) – Sample Collection Procedures;
- [Section 7.0](#) – Project Schedule and Deliverables;
- [Section 8.0](#) – References;
- [Appendix A](#) – Quality Assurance Project Plan (QAPP);
- [Appendix B](#) – Site-Specific Health and Safety Plan;
- [Appendix C](#) – Field Forms;
- [Appendix D](#) – Sampling Procedures; and
- [Appendix E](#) – Historical Data Records.

SECTION 2.0

PROJECT MANAGEMENT APPROACH

The following subsections describe the project personnel, duties, and responsibilities; project procedures; quality management; and subcontractor management.

2.1 Project Personnel, Duties, and Responsibilities

The following ERM personnel will be involved in the PA/SI activities at the 162nd CCG:

Mark Bradford, R.E.A.

Principal-in-Charge (ERM Sacramento, California)

Mr. Bradford will be responsible for overall program management. Mr. Bradford will be in charge of submittal review and approval, contract administration, and subcontractor approval.

Geof Moss, R.G.

Program Director and Quality Assurance/Quality Control (QA/QC) Manager (ERM Scottsdale, Arizona)

As the ERM Program Director and QA/QC Manager for the ANG, Mr. Moss will work directly with our Project Manager to ensure that all work is performed according to the ANG's protocol and performance-based contracting (PBC) procedures. He will assist Mr. Arnold and the entire project team with subcontractor selection and pre-approval; contracting and invoicing; schedule and budget management; and document preparation, review, and quality control. As the QA/QC Manager, Mr. Moss will be responsible for ensuring that the ANG receives high-quality work products and that data collection is done in accordance with all applicable ANG, federal, and state standards.

Mike Arnold, R.G.

Project Manager (ERM Seattle, Washington)

Mr. Arnold is a Registered Hydrogeologist based in Seattle, Washington. Mr. Arnold was previously responsible for managing the ANG One Clean

Program work performed at installations in Washington, Oregon, and Hawaii. He will work directly with our Program Manager and field staff to ensure that all work is performed according to ANG protocol and PBC procedures. He will maintain overall responsibility for QA/QC, as well as the management of scope, schedule, and budget. He will interface directly with the NGB/A7OR Program Manager, Mr. Mark Dickerson.

Brian Magee, P.G.

Program Support (ERM Sacramento, California)

Mr. Magee is a registered Professional Geologist in the State of California. He will provide program support for the PA/SI project at the 162nd CCG.

Karyn Wong

Site Manager (ERM Sacramento, California)

Ms. Wong will serve as Site Manager and maintain overall responsibility for QA/QC, as well as the management of scope, schedule, and budget for the PA/SI project at the 162nd CCG. She will work directly with our Project Manager, Program Director, and field staff to ensure that all work is performed according to ANG protocol and PBC procedures. She will interface directly with ERM local staff, the ANG Program Manager, and installation Environmental Manager (EM) for the 162nd CCG.

Jorge Acevedo

Geographic Information System Support (ERM Sacramento, California)

Mr. Acevedo is ERM's expert on the ANG Geobase policy. He combines the site data with Geographic Information System-based graphics to produce figures for reports and presentations. He will maintain a Geographic Information System-based database and all related functions, such as preparing Spatial Data Standard for Facilities, Infrastructure, and Environment-compliant figures and three-dimensional data visualization using Environmental Visualization System software. Mr. Acevedo will also maintain and update the site database and ensure compliance with geospatial data deliverables policies.

Elsie King

Technical Support (ERM Anchorage, Alaska)

Ms. King is ERM's expert on Environmental Restoration Program Information Management System (ERPIMS) deliverables and has been certified through training at Brooks Air Force Base in San Antonio, Texas. Ms. King will manage the ERPIMS data deliverables to the Air Force Center for Engineering and the Environment database, and ensure

compliance with the NGB policy memorandum on ERPIMS data deliverables.

2.2 Project Procedures

The PA/SI will be staffed by ERM personnel and their selected subcontractors. ERM will follow the procedures presented in the *Final Quality Control Plan* (QCP) for the Western Region 1 CRP (ERM 2012), *ANG Investigation Guidance* (ANG 2009), and this Work Plan, including the QAPP and *Site-Specific Health and Safety Plan* provided in [Appendices A](#) and [B](#), respectively.

ERM will establish and maintain communication with the ANG Program Manager (Mr. Mark Dickerson), the ANG oversight contractor BB&E (Mr. Aaron Etnyre), and the 162nd CCG EM (Lt. Col. Gary Aten). Field activities—such as soil boring and soil vapor point installation, on-site storage of materials and equipment, and site access for subcontractors—will also be coordinated with the 162nd CCG EM.

2.3 Quality Management

Project activities will be performed in accordance with the QCP. The QCP is designed to ensure that work performed under this project meets all necessary QA/QC requirements. The QA/QC program includes procedures that ensure that project activities are accomplished in a timely, controlled, and quality manner. Persons performing QA/QC activities will have well-defined responsibilities and authority to enforce quality requirements; to identify, initiate, recommend, and provide solutions to problems; and to verify solution effectiveness.

2.4 Subcontractor Management

ERM will direct and control subcontractor work completed for the PA/SI. The ERM Project Manager will develop a firm, fixed scope of work for each subcontractor that is assigned to the project, and establish a schedule to complete each task. Subcontractors will be included in team briefings issued at the start of the project and any time that clarification to scope, schedule, or budget is required. ERM manages critical work paths to ensure sufficient time to complete tasks, with contingencies to address any subcontractor delays. Accordingly, ERM carefully selects subcontractors

and aggressively monitors their work. ERM's approach to subcontractor management includes:

- Maintaining a large pool of qualified subcontractors;
- Executing master service agreements with tight contract performance language;
- Proactively managing project scope, schedule, and cost; and
- Ensuring quality standards are met (e.g., technical, safety, QA/QC).

Subcontractors will be responsible for conducting the following tasks under ERM's direction:

- Installing soil borings and soil vapor wells;
- Abandoning soil borings and soil vapor wells;
- Collecting soil, and soil vapor samples and submitting the samples for laboratory analysis;
- Conducting subsurface clearance of utilities;
- Transporting investigation-derived waste (IDW) generated during field activities to appropriate waste disposal facilities;
- Surveying all soil boring and soil vapor well locations; and
- Decontaminating all re-useable drilling and sampling equipment.

SECTION 3.0

ENVIRONMENTAL SETTING**3.1 Climate**

The climate in North Highlands, California, is defined as Mediterranean and is influenced by mild Pacific air. Summers tend to be hot and winters are cool (ECATS 2005). The average daily high temperature in North Highlands is 73.5 degrees Fahrenheit (°F). The highest afternoon temperatures occur from July to September and range from high 80s to occasionally above 100 °F. The average daily low temperature occurs between December and February in the high 30s °F. The average annual precipitation is 17.5 inches, with a majority of rainfall occurring between November and March.

3.2 Geology

The North Highlands ANG Station is in the northern third of the Central Valley of California, the Sacramento Valley—a region that is generally flat. The Central Valley is a large, northwesterly trending, asymmetrical, structural trough that has been filled with as much as 10 vertical miles of sediments. Sediments in the trough range in age from Jurassic to Holocene and include both marine and continental rock and deposits. Granitic and metamorphic rocks crop out along most of the eastern flank while marine pre-Tertiary rocks crop along most of the western flank. Post-Eocene continental rocks and deposits constitute a heterogeneous mixture that contains most of the fresh groundwater in the Central Valley and crop out over virtually the whole valley. These continental deposits also overlie or contain saline water at depth.

The subsurface geology of the property is described as light clay loam with slightly higher acid than surface soil. The rock stratigraphic unit associated with the ANG Station is Cenozoic era, Quaternary system, and Quaternary series. The geologic age identification category is stratified sequence (ECATS 2005).

3.3 Soil

The United States Department of Agriculture Natural Resources Conservation Service records for the area indicate that the ANG Station is underlain by approximately 3,000 feet of Pliocene to Holocene continental rocks and deposits that are a heterogeneous combination of poorly sorted clay, silt sand, and gravel.

The surface soil averages 6 inches in depth and is light brown to reddish-brown, strongly to medium acid sandy loam that dries out moderately hard. The upper subsoil extends to depths of 12 to 30 inches bgs and is a light clay loam with slightly higher acid than the surface soil. The deeper subsoil is reddish-brown or brown, compact clay that becomes more gray/grayish and then turns olive gray immediately above the impervious hard pan layer, which varies in depth from 15 to 42 inches bgs. The soil component is San Joaquin, and the soil surface texture is silt loam. The hydrologic group is Class D, with very slow infiltration rates, and soils are clayey, have a high water table, or are shallow to an impervious layer. The soil drainage class is moderately well-drained soils that have a layer of low hydraulic conductivity, are wet state high in profile, and maintain a depth to the water table of 3 to 6 feet. Depth-to-bedrock is greater than 60 feet (ECATS 2005).

3.4 Surface Water Hydrogeology

According to United States Geological Survey topographic maps, no open water is located at the North Highlands ANG Station. The ANG Station is located in the Sacramento/American River watershed, approximately 5 miles east of the confluence of the Sacramento and American Rivers. The closest surface waters to the ANG Station are Magpie Creek, approximately 4,000 feet to the north and Arcade Creek located approximately 1,000 feet to the south. These creeks drain into the Natomas East Drainage Ditch Canal west of the ANG Station. The drainage then flows south and west into the Sacramento River.

Surface water run-off at the ANG Station flows in a southwesterly direction and discharges into the unlined drainage ditches along the southern perimeter of the property. The surface water is then directed south into Arcade Creek. According to the National Wetlands Inventory survey map, there are no areas of designated wetlands on the property. According to the Federal Emergency Management Agency insurance

maps provided in the 2005 EBS report, the entire ANG Station lies within the 100-year floodplain (ECATS 2005).

3.5 Hydrogeology

The general direction of groundwater flow is west-southwest. Depth-to-groundwater, as recorded by the California Department of Water Resources at a nearby domestic well, is more than 100 feet bgs (California Department of Water Resources 2012). The geology of the aquifers containing fresh groundwater are principally heterogeneous, unconsolidated, and contain continental deposits of Pliocene to Recent age. Groundwater in both confined and unconfined aquifers in the vicinity of the ANG Station moves from east to west and then southward out of the Sacramento Valley toward the delta area at the confluence of the San Joaquin and Sacramento Rivers (ECATS 2005).

SECTION 4.0

INVESTIGATIVE APPROACH

4.1 General Approach

The SI will be achieved by accomplishing the following tasks in sequential order:

- Obtaining necessary permits from Sacramento County.
- Conducting a subsurface utility clearance of the Former Hydraulic Lift AOC in Building 4.
- Advancing three soil borings at the Former Hydraulic Lift AOC in the locations proposed in [Figure 4-1](#).
- Collecting and submitting up to three soil samples from each boring for laboratory analysis. [Table 4-1](#) lists the compounds that will be analyzed in soil samples collected at the AOC.
- Advancing a temporary soil vapor well at the most permeable lithology present between 5 and 10 feet bgs.
- Collecting and submitting a soil vapor sample for laboratory analysis of VOCs. [Table 4-1](#) lists the compounds that will be analyzed in soil vapor samples.

Data collected during the SI will be compared against California Human Health Screening Levels for soil and vapor (California Environmental Protection Agency 2005) and the May 2012 United States Environmental Protection Agency (EPA) Region IX Regional Screening Levels for soil (EPA 2012). SI activities will be conducted following the *ANG Investigation Guidance* (ANG 2009). A description of the work proposed at the Former Hydraulic Lift is provided in the following subsections.

4.2 Preliminary Assessment

A PA for the 162nd CCG was conducted to identify, gather, and evaluate information pertaining to compliance sites that require investigation, with the primary focus being on the Former Hydraulic Lift AOC, which was identified for further investigation in the One Clean SI Report. The purpose of the PA was to obtain and review any new information generated as a result of construction, equipment or mission changes, leaks, or spills at the AOC since the One Clean SI and determine whether further investigative work was warranted at the AOC.

4.2.1 Preliminary Assessment Process

Prior to the kick-off meeting at the North Highlands ANG Station on 30 May 2012, previous investigative reports described in [Section 1.3](#) were reviewed to determine what, if any, additional information may have been required to determine if further investigation of this AOC was warranted. Requests for additional information were submitted to Chief Master Sergeant (CMSgt.) Warner Ratcliff, the 162nd CCG environmental technician for the past 12 years, prior to the kick-off meeting so information would be available at that time. The questions and answers received are provided in [Appendix E](#).

During the kick-off meeting, no changes (i.e., physical, equipment or mission changes, leaks, spills) at the AOC were identified since the initial 2009 PA/SI site visit and 2009 One Clean Program were identified. Historic records from the facility files, such as underground storage tank (UST) closure reports and pertinent as-built and shop drawings provided by CMSgt. Ratcliff, were reviewed to supplement information obtained from responses to questions.

4.2.2 Preliminary Assessment Interview Process

Given the information provided in the Trip Report prepared by BB&E, supplemented with information received from the interview responses and the requested information provided by CMSgt. Ratcliff, no additional interviews were deemed necessary.

4.2.3 Preliminary Assessment Records Search Process

Previous investigation reports and historic records from the facility files, such as UST closure reports and pertinent as-built and shop drawings,

were reviewed to provide additional information about the Former Hydraulic Lift AOC. Key records reviewed include:

- EBS report (ECATS 2005);
- One Clean SI Report (ERM 2009); and
- *Preliminary Assessment for the 162nd Combat Communications Group and 149th Combat Communications Squadron, North Highlands Air National Guard Station, California Air National Guard, Sacramento, California*, prepared by Science & Technology, Inc., in January 1991 (Science & Technology, Inc. 1991).

Additional records reviewed, as provided by the ANG Station, and included [Appendix E](#), are as follows:

- First Floor Demolition Plan – Drawing A1.1, dated 12 April 2004, showing the vehicle hydraulic lift.
- First Floor Plan – Drawing A2.1, dated 12 April 2004, showing planned building renovations.
- OWS samples collected from the Building 4 OWS (Maintenance Building) and the Building 9 OWS (Power Production Building) on 20 April 1987.
- Tank Removal and Site Remediation Report for the Air National Guard Facility, 3900 Roseville Road, North Highlands, California, prepared by Azteca Construction Inc. (Azteca), in July 1996. This report documents the removal of two USTs located northwest of Building 4 and an OWS located southwest of Building 4, as well as the removal of contaminated soil and site restoration.
- NFA letter provided by Sacramento County, dated 20 October 1999, for the two removed USTs as described in the report provided in the previous bullet.
- State Water Resources Control Board GeoTracker search dated 23 April 2012, which shows the North Highlands ANG Station as a leaking UST cleanup site with cleanup completed and site closed as of 5 October 1999.

4.2.4 Preliminary Assessment Recommendations and Conclusions

The information that was obtained during the 2012 kick-off meeting, the interview with CMSgt. Ratcliff, and the records search process supports the recommendation for further investigation at the Former Hydraulic Lift, as presented in the One Clean Program SI Report.

4.2.5 Site-Specific Information

Additional information regarding the AOC and other compliance issues obtained during the 2012 records search is provided below.

- The Former Hydraulic Lift was located near the southwest corner of Building 4. Hydraulic fluids were to be purged and the vehicle lift removed according to Drawing A1.1, dated 12 April 2004.
- Two USTs, one 3,100-gallon steel diesel UST and one 2,000-gallon steel gasoline UST, located northwest of Building 4, and associated contaminated soil, were removed in December 1995 (Azteca 1996). The County of Sacramento issued an NFA letter for the USTs on 20 October 1999.
- One 375-gallon OWS located southwest of Building 4 was removed in December 1995. Based on relatively low concentrations of oil and grease in soil samples, additional soil investigation or remediation was not recommended (Azteca 1996).
- Based on the responses provided by CMSgt Ratcliff, only one OWS, at Building 9, remains at the site.

4.3 Former Hydraulic Lift Site Investigation Activities

The Former Hydraulic Lift was located in the southwest area of Building 4. The lift pit was approximately 7.5 feet deep and removed as part of the demolition and renovation plans from 2004 for the vehicle maintenance area ([Appendix E](#)). Based on the former location and approximate depth of the lift, the SI activities for the Former Hydraulic Lift will include the following:

- Advancing three soil borings to a depth of approximately 30 feet bgs;

- Submitting up to three soil samples from each boring for laboratory analysis of VOCs, TPH-D, TPH-MO, and PAHs;
- Installing a temporary indoor soil vapor point with the screened interval approximately 5 to 10 feet bgs, depending on conditions encountered; and
- Collecting one soil vapor sample from the soil vapor point for laboratory analysis of VOCs.

Proposed soil boring and soil vapor point locations are based on results from the One Clean Program and are shown in [Figure 4-1](#).

SECTION 5.0

FIELD INVESTIGATION PROCEDURES

Procedures for conducting subsurface utility clearance, soil boring installation, soil boring abandonment, IDW profiling, surveying, and equipment decontamination are provided in the following subsections. PA/SI activities will be conducted according to the procedures presented in the QCP (ERM 2012), the *ANG Investigation Guidance* (ANG 2009), and this Work Plan, including the QAPP and Site-Specific Health and Safety Plan provided as [Appendices A](#) and [B](#), respectively.

5.1 Permitting

A minimum of 10 working days prior to the start of any invasive sampling work, a soil boring permit application will be submitted with the support of the licensed driller to the Sacramento County Environmental Management Department. Soil borings completed to within 10 feet of groundwater may require a permit. Temporary soil vapor points will not require a permit.

5.2 Subsurface Utility Clearance

Prior to the start of any invasive sampling work, the location of each proposed subsurface location will be marked in the field using white spray paint and the underground utilities in the surrounding area will be reviewed with ANG personnel. After intrusive locations have been marked, public utility operators will be notified, via underground service alert, to mark all public utilities. A private utility locator will also be contracted to screen the investigation areas for the presence of additional utilities. Proposed subsurface locations will be relocated, as necessary, based on the results of the underground utility locations. Intrusive sampling locations will be sited at least 3 feet from marked underground utilities and at least 10 feet from overhead utilities. The power output associated with overhead electrical lines will be determined based on discussions with 162nd CCG personnel, and the safe allowable distance between the line and the equipment will be determined by the equipment

operator. One soil boring and the soil vapor monitoring point will be located inside the building. As-builts of existing building utilities will be requested from the ANG Station site civil engineer and confirmed with the site civil engineer and the private locator.

All borehole locations will be cleared of utilities/subsurface features using a hand auger (or other hand tools) or vacuum truck/air knife. All borings and the soil vapor monitoring point will be cleared to a minimum depth of 5 feet bgs. The diameter of the clearance will be at least as large as the drilling tools to be used to complete the boring.

5.3 Soil Boring Installation

Soil borings will be advanced to a target depth of 30 feet bgs using a limited-access, direct-push drill rig, operated by a California-registered and -licensed drilling company. Soils will be recovered from the soil borings for soil classification, field screening, and laboratory analytical sample collection, from the ground surface to the total depth of the boring. The soil samples will be classified using the Unified Soil Classification System (American Society for Testing and Materials [ASTM] D2488-06).

Up to three soil samples will be collected for laboratory analysis from each soil boring. One sample will be collected from each 10-foot interval, within 0 to 10 feet bgs, 10 to 20 feet bgs, and 20 to 30 feet bgs. The field personnel will use field screening results at the time of soil boring installation to determine which samples from each boring will be submitted for analysis. The SI field sampling program is summarized in [Table 5-1](#). Soil sampling procedures are described in [Section 6.1](#).

5.3.1 Field Screening

To support the field screening of soil cores for VOCs, a soil sample will be collected from the soil cores every 2.5 feet and placed in a resealable plastic bag for field screening. The soil in the plastic bags will be gently agitated for approximately 30 seconds and allowed to equilibrate at ambient temperature away from direct sunlight. After approximately 15 minutes, the total organic vapor concentration of the soil sample will be measured by carefully pushing the photoionization detector (PID) probe through the wall of the plastic bag into the headspace above the sample. The maximum PID reading observed for each sample will be recorded in a field logbook and on the boring log.

5.4 Soil Boring Abandonment

Borings installed for soil characterization and sampling will be abandoned by filling with a grout mixture consisting of one sack (94 pounds) of Portland cement to 5 pounds of powdered bentonite to 8 gallons of water. The grout mixture will be either pumped or gravity-fed into the borehole from total depth to ground surface. After allowing the grout to settle, the surface will be restored as closely as reasonably possible to its pre-investigation condition.

5.5 Soil Vapor Monitoring Well Installation

A temporary soil vapor monitoring well will be installed and constructed within the drive rod of a direct-push drill rig. The construction of a proposed soil vapor monitoring probe is provided in [Figure 5-1](#). The temporary soil vapor monitoring well will be installed by hand-augering the first 5 feet, and then advancing a direct-push drill rig drive rod to a total depth of 10 feet. A soil core will be initially recovered for the interval between 5 and 10 feet to be visually inspected for lithology. The 12-inch interval with the highest evident permeability will be selected for the screen interval of the vapor well. The boring will be backfilled with sand as needed and a 6-inch-long, 0.010-inch slotted screen vapor inlet will be installed through the drive rods at the target depth with sample tubing attached to the vapor inlet extending to the surface.

The well will be sealed with hydrated bentonite from the top of the well screen to ground surface. The area around the tubing where it exits the top of the drive rod will be sealed with a screw adaptor and O-ring. Once sealed at the surface, the drive rod will be pulled back approximately 1 foot to expose the vapor inlet. The installation depth of the soil vapor monitoring probe will be recorded in the field notes.

The attached sample tubing will be $\frac{1}{8}$ to $\frac{1}{4}$ inch in diameter and made of non-reactive material (such as Teflon, Nylaflo, or nylon). Swagelok® compression fittings or equivalent will be used for all connections to prevent leakage. The soil vapor monitoring well and sample tubing should be void of water. Sample tubing and vapor inlets will be discarded after use. Reusable metal parts, including drill rods, will be decontaminated using the procedures provided in [Section 5.8](#).

5.6 Investigation-Derived Waste Management

Drill cuttings generated during drilling activities will be contained in 55-gallon steel drums. The drums will be clearly marked with a description of the contents and the accumulation date. Waste characterization will be determined by the analytical results of the AOC investigation. Complete waste disposal documentation for the containerized IDW will be prepared by ERM and presented to the ANG for signature as the waste generator. The IDW will be disposed of appropriately as either hazardous or non-hazardous waste based on waste characterization. If the waste is found to be hazardous, additional arrangements will be made with the ANG for addressing disposal issues.

5.7 Surveying

The horizontal and vertical position of all soil sample locations and soil vapor monitoring probes will be surveyed by a California-registered surveyor to the horizontal accuracy of 0.1 foot and a vertical accuracy of 0.01 foot. These locations will be tied to a permanent benchmark located near the 162nd CCG. The survey data will be reported in feet in the applicable zone of the California State Plane Coordinate System, using the North American Datum of 1983. Survey data will be submitted to the ANG using the Well Inventory Form ([Appendix C](#)), along with a stamped copy of the survey report.

5.8 Equipment Decontamination

Downhole drilling equipment (e.g., augers, drill rods, and drill bits) will be steam-cleaned or pressure-washed with hot water prior to use at each boring location. Decontaminated drilling equipment and unused materials will be removed from the facility at the completion of drilling activities.

Reusable soil sampling equipment (e.g., hand augers, split-spoon soil samplers) will be decontaminated using the following procedure before and after each sample is collected:

- A scrub-brush wash in a solution of Alconox (or equivalent) detergent and tap water;
- A tap water rinse; and

- A final rinse with ASTM Type II water.

After decontamination, equipment will be placed on plastic sheeting or similar material in a manner that will minimize the potential for inadvertent contamination prior to reuse. Waste soil and water generated during equipment decontamination will be containerized and managed as IDW ([Section 5.6](#)).

SECTION 6.0

SAMPLE COLLECTION PROCEDURES**6.1 Soil Sampling**

Soil samples will be collected from all soil borings. Soil samples are planned for collection at depths of 10-foot intervals to 30 feet bgs; however, these depths may be adjusted based on lithology present or to allow for collection from the vertical interval exhibiting the greatest extent of impact within the unsaturated zone, based on visual observations during soil coring and results of field screening with a PID meter.

Soil samples will be collected as quickly as possible from the returned soil cores to prevent off-gassing of volatile compounds. [Table 6-1](#) provides information regarding the soil analytical methods, including sample container descriptions and the holding time for the samples. Terra Core® samplers will be used to collect soil samples that will be analyzed for VOCs. Terra Core® sampling procedures are described in [Appendix D](#). Adequate soil volume for the remaining analyses will be collected and then placed into laboratory-supplied containers.

6.2 Soil Vapor Sampling

6.2.1 Setup of Soil Vapor Sampling Equipment

Collecting a soil vapor sample immediately following installation of a soil vapor monitoring well may cause inaccurate results because the drilling process is disruptive to subsurface soil gas conditions. Consequently, soil vapor conditions will be allowed to equilibrate based on the drill method prior to performing a leak test and purge-volume test, and the collection of a soil vapor sample. The field setup for leak and purge tests will be photo documented.

The soil vapor sampling equipment deployment plan is illustrated in [Figure 5-1](#). The soil vapor sampling equipment generally will be

assembled in the following order, although the actual sampling equipment assembly may be modified based on the requirements for sample collection in the soil vapor sampling container provided by the laboratory:

1. Below-ground soil vapor inlet;
2. Tubing from below ground to above ground surface;
3. In-line liquids trap (optional);
4. Flow regulator set to 100 to 200 milliliters (mL) per minute;
5. Leak test compound detector;
6. Vacuum gauge;
7. Sample container;
8. Vacuum pump; and
9. Plastic or glass syringe.

The well volume will be calculated following placement of tubing and sample containers. The well volume will include the pore space of the annulus and the internal volume of the below- and aboveground tubing. Sample containers that also include volume (e.g., glass bulbs) will be included in the calculation of well volume. Sample containers that do not have an initial volume (e.g., syringes, Tedlar bags) or “negative” volume (e.g., Summa canisters, vacuum-sealed vials) will not be included in the calculation of well volume. The well volume calculations, and a drawing or description of the soil vapor sample chain, will be recorded in field notes. Any changes to the setup of the soil vapor sampling equipment plan in [Figure 5-1](#) will also be recorded.

6.2.2 Soil Vapor Leak Test

A leak test will be performed at the soil vapor sampling location prior to the purge test and sampling. A leak test involves the use of a liquid tracer (1,1-difluoroethane or isopropyl alcohol) or gas tracer compound (such as helium) to confirm that the soil vapor sample has not mixed with ambient air. Leaks of ambient air into the soil vapor sample are most likely to occur at joints, connectors, the seal where the tubing exits the ground, or any other location where a break in the sample line occurs.

A sample apparatus pressure test will be conducted prior to completing a leak test to confirm that the negative pressure is maintained between the wellhead to the sample container. The pressure test procedures are as follows:

1. Set up and connect soil vapor equipment as illustrated in [Figure 5-1](#).
2. Close the “T” valve to the Summa canister after the flow meter, and close the valve at the well or sampling point.
3. Turn on the flow regulator and record the initial time and reading on the soil vapor sampling log form ([Appendix C](#)). Wait 10 minutes and record the time and the reading.
4. Continue recording every 10 minutes until the vacuum has stabilized within 1 inch of mercury.

The following procedures should be used for performing an in-field leak test using a tracer gas such as helium.

1. Add a gas detector device to the sample chain at the effluent of the purge pump. The gas detector device must be able to measure the concentration of the tracer gas as a percent of the total sample.
2. Place the leak detection tent over the sampling point and sampling train (and associated connection), then start the vacuum pump. Record the atmospheric concentration of the tracer gas within the tent.
3. Pump the tracer gas into the tent using a piece of non-reactive tubing through a hole near the bottom of the tent. The gas detector device is then used to sample the atmospheric concentration of the tracer gas inside the tent through a valve in the tent.
4. Once the tracer gas concentration inside the tent exceeds 60 percent soil vapor, purging may be conducted following procedures provided in [Section 6.2.3](#).
5. During purging, a leak test will occur. Collect a leak test sample through the effluent line of the vacuum pump. The leak test sample is then analyzed by the gas detector device. If the tracer gas concentration exceeds 3 percent, a leak in the sampling line is likely to be present.
6. If a leak is detected, cease purging activities and locate and eliminate the leak prior to continuing to purge and collecting the soil gas sample.

7. The volume of soil gas purged during the leak test should be recorded in the field notes.

If alternate leak test procedures using liquid leak test compounds are implemented, the field procedures will be developed and confirmed prior to field execution and discussed in the SI Report.

6.2.3 Purging and Sampling the Soil Vapor Monitoring Well

Procedures for purging the soil vapor monitoring well, and collecting a soil vapor sample, are as follows:

1. Calculate the volume of vapor to be purged before sample collection (1, 3, and 10 well volumes) using the following equation:

$$3 \times (\text{tubing height} \times \text{volume/feet}) = \text{_____ cubic feet}$$

$$\text{_____ cubic feet} \times 28,320 \text{ mL per cubic foot} = \text{_____ mL}$$

Note: Height is the tubing length for soil vapor monitoring probes constructed with tubing.

2. Conduct a pressure test by closing off the valve at the well head and creating a vacuum in the line with the vacuum pump. If vacuum gauge is stable for 10 minutes, then no leaks are present. If a leak is detected, then locate and eliminate the leak and re-test. Record readings on field log.
3. Add the tracer compound to tent enclosure, measure percent in tent. If helium is used, then the concentration should be at least 60 percent within the tent enclosure.
4. Turn on vacuum pump to begin purge or use a syringe to purge the tubing. Purging is completed to displace the ambient air in the soil vapor monitoring probe before a sample is collected.
5. Set flow regulator to a rate between 100 and 200 mL per minute. Record flow rate on field log.
6. Purge the target number of well volumes of soil gas (1, 3, and 10 well volumes). If the vacuum gauge registers greater than 10 inches of mercury (136 inches of water), then the probe is considered to be under "no flow" conditions and the soil vapor monitoring probe must be re-installed at a different location or a different depth. Alternatively, a soil sample may be collected in place of the soil vapor sample.

7. Perform the leak test while purge volume is being removed or while collecting the soil vapor sample, as described in [Section 6.2.2](#).
8. Collect the soil vapor sample as described in the *Guide to Air Sampling & Analysis, Canisters and Tedlar Bags* (Air Toxics LTD 2008a) and *Sorbent and Solution Sampling Guide* (Air Toxics LTD 2008b), provided in [Appendix D](#). The flow rate will be kept between 100 and 200 mL per minute. Soil vapor samples will be collected in translucent containers and will be wrapped with aluminum foil or kept inside an opaque container to prevent photodegradation of analytes. Soil vapor samples will be collected after 1, 3, and 10 well volumes have been purged.
9. Submit the samples to a California-certified laboratory for analysis. [Table 6-1](#) provides information regarding the soil vapor analytical methods, including sample container descriptions and the holding time for the samples.

6.3 Field Quality Assurance/Quality Control

Several types of field QC samples will be collected and submitted for analysis. Each type of QC sample monitors a different aspect of the field effort, and analytical results provide information regarding the adequacy of the sample collection and transportation of samples. Collection of QC samples will be performed in accordance with the QAPP provided in [Appendix A](#).

6.4 Field Documentation Procedures

SI activities conducted at the 162nd CCG will be documented in a field notebook and/or on chain-of-custody records using waterproof, indelible black ink. Field notebooks will be bound, water-resistant, and assigned to individual field personnel for use during the duration of their field activities. Entries will be as detailed and descriptive as possible so that a particular situation can be recalled without reliance solely on the sampler's memory. All field log entries will be dated and signed. A copy of a blank daily log form is included in [Appendix C](#).

6.4.1 Sample Identification

A standardized numbering system will be used to identify samples collected during SI activities. The numbering system provides a tracking

procedure to ensure accurate data retrieval of reach sample collected for laboratory analysis. The Site Manager is responsible for enforcing the use of the standardized numbering system during sampling activities, and will maintain a listing of the sample identification numbers.

Sample identifiers for original soil samples will be labeled according to the following format: SB - AOC designator - sample number. If historical samples were collected, then the sample numbering will continue from the highest sample number. For example, the first soil sample collected during this SI from the Former Hydraulic Lift will be labeled SB-HL-03. A duplicate soil sample would be labeled as SB-HL-03D.

Sample identifiers for original soil vapor samples will be labeled according to the following format: SV - AOC designator - sample number. For example, the first soil vapor sample collected from the Former Hydraulic Lift will be labeled SV-HL-01. Duplicate soil vapor samples will be labeled as SV-HL-01D.

SECTION 7.0

PROJECT SCHEDULE AND DELIVERABLES

Implementation of SI activities at the 162nd CCG will commence upon ANG, Department of Toxic Substances Control, and the Regional Water Quality Control Board review and approval of this Work Plan. A project schedule is included as [Figure 7-1](#). Field activities are anticipated to be completed in January 2013, or upon regulatory approval of this Work Plan. The schedule is subject to change due to unforeseen obstacles, including weather, off-site access agreements, and/or delays in document review.

Subsequent to the completion of field activities, laboratory data and surveying information will be compiled in a future SI Report.

SECTION 8.0

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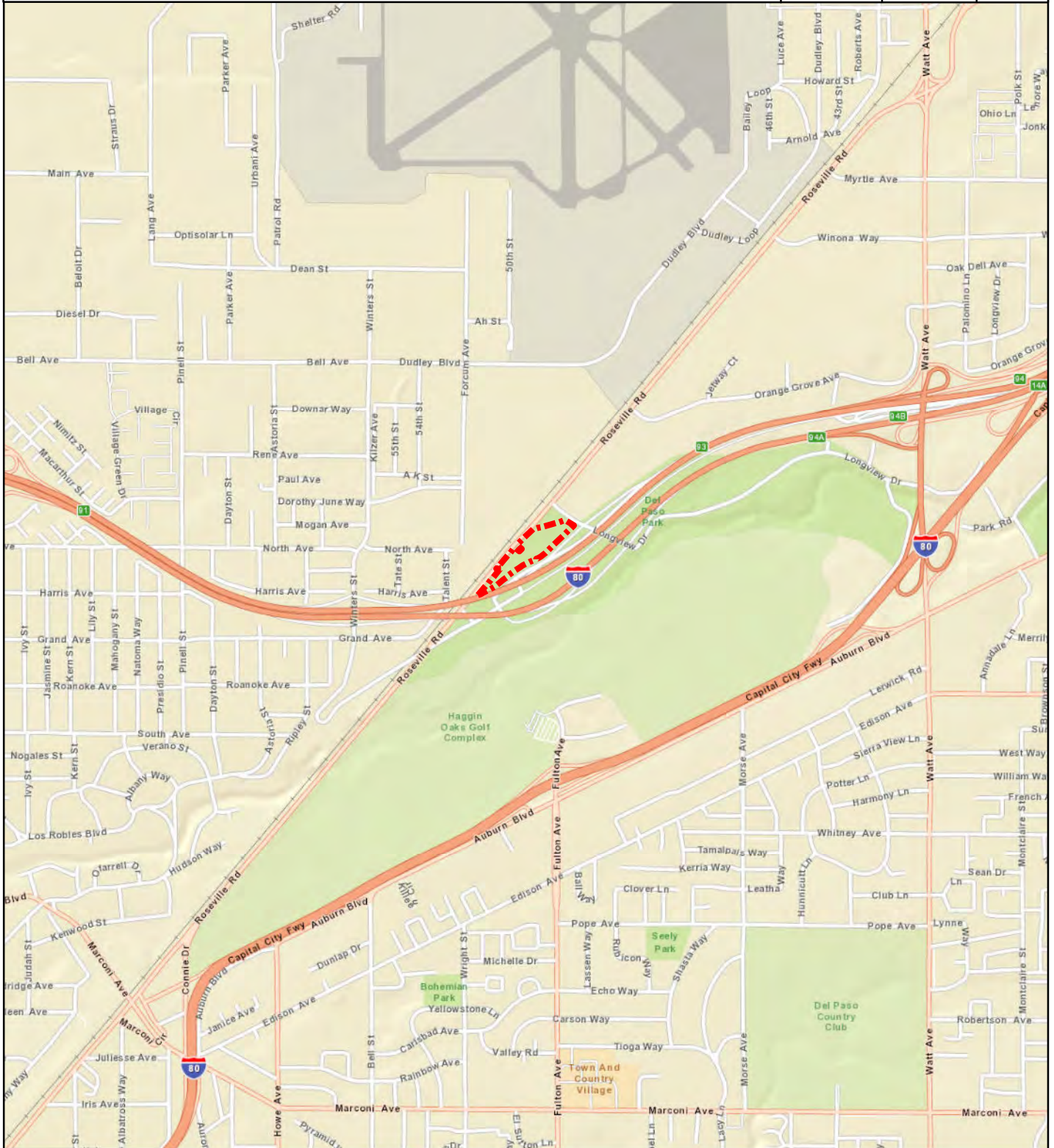
FIGURES

File: F:\Projects\ANG_NGB_Others\Western CRP\North Highlands\Workplan\Figure 1-1 SiteLocationMap.mxd

Created By:
Jorge Acevedo

Date:
6/28/2012

Project:
0117554.4



Legend

 162nd Combat Communications
Group Property Boundary



0 1,000 2,000 4,000
Feet

Figure 1-1
Site Location Map
162nd Combat Communications Group
California Air National Guard
North Highlands, California

File:
F:\Projects\ANG_NGB_Others\Western CRP\North Highlands\Workplan\Figure 1-2 SiteMap.mxd



Created By:
Mike Appel

Date:
6/28/2012

Project:
0117554.4



Legend

-  Area of Concern
-  162nd CCG Property Boundary



0 100 200 400
Feet

Figure 1-2
Site Map
162nd Combat Communications Group
California Air National Guard
North Highlands, California

File:
F:\GIS\Projects\ANG\WestDivCRP\NorthHighlands\Workplan\Figure_1_3_SoilSampleLocations.mxd

Created By:
Jorge Acevedo

Date:
7/18/2012

Project:
0117554.4



Legend

- 2009 One Clean Program Soil Boring Location
- Area of Concern
- 162nd CCG Property Boundary

0 40 80 160
Feet



Figure 1-3
One Clean Program Sample Locations
162nd Combat Communications Group
California Air National Guard
North Highlands, California

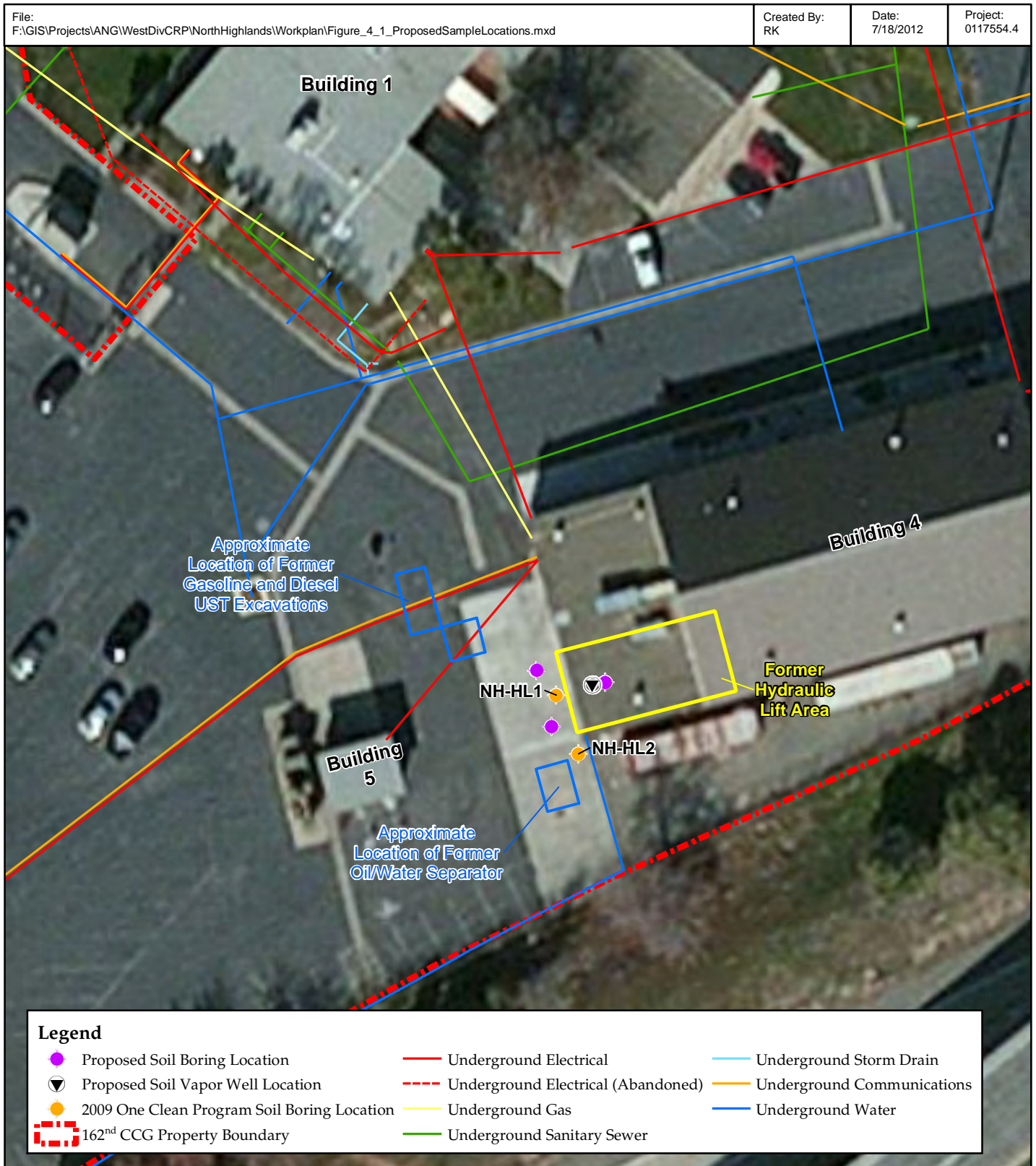


Figure 4-1
Proposed Sample Locations
 162nd Combat Communications Group
 California Air National Guard
 North Highlands, California

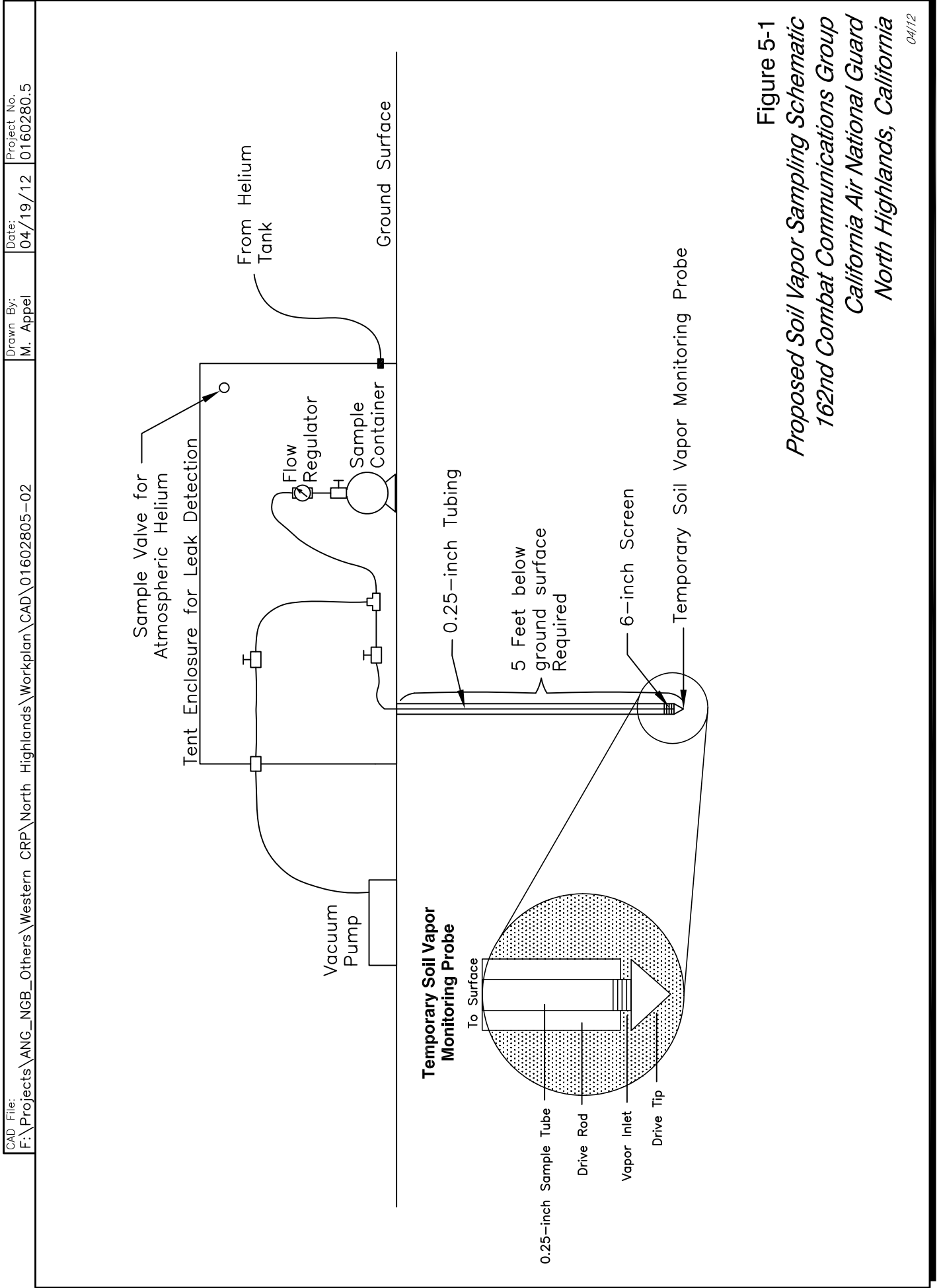
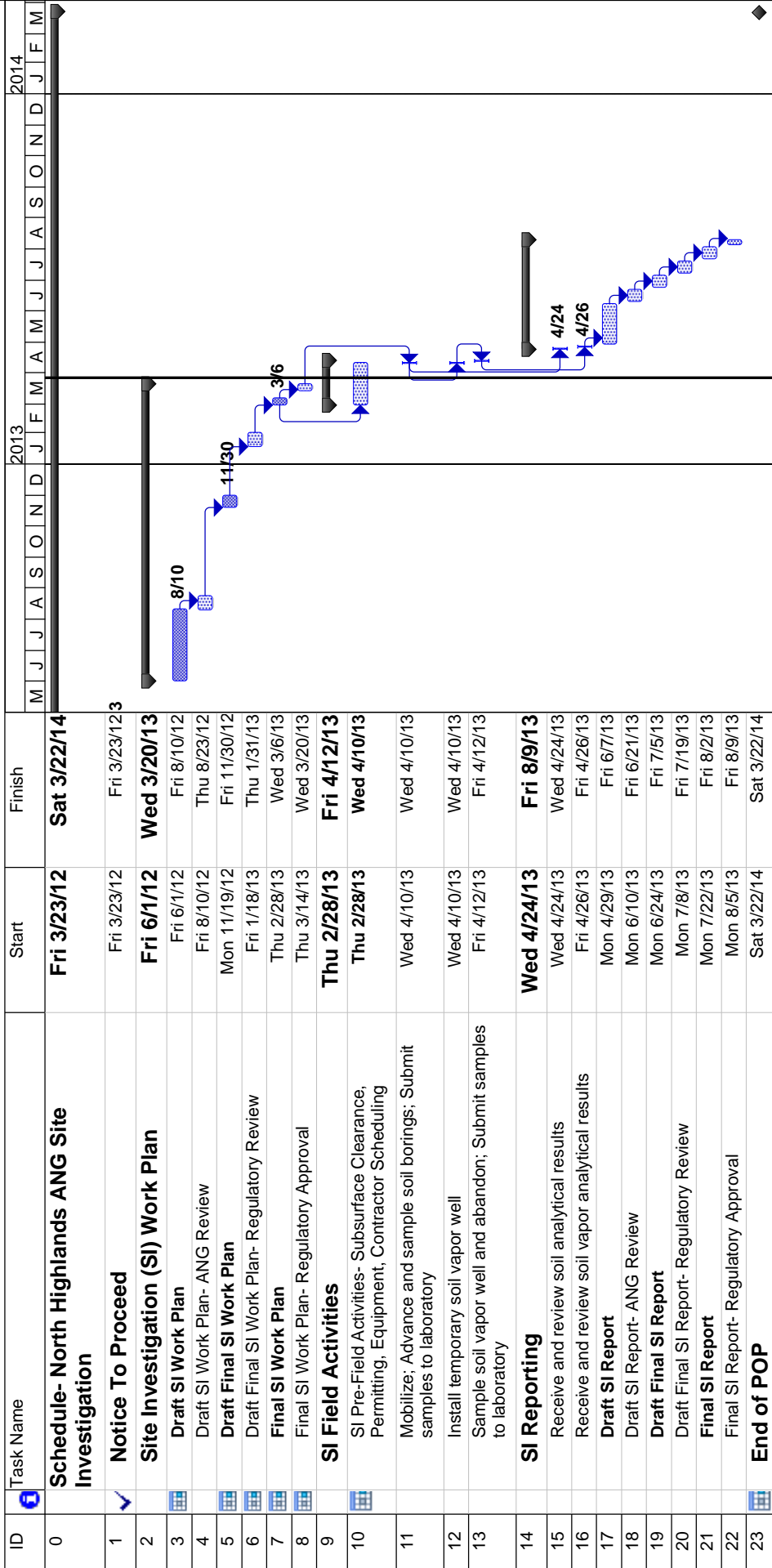


Figure 5-1
Proposed Soil Vapor Sampling Schematic
 162nd Combat Communications Group
 California Air National Guard
 North Highlands, California
 04/12

Figure 7-1
Project Schedule
162nd Combat Communications Group
California Air National Guard
North Highlands, California



Task Summary Finish-only
Milestone Start-only

TABLES

TABLE 1-1
Volatile Organic Compounds Detected in Soil Samples
Air National Guard One Clean Program
162nd Combat Communications Group
California Air National Guard
North Highlands, California

| Sample Name | Site Name | Sample Date | Sample Depth (feet bgs) | 1,2,4-TMB | 1,3,5-TMB | 2-CT | 4-IPT | ACE | BZ | CDS | CM | c-1,2-DCE | IPBZ | DCM | m,p-XYL | n-PB | o-XYL | p-IPT | STY | TOL | t-1,3-DCP |
|---|--|-------------|-------------------------|-----------|-----------|-----------|-------|------------|-------|---------|---------|-----------|------|--------|-----------|------|-----------|-------|-----------|-----------|-----------|
| Federal Regional Screening Levels (RSLs): | | | | 67,000 | 47,000 | 1,600,000 | NE | 61,000,000 | 1,100 | 670,000 | 120,000 | 780,000 | NE | 11,000 | 4,500,000 | NE | 5,300,000 | NE | 6,500,000 | 5,000,000 | 1,700 |
| California Remedial Goals: | | | | NE | — | — | — | — | — | — | — | — | — | — | — | — | — | NE | — | — | — |
| NH-LF1-10 | Former Septic Field and Drainage Basin | 06/09/2009 | 10 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NH-LF1-30 | Former Septic Field and Drainage Basin | 06/09/2009 | 30 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NH-LF2-7 | Former Septic Field and Drainage Basin | 06/08/2009 | 7 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NY-LF2-30 | Former Septic Field and Drainage Basin | 06/08/2009 | 30 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NH-LF3-15 | Former Septic Field and Drainage Basin | 06/08/2009 | 15 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NH-LF3-30 | Former Septic Field and Drainage Basin | 06/08/2009 | 30 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NH-LF4-9 | Former Septic Field and Drainage Basin | 06/09/2009 | 9 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NH-LF4-30 | Former Septic Field and Drainage Basin | 06/09/2009 | 30 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NH-OWS1-5 | Oil/Water Separator - Bldg 9 | 06/08/2009 | 5 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NH-OWS1-30 | Oil/Water Separator - Bldg 9 | 06/08/2009 | 30 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NH-OWS2-18 | Oil/Water Separator - Bldg 9 | 06/08/2009 | 18 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NH-OWS2-30 | Oil/Water Separator - Bldg 9 | 06/08/2009 | 30 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NH-OWS3-20 | Oil/Water Separator - Bldg 9 | 06/08/2009 | 20 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NH-OWS3-30 | Oil/Water Separator - Bldg 9 | 06/08/2009 | 30 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |

| Volatile Organic Compounds Abbreviations | | | |
|--|------------------------|-----------|---------------------------|
| Abbrev. | Compound | Abbrev. | Compound |
| 1,2,4-TMB | 1,2,4-Trimethylbenzene | IPBZ | Isopropylbenzene |
| 1,3,5-TMB | 1,3,5-Trimethylbenzene | DCM | Methylene Chloride |
| 2-CT | 2-Chlorotoluene | m,p-XYL | m,p-Xylene |
| 4-IPT | 4-Isopropyltoluene | n-PB | N-Propylbenzene |
| ACE | Acetone | o-XYL | o-Xylene |
| BZ | Benzene | p-IPT | p-Isopropyltoluene |
| CDS | Carbon disulfide | STY | Styrene |
| CM | Chloromethane | TOL | Toluene |
| c-1,2-DCE | cis-1,2-Dichloroethene | t-1,3-DCP | trans-1,3-Dichloropropene |

TABLE 1-2

*Polycyclic Aromatic Hydrocarbons Detected in Soil Samples
Air National Guard One Clean Program
162nd Combat Communications Group
California Air National Guard
North Highlands, California*

| Sample Name | Site Name | Sample Date | Sample Depth (feet bgs) | PAH |
|-------------|--|-------------|-------------------------|-----|
| NH-LF1-10 | Former Septic Field and Drainage Basin | 06/09/2009 | 10 | ND |
| NH-LF1-30 | Former Septic Field and Drainage Basin | 06/09/2009 | 30 | ND |
| NH-LF2-7 | Former Septic Field and Drainage Basin | 06/08/2009 | 7 | ND |
| NY-LF2-30 | Former Septic Field and Drainage Basin | 06/08/2009 | 30 | ND |
| NH-LF3-15 | Former Septic Field and Drainage Basin | 06/08/2009 | 15 | ND |
| NH-LF3-30 | Former Septic Field and Drainage Basin | 06/08/2009 | 30 | ND |
| NH-LF4-9 | Former Septic Field and Drainage Basin | 06/09/2009 | 9 | ND |
| NH-LF4-30 | Former Septic Field and Drainage Basin | 06/09/2009 | 30 | ND |
| NH-OWS1-5 | Oil/Water Separator - Bldg 9 | 06/08/2009 | 5 | ND |
| NH-OWS1-30 | Oil/Water Separator - Bldg 9 | 06/08/2009 | 30 | ND |
| NH-OWS2-18 | Oil/Water Separator - Bldg 9 | 06/08/2009 | 18 | ND |
| NH-OWS2-30 | Oil/Water Separator - Bldg 9 | 06/08/2009 | 30 | ND |
| NH-OWS3-20 | Oil/Water Separator - Bldg 9 | 06/08/2009 | 20 | ND |
| NH-OWS3-30 | Oil/Water Separator - Bldg 9 | 06/08/2009 | 30 | ND |

Notes:

ND = Not detected

TABLE 1-3

Total Petroleum Hydrocarbons Detected in Soil Samples
Air National Guard One Clean Program
162nd Combat Communications Group
California Air National Guard
North Highlands, California

| Sample Name | Site Name | Sample Date | Sample Depth (feet bgs) | TPH-D | | | TPH-G | | | TPH-MO | | |
|---|--|-------------|-------------------------|-------|----|----|-------|----|----|--------|----|----|
| | | | | NE | NE | NE | NE | NE | NE | NE | NE | |
| Federal Regional Screening Levels (RSLs): | | | | | | | | | | | | |
| California Remedial Goals: | | | | | | | | | | | | |
| NH-LF1-10 | Former Septic Field and Drainage Basin | 06/09/2009 | 10 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NH-LF1-30 | Former Septic Field and Drainage Basin | 06/09/2009 | 30 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NH-LF2-7 | Former Septic Field and Drainage Basin | 06/08/2009 | 7 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NY-LF2-30 | Former Septic Field and Drainage Basin | 06/08/2009 | 30 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NH-LF3-15 | Former Septic Field and Drainage Basin | 06/08/2009 | 15 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NH-LF3-30 | Former Septic Field and Drainage Basin | 06/08/2009 | 30 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NH-LF4-9 | Former Septic Field and Drainage Basin | 06/09/2009 | 9 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NH-LF4-30 | Former Septic Field and Drainage Basin | 06/09/2009 | 30 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NH-OWS1-5 | Oil/Water Separator - Bldg 9 | 06/08/2009 | 5 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NH-OWS1-30 | Oil/Water Separator - Bldg 9 | 06/08/2009 | 30 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NH-OWS2-18 | Oil/Water Separator - Bldg 9 | 06/08/2009 | 18 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NH-OWS2-30 | Oil/Water Separator - Bldg 9 | 06/08/2009 | 30 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NH-OWS3-20 | Oil/Water Separator - Bldg 9 | 06/08/2009 | 20 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NH-OWS3-30 | Oil/Water Separator - Bldg 9 | 06/08/2009 | 30 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NH-HL1-1 | Former Hydraulic Lift | 06/09/2009 | 1 | ND | ND | ND | ND | ND | ND | ND | 18 | ND |
| NH-HL1-30 | Former Hydraulic Lift | 06/09/2009 | 30 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NH-HL2-5 | Former Hydraulic Lift | 06/09/2009 | 5 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NH-HL2-30 | Former Hydraulic Lift | 06/09/2009 | 30 | ND | ND | ND | ND | ND | ND | ND | ND | ND |

Notes:

ft bgs = feet below ground surface
TPH-D = Diesel-range total petroleum hydrocarbons
TPH-G = Gasoline-range total petroleum hydrocarbons
TPH-MO = Motor oil-range total petroleum hydrocarbons

TABLE 4-1

*Proposed Investigation Activities
162nd Combat Communications Group
California Air National Guard
North Highlands, California*

| SOIL | | | | | |
|------------------------|--------------------------------|-------------------------|-----------------------------------|-------------|---------------------|
| | Soil Borings | | Original Soil Samples per Analyte | | |
| <i>Area of Concern</i> | <i>Proposed No. of Borings</i> | <i>Depth (feet bgs)</i> | <i>VOCs</i> | <i>PAHs</i> | <i>TPH-D,-G,-MO</i> |
| Former Hydraulic Lift | 3 | 30 | 9 | 9 | 9 |

| SOIL VAPOR | | | | | |
|------------------------|------------------------------|-------------------------|---|-------------|--------------------|
| | Soil Vapor Wells | | Original Soil Vapor Samples per Analyte | | |
| <i>Area of Concern</i> | <i>Proposed No. of Wells</i> | <i>Depth (feet bgs)</i> | <i>Helium, oxygen, nitrogen, carbon dioxide</i> | <i>VOCs</i> | <i>Naphthalene</i> |
| Former Hydraulic Lift | 1 | | 3 | 3 | 3 |

Notes:

Soil samples will be collected in the following order: VOCs, TPH-G, TPH-D,-MO, PAHs.

bgs = Below ground surface

No. = Number

PAHs = Polycyclic aromatic hydrocarbons

TPH = Total petroleum hydrocarbons

TPH-D = Diesel-range total petroleum hydrocarbons

TPH-G = Gasoline-range total petroleum hydrocarbons

TPH-MO = Motor oil-range total petroleum hydrocarbons

VOCs = Volatile organic compounds

TABLE 5-1

Field Sampling Summary
162nd Combat Communications Group
California Air National Guard
North Highlands, California

| Area of Concern | Target Media | Sampling Method and Special Considerations | Target Analytes | State or EPA Method | Number of Primary Samples | QA/QC Samples ¹ | | | | Total Number of Samples |
|-----------------------|-----------------|---|--|---------------------|---------------------------|----------------------------|-----------------|------------------------------|--------|-------------------------|
| | | | | | | Field Blank | Equipment Blank | Field Duplicate ⁴ | MS/MSD | |
| Former Hydraulic Lift | Subsurface Soil | Geoprobe (Limited Access Rig - Indoor Sampling) | VOCs | 8260B | 9 | 0 | 1 | 1 | 0 | 11 |
| | | | TPH-D ₂ -G ₂ -MO | 8015B | | | | | | |
| | | | PAH | 8270C SIM | | | | | | |
| | Soil Vapor | | Helium, oxygen, carbon dioxide, nitrogen | ASTM D-1946 MOD | 1 | 1 | 0 | 2 | 0 | 4 |
| | | | VOCs | TO-15 | | | | | | |
| | | | Naphthalene | TO-15 | | | | | | |
| | | | Naphthalene | TO-17 ³ | | | | | | |

Notes:

EPA = United States Environmental Protection Agency

MS/MSD = Matrix spike/matrix spike duplicate

PAH = Polycyclic aromatic hydrocarbon

QA/QC = Quality assurance/quality control

TPH = Total petroleum hydrocarbons

TPH-D = Diesel-range total petroleum hydrocarbons

TPH-G = Gasoline-range total petroleum hydrocarbons

TPH-MO = Motor oil-range total petroleum hydrocarbons

VOC = Volatile organic compound

¹QA/QC samples also include trip blanks (not included). One trip blank will be included in each cooler containing samples.

²The proposed number of soil borings and soil samples is approximate.

³Samples will be collected and placed on hold for analysis with the lab, pending results of TO-15.

⁴The 3-step purge test samples will qualify as the primary sample data and the additional samples may constitute field duplicates.

TABLE 6-1

Laboratory Analytical Methods
162nd Combat Communications Group
California Air National Guard
North Highlands, California

| SOIL | VOCs | | | PAHs | Naphthalene | TPH-G | TPH-D, -MO | Helium, Nitrogen, Oxygen, Carbon Dioxide (leak detection) |
|------------------|---|---|---|---|--------------|---|---|---|
| | Analytical Method | 8260B | 8270C SIM | 6-inch brass sleeve | -- | 8015B | 8015B | -- |
| Sample Container | Terra Core sample kit (three 40-mL VOA vials) | | | 6-inch brass sleeve | -- | Terra Core sample kit (two 40-mL VOA vials) | 6-inch brass sleeve | -- |
| Preservative | NaHSO ₃ or water (two vials), and MeOH (one vial) ¹ | | | None | -- | MeOH ² | None | -- |
| Hold Times | 14 days | 14 days to extraction/40 days to analysis | 14 days to extraction/40 days to analysis | 14 days to extraction/40 days to analysis | -- | 14 days | 14 days to extraction/40 days to analysis | -- |
| SOIL VAPOR | TO-15 | | | TO-15 | TO-17 | -- | -- | ASTM-1946 |
| | Analytical Method | TO-15 | TO-15 | TO-15 | TO-17 | -- | -- | ASTM-1946 |
| Sample Container | 1-L Summa Canister | 1-L Summa Canister | 1-L Summa Canister | 1-L Summa Canister | sorbent tube | -- | -- | 1-L Summa Canister |
| Preservative | None | None | None | None | None | -- | -- | None |
| Hold Times | 30 days | 30 days | 30 days | 30 days | 30 days | -- | -- | 30 days |

Notes:

Samples should be collected in the following order: VOCs, TPH-G, TPH-D, -MO, then PAHs.

¹Two vials contain NaHSO₃ or water preservative and one vial contains MeOH preservative.

²Both vials contain MeOH preservative.

HCl = Hydrochloric acid

MeOH = Methanol

mL = Milliliter

NaHSO₃ = Sodium bisulfite

PAH = Polycyclic aromatic hydrocarbon

TPH-D = Diesel-range total petroleum hydrocarbons

TPH-G = Gasoline-range total petroleum hydrocarbons

TPH-MO = Motor oil-range total petroleum hydrocarbons

VOA = Volatile organic analysis

VOC = Volatile organic compound

APPENDIX A

QUALITY ASSURANCE PROJECT PLAN

(PRESENTED ON CD)

Compliance Restoration Program – Western Region 1 Final Quality Assurance Project Plan

**162nd Combat Communications Group
California Air National Guard
North Highlands, California**

March 2013



**NGB/A7OR
Joint Base Andrews, Maryland**

Compliance Restoration Program – Western Region 1 Final Quality Assurance Project Plan

**162nd Combat Communications Group
California Air National Guard
North Highlands, California**

March 2013

**Prepared For:
Air National Guard
Shepperd Hall
3501 Fetchet Avenue
Joint Base Andrews, Maryland 20762**

**Contract Number:
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**Project Number:
ANG2012WESTCRP**

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LIST OF ACRONYMS

| <u>Acronym</u> | <u>Definition</u> |
|----------------|--|
| ANG | Air National Guard |
| AOC | Area of concern |
| ASTM | American Society for Testing and Materials |
| bgs | Below ground surface |
| CCG | Combat Communications Group |
| CIP | Common installation picture |
| COC | Chain-of-custody |
| CRP | Compliance Restoration Program |
| DL | Detection limit |
| DoD | Department of Defense |
| DQO | Data quality objectives |
| DTSC | Department of Toxic Substances Control |
| ELAP | Environmental Laboratory Accreditation Program |
| EPA | United States Environmental Protection Agency |
| ERM | ERM-West, Inc. |
| GIS | Geographic Information System |
| GPS | Global Positioning System |
| IDQTF | Intergovernmental Data Quality Task Force |
| LCS | Laboratory control sample |
| LDC | Laboratory Data Consultants, Inc. |
| LOD | Limit of detection |
| LOQ | Limit of quantitation |
| MDL | Method detection limit |
| MS | Matrix spike |
| MSD | Matrix spike duplicate |
| NFA | No Further Action |
| NGB | National Guard Bureau |
| OWS | Oil/water separator |
| PA | Preliminary assessment |
| PAH | Polycyclic aromatic hydrocarbon |
| PE | Performance evaluation |
| PID | Photoionization detector |
| PM | Project Manager |
| QA | Quality assurance |
| QAO | Quality assurance objectives |

LIST OF ACRONYMS

| <u>Acronym</u> | <u>Definition</u> |
|----------------|--|
| QAPP | Quality Assurance Project Plan |
| QC | Quality control |
| QSM | Quality Systems Manual |
| RI | Remedial investigation |
| RPD | Relative percent difference |
| SI | Site investigation |
| SOP | Standard operating procedure |
| TPH | Total petroleum hydrocarbons |
| TPH-D | Diesel-range total petroleum hydrocarbons |
| TPH-MO | Motor oil-range total petroleum hydrocarbons |
| UFP-QAPP | Uniform Federal Policy for Quality Assurance Project Plans |
| VOC | Volatile organic compound |

SECTION 1.0

INTRODUCTION/PURPOSE

ERM-West, Inc. (ERM) has prepared this project-specific Quality Assurance Project Plan (QAPP) to address Regional Compliance Restoration Program (CRP) activities to be conducted for the 162nd Combat Communications Group (CCG) of the California Air National Guard (ANG), located at the North Highlands ANG Station in North Highlands, California.

This document was prepared in general accordance with the following documents:

- *Environmental Restoration Program ANG Investigation Guidance*, September 2009 (ANG 2009a);
- Intergovernmental Data Quality Task Force (IDQTF) guidance document titled *Uniform Federal Policy for Quality Assurance Project Plans* (UFP-QAPP Manual) (IDQTF 2005);
- United States Environmental Protection Agency (EPA) guidance document titled *Guidance for Quality Assurance Project Plans*, EPA QA/G-5 (EPA 2002a); and
- EPA guidance document titled *EPA Requirements for Quality Assurance Project Plans*, EPA QA/R-5 (EPA 2001a).

The format used is in general conformance with the ANG and EPA guidance documents. To show conformance with the UFP-QAPP Manual, a crosswalk that indicates in which QAPP sections the IDQTF requirements are addressed is presented on [Table 1-1](#). This crosswalk is referred to as “QAPP Worksheet #2” and “Table 3” in the UFP-QAPP Manual.

1.1 Purpose of the Quality Assurance Project Plan

The purpose of a QAPP is described in the UFP-QAPP Manual. The QAPP documents how quality assurance (QA) and quality control (QC) are applied to an environmental data collection operation to ensure that the results obtained will satisfy the stated performance criteria. It is important to note that QA and QC are defined and used differently. QA refers to the system of management activities, whereas QC refers to the system of technical activities that measure performance against defined standards.

The purpose of a QAPP is to document the planned activities for environmental data collection operations and to provide a project-specific “blueprint” for obtaining the type and quality of environmental data needed for a specific decision or use. The planning should include the “stakeholders” (e.g., data users, data producers, decision-makers) to ensure that all needs are defined adequately and that the planning for quality addresses those needs. While time spent on such planning may initially seem unproductive and costly, the penalty for ineffective planning often is greater conflict and extensive reworking, which results in increased cost and lost time.

A QAPP serves the following purposes:

1. As a technical planning document, it identifies the purpose of the project, defines the project quality objectives, and outlines the sampling, analytical, and QA/QC activities that will be used to support environmental decisions.
2. As an organizational document, it identifies key project personnel, thereby facilitating communication.
3. As an assessment and oversight document, it provides the criteria for assessment of project implementation and for QA and contractor oversight.

According to the UFP-QAPP Manual, QAPPs can be of two types:

- A generic QAPP is an overarching plan that describes the quality objectives and documents the comprehensive set of standard operating procedures (SOPs) for sampling, analysis, QA/QC, and data review that are specific to a site (e.g., facility, base) or to an activity (e.g., compliance with an environmental program such as Safe Drinking Water Act, repetitive groundwater monitoring). A generic QAPP may be applicable to a single site with multiple activities (e.g., soil,

groundwater, and surface water sampling) or to a single activity that will be implemented at multiple sites (e.g., same type of air monitoring at several ANG bases) or at multiple times (e.g., a groundwater monitoring program that will sample the same locations every 3 months for 5 years).

- A project-specific QAPP provides a QA blueprint specific to one project or task. Project-specific QAPPs are used for projects of limited scope and time and, in general, can be considered the Sampling Analysis Plan or Work Plan for the project. A project-specific QAPP for each site or activity may be needed to supplement a generic QAPP.
- The QAPP included herein is a project-specific QAPP that has been developed from ERM's generic QAPP. ERM developed a generic QAPP for its work on all ANG bases, not only for the three purposes given above, but also for the additional purposes as follows:
 1. It is an effective way of reinforcing the latest ANG requirements and guidance under the CRP.
 2. It is a means of keeping the procedures utilized by ERM's ANG team members consistent across the ERM footprint.
 3. It provides a template for future, project-specific QAPPs generated by ERM under the CRP.

1.2 Quality Assurance Project Plan Distribution

Key personnel associated with the 162nd CCG are listed in the Distribution List ([Table 1-2](#)). The Distribution List also documents personnel that will be provided with copies of this approved QAPP, and any subsequent revisions. The Project Personnel Sign-Off Sheet provided on [Table 1-3](#) documents that all key personnel that will perform work associated with this project have read the applicable sections of the QAPP and will perform the tasks as described. Approved updated versions of the QAPP will be maintained in the appropriate project file. Outdated versions of the QAPP will be removed from ERM's active project file.

SECTION 2.0

PROJECT DESCRIPTION**2.1 Project Organization**

Specific roles and responsibilities have been defined for key project personnel to ensure that project goals are achieved. This section of the QAPP identifies the individuals involved in the project, defines their roles and responsibilities, describes the lines of communication, and indicates what specialized training or certification is required.

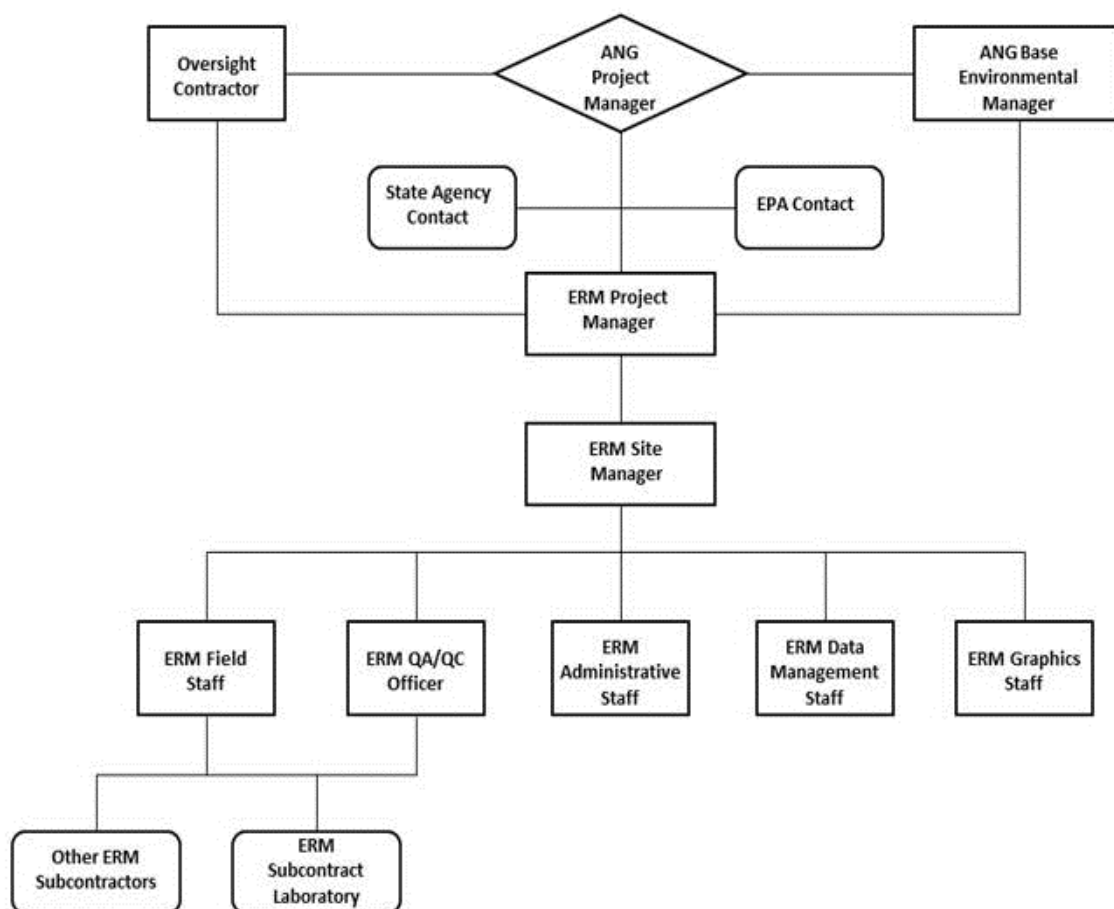
2.1.1 Roles and Responsibilities

Specific roles and responsibilities have been defined for key project personnel to ensure that the project goals are achieved. A project organizational chart illustrating the relationships among all project personnel is provided as [Figure 2-1](#). A list of personnel involved with the project, including associated responsibilities and qualifications, is provided on [Table 2-1](#).

2.1.2 Training

ERM staff and subcontractors who will provide field services will be trained, at a minimum, per the requirements of Title 29, Part 1910.120 of the Code of Federal Regulations, *Hazardous Waste Operations and Emergency Response*, including both the one-time 40-hour training and annual 8-hour refreshers. This training includes discussions of potential hazards, exposure limits, and a review of personal protective equipment, emergency procedures, and respirator selection and fit testing. While on site, ERM personnel will carry certification of Hazardous Waste Operations and Emergency Response training. A list of the training requirements for personnel is located on [Table 2-2](#). Site-specific health and safety considerations are addressed in the *Site-Specific Health and Safety Plan* included as Appendix B of the *Final Preliminary Assessment/Site Investigation (PA/SI) Work Plan* (Work Plan) (ERM 2013).

Figure 2-1. Project Organizational Chart



2.1.3 Laboratory Certification

In accordance with National Guard Bureau (NGB)/A7O Memorandum dated 31 December 2009 (NGB 2009), included in [Appendix A](#), all laboratories performing work under the CRP must be Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP)-certified, as well as licensed by the State Office of Lab Licensure in which the samples are collected. Lists of laboratories that are ELAP-certified are found at:

- <https://www.denix.osd.mil/portal/page/portal/EDQW>
- www.a2la.org
- www.aiclasscorp.com
- www.l-a-b.com
- www.pjllabs.com

Each list is maintained by a different organization or accreditation body; therefore, it is recommended that each list be checked. TestAmerica, Inc., in Arvada, Colorado, is the ELAP-certified laboratory selected to perform analytical services for the 162nd CCG. Air analyses will be performed by Eurofins Air Toxics, Inc., in Rancho Cordova, California. DoD/ELAP and California State certification for TestAmerica, Inc. and Eurofins Air Toxics, Inc., is provided in [Appendix B](#).

2.2 Site Facility Description

The North Highlands ANG Station is located in North Highlands, California. The ANG Station is the home of the 162nd CCG of the California ANG and occupies approximately 8 acres 6 miles northeast of downtown Sacramento, California, adjacent to the former McClellan Air Force Base. A site location map and site plan map are presented in the Work Plan.

The property is currently under a 30-year lease agreement with the City of Sacramento that expires in June 2022. The property has been occupied by the 162nd CCG since 1950, when the North Highlands ANG Station was constructed on land formerly used for agriculture.

Operations at the ANG Station include ground vehicle, aerospace ground equipment, and communication maintenance, and administrative activities. Wastes generated by these operations include waste oils, fuels, spent batteries, battery acid, paint thinners, and solvents.

2.3 Previous Investigations

Results of previous investigations conducted at the 162nd CCG are summarized in Section 1.3 of the Work Plan.

SECTION 3.0

TASK DESCRIPTION**3.1 Problem Definition**

The NGB and their consultant, BB&E, performed a site visit and records review for the ANG Station on 10 February 2009. The findings of this review were documented in the *PA/SI Trip Report – North Highlands ANG Station, North Highlands, California* (Trip Report) (BB&E 2009). The Trip Report identified three areas of concern (AOCs): the Former Septic Field and Drainage Basin, the Former Oil/Water Separator (OWS) at Building 9, and the Former Hydraulic Lift. These AOCs were subsequently investigated during a preliminary investigation in 2009 as part of the ANG's One Clean Program.

The One Clean Program recommended additional investigation at the Former Hydraulic Lift due motor oil-range total petroleum hydrocarbons (TPH-MO) detections in shallow soil near the area where a hydraulic lift was removed from the vehicle maintenance bay at the facility. No documentation of the removal was available. The soil at the former Hydraulic Lift at Building 4 was analyzed for diesel-range total petroleum hydrocarbons (TPH-D) and TPH-MO. TPH-MO was detected in one soil sample collected 1 foot below ground surface (bgs). No other analytes were detected at concentrations greater than practical quantitation limits.

The project objectives are to determine the presence or absence of contamination, and either: (1) obtain a No Further Action (NFA) decision for the AOC at the North Highlands ANG Station, with regulatory concurrence from the Department of Toxic Substances Control (DTSC), or (2) identify the data quality objectives (DQOs) required for conducting a follow-on remedial investigation (RI) at the AOC if it does not meet the criteria for NFA.

3.2 Scope of Work

The scope of work was discussed during a scoping session for the Work Plan held on 29 May 2012. The participants and decisions are included summarized on [Table 3-1](#). The scope of work for the project includes:

- Conducting a PA of the Former Hydraulic Lift.
- Installing three soil borings at the Former Hydraulic Lift, up to an approximate depth of 30 feet bgs. The soil boring locations were selected based on data collected during the One Clean SI.
- Collecting and submitting three soil samples from each boring for laboratory analysis of compounds listed on [Table 3-2](#).
- Installing three temporary soil vapor probes at the Former Hydraulic Lift to a depth between 5 and 10 feet bgs.
- Collecting and submitting three soil vapor samples for the temporary locations for laboratory analysis of compounds listed on [Table 3-2](#).

SECTION 4.0

DATA QUALITY OBJECTIVES

This section addresses DQOs, which are designed to support the overall project objectives. The DQOs are qualitative and quantitative statements developed by data users to specify the quality and quantity of data from a particular data collection activity to support specific decisions or regulatory actions. Physical characteristics measured and/or observed in the field and analytical results from samples collected for the project will be evaluated during the progression of each stage of the investigation. DQOs are developed using the seven-step process described in *Guidance on Systematic Planning Using the Data Quality Objectives Process*, EPA QA/G-4 (EPA 2006).

4.1 Integrity of Data Quality Objectives

The ultimate success of an environmental program or project depends on the integrity of the environmental data collected and used in decision-making, and this integrity depends significantly on effective implementation of the DQOs. The purpose of DQOs is to ensure that the data collected are of high integrity—i.e., of the right type, quality, and quantity to support defensible site decisions. The DQO development process may have both qualitative and quantitative aspects. The qualitative parts promote logical, practical planning for environmental data collection operations and complement the more quantitative aspects. Where appropriate, the quantitative part may use statistical methods to design a data collection plan that will help control the making of incorrect decisions. Qualitative DQOs for the PA/SI activities are described below.

4.2 Stages of Data Quality Objectives

Qualitative DQOs were developed using a seven-step process. This process forms a framework for addressing specific contamination problems and designs sampling plans that will produce the right type, quantity, and quality of data to support decision-making (EPA 2006). The steps are summarized below.

4.2.1 Step 1: State the Problem

A site visit was conducted in 2009 to identify areas of potential concern at the North Highlands ANG Station (BB&E 2009). Three areas of potential concern were identified during the site visit: the Former Septic Field and Drainage Basin, a Former OWS at Building 9, and the Former Hydraulic Lift.

The 2009 SI data indicated that soil at the Former Septic Field and Drainage Basin and Former OWS at Building 9 had not been impacted with volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), or total petroleum hydrocarbons (TPH). Concentrations of VOCs, PAHs, gasoline-range total petroleum hydrocarbons, and TPH-D were not detected at concentrations above the practical quantitation limit in the soil samples collected from the AOCs.

Based on the 2009 One Clean Program SI results, NFA was recommended for the Former Septic Field and Drainage Basin and Former OWS at Building 9. However, due to the TPH impacts in shallow soil at the Former Hydraulic Lift, soil and soil vapor will be investigated during the 2012 PA/SI.

4.2.2 Step 2: Identify the Goals of the Study

The objective of the PA/SI includes determining the presence or absence of contamination and either:

1. Obtaining an NFA decision for the AOC at the North Highlands ANG Station, with regulatory concurrence from the DTSC; or
2. Identifying the data quality objectives required for conducting a follow-on RI of the AOC at the North Highlands ANG Station if it does not meet the criteria for NFA. If the AOC is found to meet appropriate criteria for regulatory closure, it will be recommended for NFA.

4.2.3 Step 3: Identify Information Inputs

Soil and soil vapor samples will be collected from North Highlands ANG Station.

Soil samples will be analyzed for the following:

- VOCs by EPA Method 8260C;

- PAHs by EPA Method 8270-SIM; and
- Gasoline-range total petroleum hydrocarbons, TPH-D, and TPH-MO by EPA Method 8015B.

Soil vapor samples will be analyzed for the following:

- VOCs by EPA Method TO-15;¹
- Naphthalene by EPA Method TO-17;² and
- Helium by American Society for Testing and Materials (ASTM) Method D-1946.

4.2.4 Step 4: Define the Boundaries of the Study

All work will be performed at the North Highlands ANG Station in North Highlands, California. The spatial boundaries of the project are defined in the Work Plan. The field activities are anticipated to be completed in March or April 2013.

4.2.5 Step 5: Develop the Analytical Approach

The PA/SI will consist of accomplishing the following tasks in sequential order:

- Conducting a PA of the Former Hydraulic Lift.
- Installing three soil borings at the Former Hydraulic Lift, up to an approximate depth of 30 feet bgs. The soil boring locations were selected based on data collected during the One Clean SI.
- Collecting and submitting three soil samples from each boring for laboratory analysis of compounds listed on [Table 3-2](#).
- Installing three temporary soil vapor probes at the Former Hydraulic Lift to a depth between 5 and 10 feet bgs.
- Collecting and submitting three soil vapor samples for the temporary locations for laboratory analysis of compounds listed on [Table 3-2](#).

¹ Naphthalene is included in the TO-15 analyte list.

² Naphthalene by TO-17 will be analyzed only if detected in the TO-15 analysis.

4.2.6 Step 6: Specify Performance or Acceptance Criteria

The analytical soil and soil vapor data collected during the PA/SI will be compared to the residential California Human Health Screening Levels (California Environmental Protection Agency 2005) and the EPA Region IX Regional Screening Levels (EPA 2012). All PA/SI activities will be conducted following the *ANG Investigation Guidance* (ANG 2009a).

4.2.7 Step 7: Develop the Plan for Obtaining Data

Sampling and analysis protocols that are anticipated to satisfy the DQOs are included in the Work Plan (ERM 2012).

SECTION 5.0

QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENTS AND GEOLOGIC DATA

5.1 Quality Assurance/Quality Control Program Purpose

Data are potentially subject to sampling and data reduction errors. Quality Assurance Objectives (QAOs) are established to control the sources of errors and quantify the errors whenever possible. QC procedures are designed to improve sample data quality and to identify and help interpret discrepancies in results. QAOs are both quantifiable and qualifiable measures that are expressed in terms of precision, accuracy, completeness, comparability, and representativeness. Definitions for these terms and QAOs for laboratory and field samples are provided in [Section 6.0](#). If an assessment determines that QAOs are not achieved, corrective action will be taken as described in [Section 18.0](#). QAO levels will be based on a common understanding of the intended use of the data, available laboratory procedures, and available resources.

5.2 Quality Assurance Objectives Levels

QAO levels will be based on a common understanding of the intended use of the data, available laboratory procedures, available resources, and logistical limitations, if any. QAO levels will be different for each type of data collected (field measurements, mobile laboratory analysis, and fixed-laboratory analyses). QAOs are explained in more detail in subsequent sections of this QAPP.

5.3 Regulatory Parameters

Regulatory parameters are determined by the federal, state, and local rules and regulations that guide the scoping and implementation of the investigation and remediation activities.

SECTION 6.0

ACCURACY, PRECISION, AND SENSITIVITY OF ANALYSIS

Data quality assessment criteria include the parameters of precision, accuracy, completeness, representativeness, comparability, and sensitivity. Definitions for these terms and QAOs for laboratory samples are provided in the following subsections. As discussed in [Section 2.1.3](#), all laboratories to be used on CRP projects must be ELAP-certified. As such, the QAOs for laboratory accuracy, precision, and sensitivity presented in this section are those required by the ELAP program. The DoD Quality Systems Manual (QSM) for Environmental Laboratories, Version 4.2, dated 25 October 2010 (DoD 2010), must be followed. The measurement performance criteria for each QC sample are summarized on [Table 6-1](#).

6.1 Quality Assurance Objective for Precision

Precision is a measure of random error, and describes the degree to which repeated measurements are similar to one another. It measures the agreement or reproducibility among individual measurements. Precision will be measured through the use of duplicate samples collected at regular, specified intervals and/or duplicate sample analyses performed on two aliquots taken from the same sample. Duplicate samples are ideally expected to contain similar chemical concentrations; therefore, it is generally assumed that any variability in results is introduced by sampling, handling, or laboratory procedures. However, sample matrix heterogeneity, particularly in soil, can also affect precision. Laboratory precision goals are listed in Appendix F of the DoD QSM and summarized on [Table 6-1](#).

6.2 Quality Assurance Objective for Accuracy

Accuracy is defined as the degree of agreement of a measurement (or an average of measurements of the same type) with the accepted reference or true value. Accuracy includes a combination of random error (precision)

and systematic error (bias) components. Accuracy is measured through the analysis of standard reference materials and matrix spike (MS), blank spike, and performance evaluation (PE) samples.

6.2.1 Organic Laboratory Analysis Accuracy Objectives

Accuracy objectives for organic laboratory analysis also depend upon the analytical method and the sample matrix (e.g., air, water, soil). The objectives are set by ELAP, as indicated by the DoD QSM. Tables showing the accuracy objectives for organic laboratory analysis are included in Appendix F of the DoD QSM. The accuracy objectives are summarized on [Table 6-1](#).

6.3 Quality Assurance Objective for Completeness

Completeness is a measure of the relative number of usable data points that meet the acceptance criteria for accuracy, precision, and any other criterion required by the specific analytical methods used. The volume of data to be collected will be defined in project-specific work plans. Completeness goals must be realistically developed such that unattainable goals do not create data gaps and impede the progress of the respective project as a whole. Goals should account for a small portion of data that may not be usable due to unforeseen events while providing adequate data for decision-making purposes. Overall completeness is composed of field completeness and laboratory completeness and is determined by the ERM Project Manager (PM).

Laboratory completeness is based on the number of valid sample results achieved compared to the total number of sample results. The QAO for analytical data completeness is 90 percent. If the completeness objective is not met, additional fieldwork or analysis may be required as determined by the ERM PM.

6.4 Representativeness

Representativeness is the degree to which a set of data accurately represents the characteristics of a population, process condition, or environmental condition. Data are usually considered representative if the sample distribution is within statistically defined limits based on the sample population mean and variance of historical results (when

available). Representativeness is similar to comparability in that it is a qualitative rather than a quantitative goal. Because representativeness is dependent on the sample media and study design, goals must be realistically established.

Representativeness in the laboratory will be ensured by following the procedures outlined in this QAPP, the ELAP requirements, and the SOPs in each laboratory's QAPP.

6.5 Comparability

Comparability expresses the confidence with which one data set can be compared with another. Comparability is a qualitative, not quantitative, measurement. Comparability is assessed by reviewing results or procedures for data that do not agree with expected results. Strict adherence to QA/QC and sampling procedures will produce more comparable data.

Measures to ensure comparability of laboratory data include the review, as necessary, of the laboratory QAPP by laboratory personnel involved with sample receiving, analysis, and reporting. In addition, the Laboratory QA Manager will review the data and verify that the correct methods have been used. To facilitate comparability of a data set, the laboratory is required to perform the following activities:

- Demonstrate traceability of standards to National Institute of Standards and Technology or EPA sources;
- Use standard and approved methodologies;
- Use standardized units of measure;
- Use standardized QC acceptance criteria, as applicable; and
- Participate in inter-laboratory studies to demonstrate laboratory performance.

6.6 Sensitivity

Sensitivity is the capability of a method or instrument to discriminate between measurement responses representing different levels of a variable of interest, or to detect or reliably measure low levels of a variable

of interest. Sensitivity defines the detection limit (DL) as the minimum concentration of a substance that can be identified, measured, and reported with a 99 percent confidence when the analyte concentration is greater than zero. The DL is a fixed number that is determined from analysis of a sample in a given matrix containing the analyte. The limit of detection (LOD) is the minimum concentration of a substance that an analytical process can reliably detect with 99 percent confidence. The LOD is between the DL and limit of quantitation (LOQ). The LOQ is the level that can reliably be measured within specified precision and accuracy limits.

The LOQs for each analyte will be verified by a point on the instrument calibration curve in accordance with state laboratory licensure rules. Per the QSM, the LOQ shall be set at or above the concentration of the lowest initial calibration standard. LOQs should be at least three times the DL and may differ between samples or between analytes, depending on dilution requirements and DLs. Where applicable, the minimum LOQ should be equal or less than the appropriate regulatory standard. The LOQs, LODs, DLs, and project action limits are provided on [Tables 6-2 and 6-3](#).

The most common problem that impacts sensitivity is the presence of high concentrations of target analytes. This usually requires dilution of the sample by the analytical laboratory. The analytical laboratory will be requested to analyze samples at the lowest dilution possible to allow for maximum sensitivity. This will allow for lower LOQs for analytes reported as non-detect and allow for proper quantitation of analytes detected at low concentrations. For organic analyses, the analytical laboratory will be requested to report both the undiluted original results and the results from dilutions to allow for more accurate quantitation.

In addition, it is essential that the laboratory perform DL studies on instrumentation to document accuracy of quantitation limits. It is also important that the laboratory ensure that current methods and procedures are consistently performed. The laboratory will follow the DL procedures listed in Title 40, Part 136 of the Code of Federal Regulations when performing method detection limit studies.

Additionally, the laboratory will maintain current records of DL studies for each instrument, and will have established reasonable accuracy (lower control limits should be 10 percent or greater) and precision goals for each of the analytical methods utilized. The laboratory should perform DL verification studies at least annually for each method, as stipulated by National Environmental Laboratory Accreditation Conference. The

concentration of the standards used to determine the DLs should be no more than five times the expected DL value. Historical DL studies, accuracy, and precision limit control charts should be retained in the laboratory archives for 5 years.

LODs for each analyte are established per QSM guidelines for each analyte immediately after DL determination. LODs are approximately two to four times the DLs. If a laboratory uses multiple instruments, the LOD must be verified on every instrument. The laboratory shall maintain the LOD verification with the DL determination.

SECTION 7.0

FIELD MEASUREMENTS

Data quality assessment criteria for field measurements also include the parameters of precision, accuracy, completeness, representativeness, comparability, and sensitivity. QAOs for field measurements are provided in the following subsections.

7.1 Field Precision Objectives

Precision of field procedures will be assessed through the collection of field duplicate samples, which are discussed further in [Section 13.0](#). Field duplicate samples will be collected at a frequency of 10 percent of the total number of soil samples per analytical method. A minimum of one duplicate sample pair will typically be collected during each sampling event.

If the relative percent differences (RPDs) for field duplicates are within acceptance criteria (± 50 percent), the original result should be used. However, if the RPDs are not within acceptance criteria, the more conservative result should be used. This is summarized on [Table 6-1](#).

7.2 Field Accuracy Objectives

Accuracy in the field will be assessed through collection of trip blanks, equipment blanks, and field blanks. These blanks measure the bias due to cross-contamination, equipment contamination, and contamination from ambient air, respectively, and are discussed further in [Section 13.0](#). The accuracy objective for equipment and field blanks will be a bias of non-detect results (less than the LOD) for the analytical parameters of interest. In other words, the field accuracy objective is to introduce no detectable analytical results for trip blanks, equipment blanks, and field blanks. This is summarized on [Table 6-1](#).

7.3 Field Completeness Objectives

Field completeness is a measure of the number of valid field measurements obtained relative to the total number of field measurements. The percent of completeness for field data can be expressed by the following formula:

$$\text{Percent Completeness} = (V/T) \times 100$$

Where: V = Number of valid data points
 T = Total number of data points

Field completeness is based on the number of samples or field tests planned and the actual number collected or performed. Although 100 percent completeness is desirable, the completeness objective for field measurements is 90 percent.

7.4 Measures to Ensure Representativeness of Field Data

Representativeness in the field will be ensured by following standard procedures during data collection. The ERM PM will monitor the sampling program to ensure that field activities are being conducted consistently according to the procedures outlined in the QAPP and field sampling plan and detailed in [Section 8.0](#) of this QAPP. Additionally, field duplicates will reflect representativeness by measuring sample homogeneity and precision.

7.5 Measures to Ensure Comparability of Field Data

Measures to ensure comparability of field data include field personnel reviewing the QAPP and the Work Plan. ERM's PM and/or QA Manager will routinely verify that proper field activity procedures are being followed. To facilitate comparability of field data, ERM field staff will utilize the standardized sample collection procedures detailed in [Section 8.0](#) of this QAPP.

7.6 Field Sensitivity Objectives

As presented in [Section 6.6](#), sensitivity is the capability of a method or instrument to discriminate between measurement responses representing different levels of a variable of interest, or to detect or reliably measure low levels of a variable of interest. Field sensitivity basically refers to the smallest value or change in value a field instrument can reliably measure above background noise. This concept applies to measurement of parameters such as organic vapor concentrations, pH, conductivity, and dissolved oxygen. Sensitivity objectives for field measurements are included on [Table 7-1](#).

Table 7-1. Field Measurement Sensitivity Objectives

| Field Measurement | Sensitivity Objective |
|--|------------------------|
| Organic vapor concentration ³ | ± 0.1 part per million |

³ The make and model of the photoionization detector (PID) used to measure organic vapor will be determined during preparation for sampling activities.

SECTION 8.0

SAMPLING PROCEDURES

The Work Plan discusses the sampling process for the SI. Additionally, for investigative work, implementation of the Triad Approach will be encouraged to manage decision uncertainty, in accordance with the *ANG Investigation Guidance* (ANG 2009a). According to the EPA white paper, *Summary of the Triad Approach* (EPA 2004), and the Triad Research Center webpage, <http://www.triadcentral.org>, the Triad Approach involves three components described as follows:

Systematic Project Planning

- Developing a preliminary Conceptual Site Model;
- Identifying key decisions (e.g., regulatory, scientific, administrative, engineering) to be made;
- Identifying the unknowns/data gaps that are generating decision uncertainties;
- Establishing strategies to eliminate, reduce, or manage around the unknowns; and
- Proactively controlling the sources of greatest uncertainty (e.g., sample density).

Dynamic Work Strategies

- Using strategies, such as work plans, that have the flexibility to adapt to information from real-time measurements (“real-time decision-making”) and allow projects to be completed faster.

Real-Time Measurements

- Using data generation mechanisms that support dynamic work strategies and return results quickly enough to influence the progress of data collection and field activities.

Examples include field instrumentation (direct-push technologies such as laser-induced fluorescence, PID/flame-ionization detectors, Global Positioning System (GPS), etc.), in situ sensing systems, geophysics, computer systems that display field results, and rapid turnaround from a fixed laboratory.

Three boreholes will be installed to a target depth of 30 feet bgs. Three soil samples will be collected from each borehole. One temporary soil vapor probe will be installed to a depth of 5 feet bgs and a soil vapor sample will be collected. A detailed list of the sampling to be conducted is provided on [Table 8-1](#). The project schedule is complete for the next year and is provided on [Table 8-2](#). The number of samples to be collected, including QC samples, is provided on [Table 8-3](#).

Standardization of field procedures serves to increase reproducibility and to document each of the steps required to perform the task. To facilitate consistent sample collection and management, ERM has developed SOPs for sample and data collection activities. For the purpose of this QAPP, the relevant field SOPs are identified on [Table 8-4](#) and are included in [Appendix C](#).

Approved and correctly implemented field procedures should produce data of acceptable quality that meet project DQOs. Any and all nonconformance with the established sampling procedures will be identified, documented, and corrected. If a failure in the sampling system occurs, corrective action will be initiated as indicated in [Section 18.0](#).

9.1 Sample Labels

All samples will be identified with a label affixed directly to the sample container. Information that should be included on each sample label is provided in the SOP for sample container identification in [Appendix C](#).

9.2 Chain-of-Custody Record

Completed Chain-of-Custody (COC) forms maintain a record of sample collection, transfer between sample custodians, shipment, and receipt by the laboratory. The forms document that proper custody has been maintained and track the possession of the samples. For each sample collected for laboratory analysis, a COC form (Figure 9-1) will be completed legibly, in dark-colored, permanent ink.

Figure 9-1. Chain-of-Custody Form

| Environmental Resources Management | | CHAIN OF CUSTODY RECORD | | NO: 2547 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|------|--------------------------------|---------------------|--|--|-----------------|---------------|---------------|-----------------|-----------------|---------------|---------------|-----------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| 7272 E. Indian School Road, Suite 100 • Scottsdale, AZ • 85251 • (480) 996-2401 • FAX (480) 996-2106 | | | Page _____ of _____ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PROJECT # _____ | | PROJECT NAME _____ | | REQUESTED PARAMETERS <div style="display: flex; justify-content: space-around; font-weight: bold;"> WATER SOIL GAS </div> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SAMPLER (PRINT NAME) _____ | | (SIGNATURE) _____ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RECEIVING LABORATORY _____ | | # OF CONTAINERS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| REMARKS ON SAMPLE RECEIPT _____ | | | | IRM REMARKS _____ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> BOTTLE INTACT <input type="checkbox"/> CUSTODY SEALS <input type="checkbox"/> CHILLED <input type="checkbox"/> PRESERVED <input type="checkbox"/> SEALS INTACT <input type="checkbox"/> SEE REMARKS | | | | SEND REPORT TO: _____ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Information required on the COC form includes the following:

- Project name, location, and number;
- Name of ERM PM or contact person;
- Sampler name and signature;
- Sample collection dates and times;
- Sample type and matrix;
- Number and type of sample containers;
- Requested analytical parameters or methods;
- Sample preservatives, if any;
- Laboratory name and contact information;
- Signature of person relinquishing samples;
- Date and time of relinquishing;
- Special instructions, if any;
- Whether a COC seal was included on the shipping container; and
- Signature of receiver and date and time samples received (completed by laboratory upon receipt).

Any errors made on the COC form will be crossed out with a single line, initialed, and dated by the person making the correction. A sample is judged to be in proper custody when at least one of the following criteria has been met:

- The sample is in one's actual physical possession;
- The sample is in one's clear field of view after being in one's physical possession;
- The sample is in one's physical possession and is then locked up in a secure, tamper-proof container; or
- The sample is kept in a secured area that can be accessed by authorized personnel only.

After samples, QC samples, and a temperature blank have been placed in the cooler, the cooler will be packed for shipment. Samples must be packaged carefully to avoid breakage or contamination and must be shipped to the laboratory at proper temperatures. Any remaining space in the cooler should be filled with inert packing material such as bubble wrap, newspaper, etc. Under no circumstances should material such as sawdust, sand, or Styrofoam peanuts be used.

The completed COC documentation will be placed in a resealable bag and taped to the inside of the cooler lid, and the cooler will be sealed with packing tape and affixed with a custody seal. The custody seal indicates that, once sealed, the cooler has not been tampered with from sample collection to its arrival at the laboratory. Vapor samples are packaged with COC documentation in a cardboard box, sealed, and affixed with a custody seal. The seal will be either a laboratory-provided custody seal or similar label that is completed with the sampler's signature and affixed across the opening of the cooler to provide evidence that the cooler was not opened during transit. The custody seal should be taped over with packing tape such that it cannot be removed without being destroyed. This procedure will not be required for coolers that are hand-delivered to the analytical laboratory by the sampler.

9.3 Transfer-of-Custody Shipment

The transfer of samples from one person to another will be documented with signatures from both the person relinquishing and the person receiving the samples, as well as the date and time of the transfer. Prior to shipment of samples to the laboratory, the COC form will be signed and dated by a member of the field team who has verified that those samples indicated on the COC form are indeed being shipped. After packaging has been completed and the samples are locked within a cooler or cardboard box, the COC form will again be signed.

Samples will be delivered to the laboratory by via an overnight shipping service. If samples are delivered by courier or shipping service, the cooler(s) will be sealed with packing tape and a COC seal will be affixed to the lid as evidence that the cooler was not opened during transit. Upon receipt of the samples at the laboratory, the sample custodian will complete the transfer by dating and signing the COC form. The field copy of the COC form will be retained in the appropriate project file.

9.4 Laboratory Chain-of-Custody Procedures

The following subsections describe laboratory sample receipt, sample storage, and data recording procedures.

9.4.1 Sample Receipt

The steps that will be taken after receipt of the sample by the laboratory are as follows:

- Upon receipt, the sample custodian will document the presence or absence of a COC seal and, if applicable, measure the temperature of the temperature blank with a thermometer calibrated to National Institute of Standards and Technology standards. If a temperature blank was not placed in the cooler, the laboratory may use a calibrated temperature gun to record the temperature of the cooler from one of the samples. The sample custodian will record the temperature on the sample log-in form and/or the appropriate section of the COC form. This procedure is not required for air or light non-aqueous-phase liquid samples.
- Sample containers will be inspected for leakage or breakage. Damaged or leaking sample containers will be noted on the sample log-in or COC form. The sample custodian will sign the COC form with the date and time of receipt, thus assuming custody of the samples.
- In the event of non-compliant cooler temperatures, damaged sample containers, or cooler or cardboard box contents that do not agree with COC forms, the sample custodian will immediately notify the Laboratory PM. The Laboratory PM is required to notify the ERM QA/QC Officer of any problems encountered during sample log-in within 24 hours of sample receipt. Any inconsistencies will be immediately (within 24 hours of receipt at the laboratory) resolved with the ERM QA/QC Officer before sample analysis proceeds. If the sample cannot be reused, the ERM QA/QC Officer may need to evaluate whether samples must be re-collected.

9.4.2 Sample Storage

The temperature of the temperature blank will be recorded by the laboratory upon receipt. Samples requiring refrigeration will be maintained in a secure storage refrigerator at a temperature ranging from

0 to 6 degrees Celsius. Samples with the potential for exhibiting elevated levels of contaminants (i.e., pure product) should be stored separately from other project samples to reduce any possibility of cross-contamination.

Samples must be extracted and/or analyzed by the laboratory prior to holding time expiration. The holding time is the total time from sample collection to extraction or analysis. The sampling and holding time requirements are presented on [Table 9-1](#).

On a daily basis, the laboratory must monitor and record the temperatures of each refrigerator or freezer used to store soil samples, sample extracts, standards, or reagents. In the event of a refrigerator/power failure, the laboratory should have a plan to maintain required refrigerator and freezer temperatures. This plan should be available to all laboratory personnel. To ensure that samples or extracts are not tampered with, the laboratory is required to maintain a full-time security system and internal COC procedures. The laboratory may dispose of the remaining sample volume 4 weeks after delivery of the final data.

9.4.3 Data Recording

Samples will be given a unique internal laboratory number within the work order number for each group of samples delivered to the laboratory on a given day. Samples delivered together should not be split into separate work orders unless ERM directs the laboratory to do so.

The laboratory will store the original carbon copies of the COC form in a central storage area prior to submittal of the final data report. The original COC form will be included in the final data report. One photocopy will also be sent to the laboratory's locked master file cabinets or archives.

The sample custodian will alert the appropriate section managers and analysts of any analyses requiring immediate attention due to short holding times.

Samples requiring subcontracting to another laboratory must be pre-approved in writing by ERM prior to shipment of samples to that laboratory. The samples shall be packed in a manner appropriate for each sample container to minimize potential damage during shipping. To ensure sample integrity, normal COC protocol will be followed. The original COC form will be included in the sample shipment to document the transfer of custody unless otherwise indicated in the laboratory's QA Plan.

SECTION 10.0

DOCUMENTATION PROCEDURES

Thorough documentation of field activities is critical to the success of the overall project. Specifically, observations regarding site conditions or sample collection techniques may have a significant impact on data evaluation and interpretation. Field observations can often be used to explain anomalous chemical detections. The ultimate goal of documentation is to establish records that meet acceptable standards of accuracy, precision, completeness, comparability, and representativeness. These standards can be attained by providing the complete documentation described in this section.

Documentation and records anticipated to be generated during ANG projects include:

- Sampling collection and handling records, such as field notebooks or operational records;
- GPS or other geospatial data;
- Sample receipt records, including sample labels and shipping bills;
- Field notes, periodic water level and/or piezometric measurements as appropriate, borehole logs for soil borings (including lithologic descriptions), and field instrument logbooks;
- Sample COC records;
- Test method raw data and QC sample records;
- Standard Reference Material and/or Proficiency Test sample data;
- Instrument, equipment, and model calibration information;
- Computer documentation, such model input and output files as results of code and database test procedures;
- Data verification reports;

- Data validation reports and data validation catalog tables; and
- Contact reports for telephone conversations or electronic messages with regulator agency representatives, public officials, or off-site subcontractors that describe the subject of the contact remedy, as appropriate.

Other project records to be documented as they apply are:

- Inspection or assessment reports and corrective action reports;
- Interim progress reports and final reports;
- Copies of all appropriate permits to complete the scope of work;
- Billing receipts;
- Computer system user guides, and programmer software and hardware maintenance documents;
- Code description documents and model evaluation summaries; and
- Presentations to be made during and after the project, for example, to management or at technical meetings.

Field personnel will record descriptive information and/or indicate on field maps the approximate locations of specific observations.

10.1 Sample Identification

A complete record of all samples, whether submitted for laboratory analysis or not, will be maintained on one or more of the following formats:

- Daily field notes; and/or
- COC form ([Figure 9-1](#)).

10.2 Field Logs

Field data will be recorded in field notebooks and/or on data collection forms. These records should be neat, legible, completed in dark, permanent ink, and signed and dated by the person completing the entry.

Notes and forms are typically kept in a field notebook. Copies of the completed field forms or field notebook will be provided to the PM, and the data will be summarized for reporting purposes and retained in the appropriate project file. Survey data will be supplied in both hard copy and electronic data deliverable format, when possible.

The pages of the field notebooks will be sequentially pre-numbered; the field notebooks will be bound, have a water-resistant cover, and be assigned to individual field personnel for the duration of field activities. Entries will be as detailed and as descriptive as practical so that a particular situation can be recalled without relying solely on the sampler's memory. Field log entries will be dated and signed. Information entered in the field notebook will include, at a minimum, the following items:

- Project name and number;
- Dates and times of entries;
- Weather conditions;
- Names of personnel performing the activities;
- A description of sample locations, including sample name and type;
- Field instrument calibration information;
- Field instrument readings; and
- Health and safety information.

Field notebooks will be stored in ERM's project file when not in use.

10.3 Corrections to Documentation

Corrections to documentation will be made by striking out the incorrect entry, entering the corrected value or text, and dating and initialing the document; the original entry will remain visible.

10.4 Laboratory Records

Laboratory records are defined as all written, recorded, and electronic documentation necessary to reconstruct all laboratory activities that produce data and include all information relating to the laboratory's equipment, analytical test methods, and related activities.

The laboratory will retain copies of all sample, sample QC and calibration chromatograms, quantitation reports, injection logs, preparation summary sheets, corrective action reports, and summary information in a central file location⁴ for 5 years from the date of analysis. Electronic copies of raw data should also be retained by the laboratory for 5 years from the date of analysis. As standards and solvents occasionally contain impurities, the laboratory should test their purity prior to use. To demonstrate that standards and solvents are of acceptable quality, the laboratory is required to document and maintain records of standard lot numbers, standard purity, standards preparation, solvent lot numbers, and reagent purity.

Specific laboratory instrument calibration procedures for various instruments are described in detail in the method-specific procedures and laboratory SOPs for the analytical laboratory selected.

10.4.1 Manual Integration

To properly document manual integrations, the laboratory is required to retain a copy of both the unaltered and the altered (manually integrated) raw data. The analyst performing the manual integration must list the reason for the alteration of the data, and initial and date the altered chromatogram. The laboratory supervisor or QA/QC Officer should regularly review manually integrated data to verify that analysts are using proper judgment when altering data.

10.5 Final Evidence File Documentation

Policies and procedures that will be employed for document retention will be consistent with general project filing and ERM's Project Management System. This section addresses these filing procedures.

⁴ Central filing system may include an electronic filing system.

All information will be stored in files using the assigned ERM project number. At a minimum, the following information will be included in the primary project files:

- Contracting/Job Costing:
 - Proposals
 - Change Orders
 - Contracts
 - Invoices
- Correspondence/Communications:
 - Client
 - Regulatory
 - Internal
 - Status Reports
 - Subcontractors
- Data:
 - Laboratory Reports
 - Field Notes
 - Analysis/Computations
 - Aerial Photographs/Photos/Negatives
 - Transportation and Disposal Records
 - Surveying Information
- Reporting:
 - Report(s)
 - Work Plans (including Health and Safety Plans and QAPPs)

Additional filing headings may be added as warranted during project implementation. Data acquired during field efforts will be filed in the primary project files. Specifically, all primary data—including completed forms, notes, correspondence, analytical data reports, and other project information—will be stored in the primary project files. Documents will be maintained in the project file in the ERM Sacramento office for a minimum of 10 years. Working files may also be used to temporarily store information.

SECTION 11.0

CALIBRATION PROCEDURES AND FREQUENCY

Calibration is an integral part of ensuring that results are quantitated correctly. Instruments that are not calibrated either to manufacturer and/or method specifications are likely to produce unreliable results. Proper procedures must be followed and sufficient documentation maintained to ensure calibrations are performed correctly and sample quantitations accurately reflect sample concentrations.

Certified materials will be used to perform and verify calibrations. The manufacturer's lot or an internal number assigned to the standard should be referenced on calibration documents. The certificates of analysis supplied by the vendor should be stored in the laboratories and/or ERM's central filing system for a period of 5 years. This section summarizes calibration procedures for field and laboratory instrumentation.

11.1 Field Equipment

Before a field instrument can be used to test samples, the instrument will be calibrated using standard reference materials. The calibration verification may range from a single point to multiple points. The concentration of the standard, reference identification number, instrument response, instrument identification number, date, and time will be recorded on a standard equipment calibration record ([Figure 11-1](#)). The calibration verification will be performed at the start and end of each sampling event, or more frequently as warranted by the ERM QA/QC Officer or as required by the manufacturer. Instruments that do not meet minimum requirements for calibration will not be used and will be replaced by a properly calibrated instrument. Proper calibration of equipment is necessary in generating data of acceptable quality that meet project DQOs. Calibration of field equipment is briefly summarized on [Table 11-1](#).

The following field instruments/equipment will require calibration:

- All equipment will be calibrated per manufacturer instructions.

Before an analytical instrument is used, the relationship of instrument response to the known concentration of analytes in a standard or reference

material must be determined. The manner in which various instruments are calibrated is dependent on the particular type of instrument and its intended use. All sample measurements will be made within the calibrated range of the instrument and will follow method protocols for calibration.

Method protocols include *Test Methods for Evaluating Solid Waste Physical/Chemical Methods*, SW-846, and any other appropriate methodologies. Laboratory calibrations typically consist of two types: initial calibration and continuing calibration verifications (EPA 2008). The laboratory SOPs used for this project are listed on [Table 11-2](#) and are included as [Appendix D](#).

11.2.1 Initial Calibration

Initial calibration procedures are used to determine the mathematical relationship between analyte concentration and instrument response. For example, for a gas chromatograph method, three to five analyte concentrations are used to establish instrument response over a concentration range. An initial calibration that meets the reference methods calibration requirement (maximum percent relative standard deviation and/or correlation coefficient) must be performed prior to analysis of samples. A summary of calibration procedures for the analyses to be performed are included as [Table 11-3](#).

11.2.2 Continuing Calibration

A continuing calibration usually includes measurement of the instrument response to one or more calibration standards. The analytical methods require the instrument response to be within certain limits (e.g., ± 15 percent) of the initial measured instrument response.

A continuing calibration must be performed between initial calibrations and prior to sample analysis. The laboratory must perform a continuing calibration at least once every 12 hours in which samples for the project are analyzed. A valid initial and continuing verification calibration will have been performed and documented for each instrument that is used to analyze project samples. The laboratory will file each of the calibrations in a central filing system for a period of 5 years. A summary of calibration procedures for the analyses to be performed are included as [Table 11-3](#).

SECTION 12.0

ANALYTICAL PROCEDURES

Results from data analysis are the basis for assessing contaminant concentrations, extent of contamination, and compliance with state and federal regulations. The procedures used to measure chemical concentrations in samples must follow recognized methods and procedures to facilitate defensible results that are as accurate and representative of sample concentrations as possible. The analytical methods listed in the QAPP are detailed in the sources listed in [Section 20.0](#), References.

12.1 Field Testing and Screening

Field screening for organic vapors will be performed using an organic vapor analyzer. A PID may be used as selected by the ERM PM, depending upon the contaminants of concern and other factors. An SOP for organic vapor screening is included in [Appendix C](#).

12.2 Laboratory Methods

The reporting and QC limits, target compound list, and LOQs for the analytical methods are provided on [Tables 6-2](#) and [6-3](#). Samples submitted for analysis will be prepared and analyzed using standard EPA, ASTM, and/or other approved methodology as described in the following subsections.

12.2.1 Laboratory Extraction Methods

The laboratory extraction methods anticipated to be used on this project are the following:

Anticipated Laboratory Extraction Methods

| Soil |
|-----------|
| EPA 5035 |
| EPA 3546 |
| EPA 3550 |
| EPA 5030B |

12.2.2 Laboratory Analytical Methods

The analytical methods that can be used as appropriate to analyzed samples are included in the DoD QSM.

The laboratory analytical methods anticipated to be used on this project are the following:

Anticipated Laboratory Analytical Methods

| Soil | Soil Vapor |
|-----------|----------------|
| EPA 8260B | EPA TO-15 |
| 8270-SIM | ASTM D-1946Mod |
| 8015C-DRO | |
| 8015C-GRO | |

SECTION 13.0

INTERNAL QUALITY CONTROL CHECK

It is essential to demonstrate that data used for decision-making purposes are of known and appropriate quality. Data of questionable quality may not be suitable for decision-making purposes and may not meet DQOs. Thus, it is essential to define proper QC procedures and to specify limits of acceptability prior to start of sampling. Data quality is assessed by performing routine QC checks and/or analyzing QC samples at various phases of each project. QC procedures are used in the evaluation of data quality as it relates to a specific set of data. QC activities provide methods for monitoring, verifying, or quantifying the acceptability of data against established goals.

Data quality will be monitored both in the field and in the laboratory using QC samples. QC samples will be collected in the field and submitted to the laboratory for analysis. Results for QC samples will be analyzed to ensure that field procedures are not compromising data quality. In addition, the laboratory will analyze several types of QC samples to monitor for and facilitate acceptable data quality. Procedures for data reduction, validation, and reporting are described in [Section 14.0](#).

The following subsections detail the various QC samples that will be collected and analyzed to ensure that field and laboratory data are of acceptable quality and can be used for decision-making purposes. In addition, this section contains procedures for documenting quantitation limits and decontaminating laboratory equipment. QC samples will not be collected for waste characterization profiling.

13.1 Laboratory Data Reporting Requirements

All data will be reported at the EPA data report level II appropriate to the project requirements, and approximately 10 percent of the data will be reported at Level IV. To ensure that the laboratory includes sufficient information to perform a QA review or validation of the data, the laboratory will be requested to include, at a minimum, the information listed as follows:

EPA Level II data report – [Table 13-1](#)

EPA Level IV data report – [Table 13-2](#)

The laboratory will strictly adhere to the QAPP QC goals for precision, accuracy, blank samples, calibrations, and surrogate spikes.

Electronic deliverables are required to be provided in ERPToolsX in order to be compatible with Environmental Restoration Program Information Management System.

13.2 Routine Analytical Services

Laboratory QC samples will include method blanks, MSs, laboratory control samples (LCSs), laboratory duplicates, and surrogate spikes. Measurement performance criteria are listed on [Table 6-1](#) and the results of QC samples will be reported as described in [Section 18.0](#). Routine analytical maintenance is listed on [Table 13-3](#). The five types of laboratory QC samples are defined below.

13.2.1 Method Blanks

Method blanks are used to verify whether the analytical instrumentation is free of detectable contamination (i.e., less than the DL) due either to carryover from previous samples or from laboratory procedures. A method blank is prepared using laboratory reagent water or other clean, matrix-specific media. The reagent matrix is extracted and analyzed in the same manner as a sample by the laboratory. A method blank should be performed at least once per day for each matrix and method used that day. No more than 20 samples of the same matrix should be associated with a method blank; these samples and all associated QC samples are defined as the analytical batch. Target analytes should not be present at levels above the LOQ in the method blanks. Project samples that are associated with method blanks that do not meet these criteria and exhibit detections of the blank contaminant will be re-analyzed and, if necessary, re-extracted and re-analyzed. If method blank criteria cannot be met, the associated samples must be re-extracted and re-analyzed.

13.2.2 Matrix Spike Samples

MS samples are used to monitor and assess the effects of sample matrix on the sample analysis and verify the accuracy and precision of the analysis. MS samples are prepared by adding known quantities of target compounds to a sample. Per the QSM, the MS must include the target analytes as follows:

- For methods with 10 or fewer analytes, spike 100 percent of analytes;
- For methods with 11 to 20 target analytes, spike at least 10 analytes or 80 percent, whichever is greater; and
- For methods with more than 20 target analytes, spike at least 16 target analytes.

The analytical results are compared with the known concentrations added to the sample, and an MS recovery is calculated. The calculated recovery gives an evaluation of the effect of the sample matrix and accuracy of the analytical procedure.

Accuracy limits for MS recoveries are presented on [Table 6-1](#) and the DoD QSM. No corrective action or re-analysis of samples is required for MS recoveries outside of acceptable limits. MS samples will be prepared and performed by the laboratory at a frequency of one per batch of 20 samples. An MSD, as well as an MS, should be included with each batch of organic analyses. All MS/MSD samples must be spiked by the laboratory before addition of extracted fluid. The RPD for the MS/MSD is calculated as shown in [Section 17.1.2](#).

13.2.3 Laboratory Control Samples

LCSs monitor the accuracy of the analytical procedure without the potential interference of a matrix. The LCS is prepared similarly to an MS sample using the same spiking constituents, except a control (clean reagent) matrix is used. Per the QSM, the LCS must include the target analytes as follows:

- For methods with 10 or fewer analytes, spike 100 percent of analytes;
- For methods with 11 to 20 target analytes, spike at least 10 analytes or 80 percent, whichever is greater; and
- For methods with more than 20 target analytes, spike at least 16 target analytes.

The RPD is calculated in the same way as the MS recovery, discussed in [Section 17.1.2](#). LCS recoveries outside of acceptable limits should be re-extracted and re-analyzed along with the associated samples in the batch. LCSs will be prepared and analyzed by the laboratory at a frequency of one per batch of 20 samples.

13.2.4 Laboratory Duplicate Samples

One laboratory duplicate will be analyzed for each batch of 20 samples as required for methods identified in the QSM. These samples are used to monitor and assess laboratory precision, as well as potential matrix heterogeneity. Laboratory duplicate samples are performed by analyzing an additional aliquot of the sample. The two results are compared, and an RPD is calculated ([Section 14.2](#)).

13.2.5 Surrogate Spikes

These samples monitor for potential interference from the sample matrix and system performance issues. Surrogate spikes are required for organic analyses only. Known concentrations of surrogate spikes are added to each sample, including QC samples and method blanks, prior to performing an organic analysis. The surrogate spike recovery is calculated similarly to the MS and LCS recovery. [Table 6-1](#) lists the surrogate recovery limits for the various EPA methods.

Surrogate limits are based on percent recovery. Samples with surrogate recoveries outside of the acceptable limits should be re-analyzed and, when necessary, re-extracted and re-analyzed. If surrogate recoveries are still outside of acceptable limits upon re-extraction and re-analysis, the out-of-limit occurrence will be considered an indication of matrix interference and both analyses will be reported. If the surrogate recoveries are within acceptable limits in the re-extracted and re-analyzed sample, the re-extraction and re-analysis will be reported.

13.3 Field Measures

Several types of field QC samples will typically be collected and submitted for analysis for each project. Each type of QC sample monitors a different aspect of the field effort, and analytical results provide information regarding the adequacy of sample collection and transportation of samples. The results of QC samples will be discussed

and reported as described in [Section 14.2](#). The types of field QC samples that will typically be collected during the project are discussed below.

13.3.1 Trip Blanks

Trip blanks monitor for contamination due to handling, transport, cross-contamination from other samples during storage, or laboratory contamination. Positive detections in the trip blank sample results indicate cross-contamination of samples has occurred. Sample detections at similar concentrations as those reported in associated trip blank samples are considered suspect. These results may be qualified as non-detect during the data validation. In the event that detections of target analytes, other than EPA-identified common laboratory contaminants, are consistently reported in trip blank samples, adjustments to packing and handling may be implemented.

The laboratory prepares trip blank samples by filling volatile organic analysis vials with organic-free water and sealing the vial with a Teflon-lined septumated lid. Trip blank samples should not include any head space. The trip blank sample is taken to the field; the label is completed by field personnel and includes the date, cooler identification, and method of analysis; and the trip blank sample is then stored with the field samples until they are delivered to the laboratory. Trip blanks are opened only by laboratory personnel. A trip blank will be included with each cooler containing samples for VOC soil analysis.

13.3.2 Temperature Blanks

Temperature blanks monitor temperature within a sample cooler. Temperature blank results that are outside of acceptable limits (0 to 6 degrees Celsius) indicate unacceptable sample preservation and may require re-collection of samples. A temperature blank is prepared by laboratory personnel by pouring reagent water into a clean plastic container. The temperature blank is placed in the sample cooler prior to sample collection. It is stored with the sample(s) until receipt at the laboratory, at which time it is immediately opened and the temperature of the reagent water is measured and recorded on the sample log-in form. A temperature blank will be placed in each cooler containing samples for environmental analysis.

13.3.3 Equipment Rinsate Samples

These samples monitor equipment decontamination procedures. Positive detections in the rinsate sample results may indicate ineffective equipment decontamination procedures and carryover contamination of subsequent samples collected from the sampling equipment. Sample detections at similar concentrations as those reported in associated rinsate samples are considered suspect and may be qualified as non-detect during the data review. If target compound detections other than the EPA-identified common laboratory contaminants are reported in rinsate samples, adjustment of the decontamination procedures may be considered.

Equipment rinsate blanks are prepared by pouring deionized reagent water through the decontaminated equipment into sample containers. The sample is given a QC name consistent with the sample nomenclature established for each project. After placing labels on the sample containers, the rinsate blanks are then stored with the project samples until delivery to the laboratory. Rinsate samples should be collected at a frequency of 10 percent of the total number of original samples collected with a non-dedicated pump. A minimum of one equipment rinsate sample will be collected during each sampling event. If more than one rinsate sample is to be collected during a sampling event, then the samples will be collected at different locations.

13.3.4 Field Duplicates

Field duplicates monitor field and laboratory precision, as well as matrix heterogeneity. Preservation and shipping of samples and their duplicate sets will be identical. Duplicate samples will be collected at a frequency of 10 percent of the total number of original samples. A minimum of one duplicate sample will be collected during each sampling event.

13.3.5 Field Blanks

Field blanks monitor ambient site conditions for potential cross contamination. These blanks are prepared at the sample collection site by slowly pouring water into clean sample containers. At least one field blank prepared with ASTM Type II decontamination water will be submitted during each sampling event, if quarterly monitoring is needed. Field blank samples will be analyzed for each of the monitored parameters.

SECTION 14.0

DATA REVIEW, REDUCTION, VALIDATION, AND REPORTING

This section describes the QA activities for data review, reduction, validation, and reporting that may be implemented. These procedures have been developed to facilitate accurate and reproducible results. The objective of these procedures is to document the history of a sampling or measurement activity to ensure that data containing typographical errors or miscalculated results are not used for decision-making. A standardized system has been developed to reduce both raw field and laboratory data, to validate data, and to report analytical results in a consistent, reproducible format.

14.1 Field and Technical Data

This section identifies the data review, reduction, verification, and validation procedures required for the project. All data will be reviewed by the ERM PM. In addition, all data will be verified and approximately 10 percent of the data will be validated by a data validation subcontractor.

14.1.1 Field and Technical Data Review

Prior to data reduction, field and technical data will be reviewed by the ERM PM or qualified designees to ensure that project DQOs are met. The following items will be reviewed:

Sampling Program Design Execution

Sample collection records will be reviewed by the ERM QA/QC Officer/PM or qualified designee to ensure that samples have been collected according to the sampling design. Items to be reviewed include the types and numbers of samples collected, sampling locations and frequencies, and measurement parameters of interest. Deviations must be reported to the PM immediately. The PM will determine whether the sample(s) having the deviation(s) provide(s) acceptable data.

Sample Collection Procedures

Sample collection procedures will be reviewed by the PM or a qualified designee, such as the ERM QA/QC Officer, to ensure that the appropriate procedures have been followed. Items to be reviewed include sampling methods and equipment, sample type, time, location, sample preservation requirements, decontamination procedures, and disposal of investigation-derived waste. Deviations must be reported to the PM immediately. The PM will determine whether the sample(s) having the deviation(s) provide(s) acceptable data.

Sample Handling

Sample handling procedures will be reviewed by the PM or a qualified designee, such as the ERM QA/QC Officer, to ensure that the appropriate procedures have been followed. Items to be reviewed include sample labeling, COC documentation, sample extraction and holding times, sample packaging, and shipment. Deviations from established procedures must be reported to the PM immediately. The PM will determine whether the sample(s) having the deviation(s) provide(s) acceptable data.

Quantitative Field Data

It is essential that observations and recorded data are accurate and detailed. Project-specific work plans will specify requirements for documentation including the following items as appropriate:

- Types of forms used in the field;
- Information to be reported in the notebook or on a form (e.g., date, name or initials of the sampler, sampling procedure, location, sample type, sample identification, preservation, or other applicable items); and/or
- Field data reduction methods, including equations and reporting units.

Field data will be reviewed by the ERM QA/QC Officer, ERM PM, or a qualified designee to verify that the following items are correctly documented and/or performed:

- Accurate descriptions of field observations;
- Field instrument analytical techniques and sample screening results;
- Field instrument calibration verification results and procedures; and

- Calculations used in the field.

Field data may be provided in electronic format or as copies of field logbook entries. Field data will be stored in the appropriate project files and organized by the phase of the field investigation as described in [Section 10.5](#). Deviations from established procedures must be reported to the PM immediately. The PM will determine whether the sample(s) having the deviation(s) provide(s) acceptable data.

14.1.2 Field and Technical Data Reduction

Field and analytical data will be summarized on tables as appropriate and discussed in the text of the data report. Data will be presented in figures generated using Geographic Information System (GIS), following the *Policy on ANG Environmental Geospatial Data Deliverables* (ANG 2008). GIS will be used to visually demonstrate the extent of the measured concentrations.

14.1.3 Field and Technical Data Review

The ERM PM will ensure that the field and technical data obtained for each project will provide the end user with acceptable data. All field and technical data shall be reviewed, by the PM or a qualified designee, such as the ERM QA/QC Officer, to ensure that the data is accurate prior to the inclusion in the project report. Review will involve recalculating information reported on field forms and review to check for errors in field personnel documentation or incorrect interpretation of field instrument readings. The process of reviewing field data will involve evaluating field records for consistency and completeness, reviewing QC and calibration information, evaluating whether appropriate SOPs were followed, summarizing deviations and determining their impact on data quality, summarizing the samples collected, and summary of the review in the project report.

14.2 Laboratory Data

This section describes the data review, reduction, verification, validation, and reporting processes for laboratory data, as well as who is responsible for executing each process.

14.2.1 Laboratory Data Review and Reduction

The laboratory will review and reduce the data internally prior to submitting the data to the ERM PM. Laboratory SOPs for internal data review procedures are included in each laboratory's QAPP. Specifically, the laboratory will review the data package to ensure the following:

- Sample preparation information is correct and complete;
- Analytical information is complete and was generated within acceptable criteria;
- Any discrepancies/corrective actions identified during sample login, preparation or analysis have been addressed and documented;
- The appropriate SOPs have been followed;
- QC samples were within established control limits;
- Analytical requirements have been met (e.g., the correct analytical procedures were used as defined by the COC); and
- Documentation is complete and any QC issues are fully explained in a detailed case narrative.

An authorized laboratory employee must sign the data package to indicate the data have been reviewed.

Data will be reduced in the laboratory following method protocols and reported in standard formats. The data will be peer-reviewed by a qualified analyst before it is released to the client. The review should be documented with a standard checklist that has been initialed and dated by the peer reviewer. Reporting requirements for analytical data pertain only to the final data report.

14.2.2 Laboratory Data Review, Verification and Validation

Following receipt of the laboratory report, ERM will send data to Laboratory Data Consultants, Inc. (LDC) to perform Level IV validation. ERM staff will perform the Level II data review. This three-part process is described in the following paragraphs.

Data Review

All laboratory results will be reviewed by the ERM PM to verify that the data package is complete. The completeness check will include a brief screening of six basic elements that should be included in each data package. Those six elements are described in the checklist included as [Table 14-1](#).

Data Verification

Guidance for data verification is provided in EPA's *Guidance on Environmental Data Verification and Data Validation* (EPA 2002b) and EPA's National Functional Guidelines (EPA 1999; EPA 2004). One hundred percent of laboratory data will be verified by the PM or designee. The person performing data verification will be a staff professional with a minimum of 2 years of experience in sample collection, COC documentation, and data review.

Data verification involves verifying the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual requirements. This review typically can be performed by a review of a Level II data package utilizing only the summary forms and does not involve review of the raw data. Data that do not meet the acceptance criteria such as accuracy, precision, and holding time as described in this QAPP will be qualified. The qualifier applied to the data will depend upon the severity of the exceedance. Data that are non-detect with grossly exceeded holding times or exceptionally low spike (less than 10 percent) recoveries will be rejected and deemed unusable. Data that are found to be outside of acceptance criteria and do not grossly exceed criteria will be qualified as estimated.

Data found to be associated as detailed in the appropriate National Functional Guidelines document (EPA 1999; EPA 2004). While the National Functional Guidelines for Superfund are newer, the National Functional Guidelines selected are based upon methods similar to the SW-846 methods used for this project.

During verification, data are reviewed for compliance with the pre-established project goals and limits defined by data quality indicators and DQOs. Data that do not meet these goals or limits may require qualification to identify results that should be used with caution or should not be used for decision-making purposes. [Table 14-2](#) lists the items to be checked during data verification.

The verification process for laboratory-generated data will include the elements of [Table 14-1](#) and the following:

- Case Narrative Review. Review the case narrative to ensure that any anomalies, deficiencies, or QC problems have been identified. Any corrective actions should also be discussed in the case narrative.
- Chain-of-Custody Review. Review the data package to ensure that an original copy of this form has been included. Receipt signatures from laboratory personnel should be included on this form.
- Holding Time Review. Review extraction/preparation and analysis holding times for compliance with method- or project-prescribed holding times.
- Matrix Spike Review. Review MS recoveries for compliance with project-specified limits, appropriate corrective actions, and potential interference from the sample matrix.
- Laboratory Control Sample Review. Review LCS recoveries for compliance with project-specified limits, appropriate corrective actions, and to verify laboratory accuracy.
- Matrix Spike and Laboratory Duplicate Review. Review RPD calculations for compliance with project-specified limits, appropriate corrective actions, and to verify laboratory precision.
- Method Blank Review. Review method blank results for positive detections of target compounds and compare with positive sample detections for possible sample contamination. This evaluation will also include assessing potential impact of qualified data on low reporting limits and action levels.
- Trip, Field, and Equipment Rinse Blank Review. Review trip, field, and/or rinse blank sample results for positive detections of target compounds and compare with positive sample detections for possible sample contamination.
- Surrogate Review. Review surrogate recoveries for compliance with limits listed on [Table 14-1](#) to verify whether sample results were subject to interference from the sample matrix.
- Field Duplicate Sample Review. Review results for original and field duplicate samples for positive detections (the RPD is calculated for all positive detections and reviewed for agreement).

- Completeness Review. Compare the amount of valid, usable data to the amount of data collected to verify that completeness goals have been achieved ([Table 14-1](#)).
- Comparability Review. Review data to verify that results are comparable and can be used without limitations.
- Representativeness Review. Review data set to verify that results are representative of site conditions.

Data Validation

Validation differs from verification in that issues are identified through inspection of raw data. Data validation is a more thorough review process than the data verification process described above. Data validation will be performed by LDC. Data review and verification will be performed for 100 percent of the data. Data validation will be performed on analyses containing project-specific contaminants of concern. A minimum of 10 percent of the data containing project-specific contaminants of concern will be reported at EPA Level IV and be assigned for data validation.

Data validation involves review of raw data, verifying calculations and procedures performed to generate sample results. When possible, laboratory data will be validated in accordance with method requirements. In the absence of method-specific requirements, data may be validated according to Contract Laboratory Program National Functional Guidelines (EPA 1999; EPA 2004). Project-specific calculations or algorithms are not anticipated for the project. Documentation requirements for performing data validation will be consistent with the EPA publication entitled *Laboratory Documentation Requirements for Data Validation* (EPA 2001b).

[Table 14-3](#) lists the items to be reviewed during data validation. In addition to the data verification requirements, data validation will include the following:

- Initial Calibration Review. Review initial calibration calculations for agreement with summary form results, linearity, and method-specified minimum requirements;
- Continuing Calibration Review. Review continuing calibration calculations for agreement with summary form results, linearity, and method-specified minimum requirements;

- Internal Standard Review. Review internal standard responses to ensure that minimum and maximum method-specified requirements are met and the correct internal standard has been assigned to target compounds and surrogates;
- Target Compound Identification Review. Review target compounds identified in project and QC samples and ensure that calculated concentrations and identifications are accurate; and
- Contract-Required Detection Limit Sample Review. Review contract-required DLs against sample results for project-specified limit requirements (e.g., action limits).

If deemed appropriate according to the EPA National Functional Guidelines, Contract Laboratory Program data qualifiers will be applied to indicate potential concerns regarding data quality. Data qualifiers that may be applied to project data based on data validation are listed below:

- **U**: The analyte was analyzed, but not detected above the reported LOD or the LOQ was raised to the concentration found in the sample due to blank contamination;
- **J**: The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample or result/LOQ is estimated due to quality control issues identified during the verification or validation process;
- **N**: The analysis indicates the presence of an analyte for which there is presumptive evidence to make a “tentative identification;”
- **NJ**: The analysis indicates the presence of an analyte that has been “tentatively identified” and the associated numerical value represents its approximate concentration;
- **UJ**: The analyte was not detected above the reported LOQ; however, the LOQ is approximate and may or may not represent the actual LOQ necessary to accurately and precisely measure the analyte in the sample; and
- **R**: The sample result or LOQ is rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria. The presence or absence of the analyte cannot be verified.

The application of nonstandard qualifiers may be deemed necessary and used for atypical situations such as contamination of samples from a preservative. Nonstandard qualifier definitions (if applicable) will be included in the database.

ERM staff will perform the Level II data review and LDC will perform the Level IV data validation, and results will be summarized in text and tables included in a validation report. Validation reports will be included as an appendix to the report. Validation issues can arise when the validation process uncovers a data entry error, errors made during scaling or conversion, or errors made during transformations. The validator will request resubmittal of any data requiring change or correction and will document resubmittal in a table included in the validation report. Any issues or deficiencies that are identified will be resolved between the DTSC Project Manager and ERM QA/QC Officer through verbal or written communication. If validation issues arise, additional data may be validated to determine whether additional errors have been made.

14.3 Geospatial Data Deliverables

Geospatial data is data that has both a spatial component and a thematic component. Spatial components of geospatial data are absolute locations, such as locations in a coordinate system, and topological locations relative to other features. Thematic components of geospatial data are the values of the data at a given location (e.g., 34 milligrams per liter of trichloroethene at MW-1 on 24 July 2010). ERM will follow the guidelines established by the ANG in the NGB/A7O memorandum A7O 09-01 *Requirements for Geospatial Data Deliverables* dated 31 December 2009 ([Appendix A](#)). The memorandum required implementation of the ANG's *Electronic Data Deliverables Requirements* guidance document issued in October 2009 (ANG 2009b). This guidance document explains NGB/A7OR-specific data deliverables and supplies specifics for open and closed Installation Restoration Program sites that were not supplied in the previous guidance documents.

The ANG Geo Integration Office provides a training course titled *Understanding ANG's Spatial Data Requirements*. ERM will ensure that appropriate personnel have attended this training course. As such, they will assist in producing maps in ESRI ArcGIS and Personal Geodatabases in Spatial Data Standard for Facilities, Infrastructure, and Environment format.

Common installation pictures (CIPs) for many installations are not yet available. As new projects and delivery orders are awarded and CIPs become available for each base, we will work with the ANG PMs on the transition to formatting the new data in accordance with the ANG's Geospatial Data Deliverable Requirements. ERM will contact the ANG's Geospatial Information and Services or the installation directly to request the most recent CIP, if available. An official data request form must be submitted to receive this information. In addition, the ERM PM will contact the Geospatial Information and Services for the most recent copy of the ANG's Geospatial Data Deliverable requirements, since the document will be continually updated.

14.3.1 Data Delivery Requirements

The following software is required for deliverables:

- Microsoft Office 2003 or 2007 (Professional Edition);
- Adobe Acrobat 8 or later;
- ESRI ArcGIS 9.2 or later; and
- AutoCAD 2006 or later.

14.3.2 Geographic Information System Requirements

The following is a summary of requirements specific to GIS:

- Data must be in the same projection as the CIP;
- Data must be created in Personal Geodatabases, utilizing the Spatial Data Standard for Facilities, Infrastructure, and Environment format;
- Cartographic standards must be adhered to (e.g., north arrow, scale, legend, etc.);
- Files must be submitted as an MXD file, as well as in PDF or JPEG format;
- No superfluous layers should be placed in the data frame of the MXD; and
- A relative path setting must be used.

14.3.3 Geospatial Data Deliverable Formats

The submission files should be organized in the following file format:

- Project;
- CIP;
- Other Data;
- External Sources;
- CAD;
- GPS; and
- Metadata.

14.3.4 Importance of Metadata

Metadata is information, usually text, used to describe and catalog data. It is sometimes described as data about data. The importance of metadata cannot be overstated. The following guidelines should be followed when creating a layer's metadata:

- Use good writing skills;
- Generate the metadata when a feature is created so no information is lost;
- Update metadata when a feature is updated;
- Make sure the metadata is not too general; and
- Included enough detail to enable sufficient evaluation and use of the data.

SECTION 15.0

PERFORMANCE AND SYSTEM AUDITS

To assess the effectiveness of the QA program and QC activities, audits may be performed and documented. The assessment will be performed to ensure that the procedures have been implemented. The various assessment and response actions that may be undertaken are discussed in the following subsections.

Systems and performance audits and checks may be conducted to evaluate the adequacy of the QA program and to ascertain whether it is being properly and uniformly implemented. QA audits may be initiated by the PM, regulatory agencies, or the laboratory. The QA/QC Officer or a qualified designee is responsible for such audits. QA audits are based mostly on procedural reviews and, therefore, are qualitative as compared to QC audits, which are quantitative.

QA audits also assess the effectiveness of the QA program, identify nonconformances, and verify that identified deficiencies are corrected. Upon discovery and documentation of any significant deviation from the QA program identified during an audit, corrective action measures will be immediately implemented and documented. The scope and components of the systems, performance, and procedure audits are described below.

15.1 Project Systems Audits

A systems audit verifies that the components of the task or measurement system(s) have been properly selected to ensure that the system is capable of producing the appropriate data. Systems audits may be conducted in both the field and the laboratory prior to, or soon after, startup to identify and resolve any potential problems early in the program. Additional field and laboratory systems audits may be conducted throughout each project.

15.2 Technical Performance Audits

A performance audit is defined as a review of the existing procedures and analytical data (sample and QA) to determine the accuracy of the total measurement systems, or a component of the system. The analysis of project-specific laboratory PE samples is the primary method for a performance audit of the laboratory. An equivalent evaluation sample audit method is difficult to produce in the field; therefore, procedure audits will be performed to assess the accuracy and consistent application of SOPs.

15.3 Field Audits

15.3.1 Field Systems Audits

A field systems audit may be conducted at the initiation of fieldwork for each project phase and at other times, as needed. The ERM QA/QC Officer or PM will review the field equipment selection to ensure that the equipment is capable of accurately performing the desired functions. Equipment selection review will be based on the capabilities and limitations of the instrument/sampling device. Equipment use will be reviewed based on observations and comparison of actual versus expected results. The auditor will also review field records to ensure that field activities are being properly documented.

The ERM QA/QC Officer and the PM both have the authority to stop work in the event one of them finds that no adequate equipment is available. In addition, a field auditor will meet with key field staff members to evaluate the field program and the need for changes that may improve results. Field audits will be performed approximately once per year. Specific issues evaluated will include adequacy and applicability of the data collection and sampling procedures, effectiveness of the decontamination procedures, disposal of investigation-derived waste, applicability of health and safety protocols, and other issues as needed. The field auditor will be the PM or qualified designee.

If the field auditor is a person other than the PM, a verbal report summarizing the results of the audit will be provided to the PM within one working day following the audit. The PM has the authority to stop work at any time for any justifiable reason. If the field auditor is not the PM, the auditor only has authority to stop work if health and safety issues

exist or if field personnel are not following standard written protocols for data collection, sampling, and waste disposal. Any nonconformances identified during the audit will be reported immediately to the PM and remedied as soon as possible.

A written report documenting all activities associated with the field systems audit will be provided to key personnel and placed in the appropriate project file within 10 working days of completion of the audit. The report may document on-site meetings, findings, and program revisions as necessary. Corrective action implementation and documentation are discussed in [Section 16.0](#). The PM is responsible for deciding corrective action(s), if necessary. The QA/QC Officer will be required to respond in writing within 5 days of receipt of a written report, addressing any necessary corrective actions implemented as a result of audit findings. A follow-up audit will be performed during the next applicable field event to confirm that recommendations for improvement are being implemented. Audit reports and responses should be placed in the main files for the study area in which the field audit was performed.

15.3.2 Field Performance Audits

Performance audits of field activities consist of procedure audits that may be conducted during each project phase by the PM or qualified designee. During a procedure audit, the field auditor observes and reviews actual procedures to verify conformance with written field procedures as well as sampling and analysis protocols. Specific attention is given to sampling, data collection, sample preservation, decontamination, and disposal of waste to demonstrate compliance with required procedures. Field instrumentation QC procedures are also verified. The field auditor meets with key field staff members to evaluate the field program and determine if changes are necessary to improve data quality.

Prior to a field procedure audit, the auditor prepares a list of items to be audited. This list may be based on the applicable written field procedures. Audit items are tied to the tasks defined in the field procedures, as well as in the sampling and analysis protocols, rather than restricted to a specific list. The field auditor verbally reports the results of each audit to the PM within one working day to transmit any significant problems with the field QA program. Any nonconformance identified during the audit will be reported immediately to the PM and remedied as soon as possible. A written report will be provided to key personnel and placed in the appropriate project file within 10 working days of each audit. This report

could include a field audit checklist, documentation of on-site meetings, findings, and program revisions.

The PM is responsible for deciding corrective action(s), if necessary. Corrective action implementation and documentation are discussed in [Section 16.0](#). The PM has the authority to stop work at any time for any justifiable reason. If the field auditor is not the PM, the auditor only has authority to stop work if health and safety issues exist or if field personnel are not following standard written protocols for data collection, sampling, and waste disposal. A follow-up audit will be performed during the next applicable field event to confirm that recommendations for improvement are being implemented. Audit reports and responses should be placed in the main files for the study area in which the field audit was performed.

15.4 Laboratory Audits

15.4.1 Laboratory Systems Audits

The ERM QA/QC Officer or qualified designee may conduct laboratory systems audits. This auditor, in conjunction with the Laboratory QA Manager, may conduct the systems startup audit to ensure that all instruments proposed or in use are appropriate for the given methods and functioning properly. Additional external audits will be performed as needed. Internal laboratory audits should be performed by the Laboratory QA Manager, Laboratory PM, or qualified designee annually.

During internal and external audits, the auditor will observe and review laboratory procedures and analytical results to ensure that they conform to the operating procedures and reporting requirements. Prior to the laboratory audit, the auditor will prepare a list of items and procedures to be audited. Audit items may be tied to the analyses of the samples in progress rather than be restricted to a specific list. Internal systems audits will include a review of the following:

- Sample custody and tracking procedures;
- Calibration procedures and documentation;
- Completeness of data forms, notebooks, and other data reporting documents;
- Compliance with laboratory SOPs;

- Data review and validation procedures;
- Data storage, filing, and record-keeping procedures;
- QC procedures, criteria, and documentation;
- Operating conditions of equipment and facilities;
- Employee training records; and
- Laboratory information and management system procedures and security.

External systems audits will include a review of the previous items plus a review of laboratory internal assessment SOPs and laboratory internal assessment documentation. The auditor will meet with key staff members to evaluate the program and determine if corrective actions are necessary to improve the data quality.

The auditor will submit a report in writing to the ERM QA/QC Officer or PM within 5 working days of the audit. The report will include the documentation of on-site meetings, findings, and proposed revisions. A written assessment of the laboratory with any suggested changes in procedures will be provided to the laboratory. Follow-up audits will be conducted if warranted by the audit findings. If changes in the systems are necessary, the Laboratory PM or designee will make the changes. Written confirmation within 10 days will document any corrective actions the laboratory has implemented to meet requirements of the measurement system. The letter should be directed to the ERM PM or QA/QC Officer's attention.

After the ERM PM has been notified (following the initial systems audit) that the laboratory systems are all satisfactory, QC measures will be implemented. After implementation of the plan, all procedures will be monitored internally by the laboratory to facilitate compliance with the requirements. Any significant problems within the system will be verbally reported immediately to the QA/QC Officer. Verbal notification will be followed by a written report within 10 working days from completion of the audit and/or the resolution of the change. Written reports should be retained in the laboratory permanent files, as well as in ERM's project file.

15.4.2 Laboratory Performance Audits

Laboratory performance audits may be conducted either internally or by outside agencies. Laboratory performance may be audited through PE check samples that contain certified concentrations of target analytes. The PE sample is submitted to the laboratory under a fictitious sample identification number and the results are compared to the certified values. Review of PE sample data includes verifying the following:

- Sample analysis was completed following the correct methodology;
- Correct identification and quantitation of sample analytes;
- Accurate and complete reporting of data to meet project specifications; and
- Instruments are operating within established precision and accuracy control limits.

Results that do not fall into the certified limits of acceptability may indicate a laboratory performance problem and will trigger immediate corrective actions. PE samples may be submitted prior to or during sample collection. Laboratories are routinely audited by State agencies for compliance with government regulations. Results of these performance audits will be provided upon request to the ERM QA/QC Officer for review.

In the event that the results are unacceptable, use of the analytical laboratory may be discontinued. The ERM QA/QC Officer and/or PM will make the decision whether to continue using the current laboratory or to select another laboratory. All samples will be analyzed by a laboratory that is currently certified for the required analytical methods.

SECTION 16.0

PREVENTIVE MAINTENANCE

Equipment that will be used to analyze samples will be inspected, tested, and calibrated to ensure that it is operating properly prior to use. These checks will be performed in accordance with manufacturer and/or testing method recommendations. Instruments found to be operating below minimum standards will not be used to analyze project samples. A qualified technician will repair the instrument before it is used to test samples. All checks and inspections will be properly documented.

Preventive maintenance generally involves the routine replacement or adjustment of equipment and instrument components as specified by the manufacturer to prevent failures. Preventive maintenance will be performed in accordance with the manufacturer's manual to facilitate timely and accurate sample collection and analysis. The goal is to reduce down time or loss of time due to equipment or instrument failure or inaccuracy.

16.1 Field Equipment

The following field instruments and equipment may be used:

- PIDs.

Field instruments will also be examined prior to each mobilization for field activities to identify maintenance issues. If maintenance issues exist, maintenance will be performed by qualified personnel according to manufacturer guidelines. If equipment requires maintenance or repair by an off-site facility, ERM will inspect the equipment upon return to ensure that the maintenance issue(s) were resolved. Maintenance and service repairs will be documented in ERM's equipment files on a standard equipment maintenance log ([Figure 16-1](#)).

The analyzing laboratory will have a written SOP covering decontamination of glassware, instruments, and other items that come into contact with samples, standards, or blanks. At a minimum, the laboratory will wash glassware and similar items in a laboratory-grade detergent. Washed items will be rinsed in clean tap water with a final deionized rinse and, where appropriate, a final solvent rinse. Broken or damaged glassware should not be used for the preparation or analysis of standards, samples, or blanks.

In addition, the laboratory will also have a procedure to decontaminate or clean instruments that have been compromised by highly contaminated samples. At a minimum, the laboratory will re-analyze any samples following a sample with detections above the linear range of the instrument, if subsequent samples contain detections of those analytes.

16.3 Instrument Maintenance Logbooks

Maintenance or service repairs will be recorded in a bound service logbook. Service logbooks will clearly document the date, description of problem, service or maintenance performed, and the initials of the person(s) performing the work.

SECTION 17.0

SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

17.1 Laboratory Procedures

Routine procedures for determining the accuracy, precision, and bias of laboratory measurements are described in this section.

17.1.1 Routine Laboratory Accuracy Assessment Procedures

MS samples measure bias in laboratory accuracy caused by sample matrix interference. Bias due to matrix effects may be calculated as:

$$\text{Bias} = ((X_s - X_u) - K) \times 100\%$$

Where:

| | | |
|-------|---|-----------------------------------|
| X_s | = | Measured value of spiked sample |
| X_u | = | Measured value of unspiked sample |
| K | = | Known value of spike added |

Blank spike samples are commonly referred to as LCSs. Accuracy objectives depend on the sample media and the type of analysis. The goal of laboratory accuracy, which is measured by percent recovery, is to demonstrate the laboratory's ability to successfully perform analyses. LCS and PE samples measure laboratory accuracy without the potential interference of a sample matrix.

Analytical accuracy is calculated by expressing, as a percentage, the recovery of an analyte that has been added to the sample (or standard matrix) at a known concentration before analysis, and is calculated from the following formula:

$$\text{Percent Recovery} = \frac{(\text{SSR} - \text{SR})}{\text{SA}} \times 100\%$$

Where:

| | | |
|-----|---|----------------------|
| SSR | = | Spiked sample result |
| SR | = | Sample result |
| SA | = | Spike added |

The spiked concentration will be specified by laboratory QC requirements or may be determined relative to the background concentrations observed in the non-spiked sample. In the latter case, the spiked concentration should be significantly (two to five times) higher than the background concentration to permit a reliable recovery calculation.

Analytical bias will be assessed through the use of known LCSs and site-specific MS sample analyses. LCSs and MS/MSD sample analysis will be performed as prescribed by the analytical method SOPs. LCS analyses will be performed with each analytical batch of project samples to determine the accuracy of the analytical system.

The results of the LCS and MS/MSD analyses will be compared against the acceptance criteria presented in the laboratory reference data provided on [Table 13-1](#).

The accuracy of organic parameter analyses is also monitored through the analysis of system monitoring or surrogate compounds. Surrogate compounds are added to each sample, standard, blank, and QC samples prior to the sample preparation and analysis.

Surrogate compound percent recoveries provide information on the effect of the sample matrix on the accuracy of the analyses and are evaluated against the acceptance criteria ([Table 13-1](#)).

17.1.2 Routine Laboratory Precision Assessment Procedures

Precision of laboratory procedures will be assessed through the analysis of MS/MSD and laboratory duplicate samples. The goal of MS/MSD laboratory duplicate analysis is to demonstrate the ability to acceptably reproduce analytical measurements. RPD is used as the measure of precision between MS and MSD samples and laboratory duplicate pairs. The formula for calculating RPD is as follows:

$$RPD = \frac{|SPL1 - SPL2| *}{(SPL1 + SPL2)/2} \times 100$$

Where: SPL1 = first sample analysis, and
 SPL2 = duplicate sample analysis
 * = absolute value

MS/MSD and laboratory duplicate samples will be analyzed at the frequency of one sample pair per analysis batch. An analysis batch is defined as no more than 20 samples of the same matrix. If the RPDs for

laboratory duplicates or MS/MSD pairs are not met, the specific analyte(s) in the parent sample will be reported by the laboratory as a qualified result. The project team will evaluate during data validation to determine the source and importance of the difference.

17.1.3 Routine Laboratory Completeness Assessment Procedures

The ERM PM will evaluate completeness. The percent of completeness is expressed by the following formula:

$$\text{Percent Completeness} = (V/T) \times 100$$

Where: V = Number of valid data points
 T = Total number of data points

17.2 Field Procedures

Routine procedures for determining the accuracy, precision, comparability, completeness and sensitivity of field measurements are included in [Section 7.0](#) of this QAPP.

SECTION 18.0

CORRECTIVE ACTION PROTOCOLS

Nonconformances with QC procedures will be identified, documented, and corrected. Work that is dependent on the nonconforming activity will be halted until the nonconformance is corrected.

18.1 Field Corrective Action

Corrective actions to remedy a nonconforming situation in the field can be defined by the ERM field personnel or the ERM QA/QC Officer or PM. A description of the required action will be documented on the Corrective Action Report form ([Figure 18-1](#)). Corrective actions must be approved verbally by the QA/QC Officer prior to implementation. Upon implementation of the corrective action, the ERM QA/QC Officer or PM will be provided with the completed Corrective Action Report form, which becomes part of the project file. Copies of completed Corrective Action Report forms will also be provided to project personnel in the PA/SI Report.

Figure 18-1. Corrective Action Report Form

| | |
|--|--------------------------------|
| Nonconformance And Corrective Action Report | |
| | Date: _____ |
| | ERM-West Project Number: _____ |
| SUBMITTAL | |
| To: Project Director QA/QC Officer | |
| Description of Nonconformance and Cause: | |
| Proposed Corrective Action: _____ _____ | |
| Submitted By: _____ | Location: _____ |
| Approved By: _____ | Date: _____ |
| <u>CORRECTIVE ACTION</u> (by Project Manager or Designee): _____ | |
| Implementation by Action assigned to: Actual Corrective Action: Implementation verbally approved by QA Officer on _____ _____ (date) | |
| Action implemented on _____ (date) | |
| _____ (Signature) | |
| <u>VERIFICATION (by QA/QC Officer or Designee)</u> Corrective Action implementation reviewed and Work Inspected by: on _____ | |
| Corrective Action Verified by on _____ | |

Figure A18-1
Corrective Action Report
162nd Fighter Wing
Arizona Air National Guard
Tucson International Airport
Tucson, Arizona
ERM 0000

18.2 Laboratory Corrective Action

The laboratory has an established corrective action policy that can be initiated at several operational levels. During or following the analysis of project samples, the Laboratory PM or Laboratory QA Manager will provide the ERM QA/QC Officer or qualified designee with a corrective action memo documenting the nonconformance and resolution. This memo will be included in the appropriate project file. Corrective action or nonconformance reports issued by the laboratory will be included in data deliverables. Further information regarding laboratory corrective actions can be found in the specific laboratory QA Plans. Copies of completed Corrective action or nonconformance reports will also be provided to project personnel in the PA/SI Report.

SECTION 19.0

REPORTS TO MANAGEMENT

This section describes the types of reports that may be produced for the project and designates the party responsible for their production. The types of reports that may be produced include data quality assessment reports, project status reports, PE and audit reports, corrective action reports, data validation reports, and final project reports.

19.1 Data Quality Assessment Reports

The field staff will report to the ERM QA/QC Officer, PM, or a qualified designee on the progress of each phase of field work and any QA/QC issues associated with field activities. Additionally, the laboratory will maintain detailed procedures for record-keeping and reporting to support the validity of all analytical work. The Laboratory QA Manager will provide the ERM QA/QC Officer shall provide DoD ELAP or National Environmental Laboratory Accreditation Conference certification documentation including audit reports upon request. A data quality assessment will be included in the PA/SI Report to ensure that the DQOs were met.

19.2 Project Status Reports

Project status reports will be generated by the ERM PM and will consist of monthly progress reports provided to the ANG. In addition, a PA/SI Report will be provided to the ANG.

19.3 Performance Evaluation and Audit Reports

As discussed in [Section 15.4](#), laboratory performance evaluations and audits may be performed during the course of the project. If performed, the ERM QA/QC Officer will prepare a report summarizing the results.

19.4 Corrective Action Reports

When applicable, corrective action reports will be generated as discussed in [Section 18.0](#).

19.5 Data Validation Reports

Data validation reports will be prepared and submitted to the ERM PM for review as soon as practical following the receipt of analytical results from the laboratory. Data validation reports will be submitted to the ANG PM in the PA/SI Report, as determined by the ERM PM.

19.6 Preliminary Assessment/Site Investigation Report

A PA/SI Report will be produced by the ERM PM. This will include a summary of all data collected, data validation reports, and a data quality assessment.

SECTION 20.0

REFERENCES

- Air National Guard (ANG). 2008. *Policy on ANG Environmental Geospatial Data Deliverables*.
- ANG. 2009a. *Environmental Restoration Program Air National Guard Investigation Guidance*, September 2009.
- ANG. 2009b. *Electronic Data Deliverables Requirements*. Air National Guard Geo Integration Office. Andrews AFB, Maryland. October 2009.
- BB&E Consulting Engineers & Professionals. 2009. *PA/SI Trip Report – North Highlands ANG Station, North Highlands, California*. Memorandum from Aaron Etnyre. 17 February 2009.
- 29 Code of Federal Regulations 1910.120. *Hazardous Waste Operations and Emergency Response*.
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- National Guard Bureau. 2009. *A7O 09-01 Requirements for Geospatial Deliverables*. Memorandum for NGB/A7OR National Contractors. December 31.

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- EPA. 2008. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846, Final Update IV to the Third Edition. Office of Solid Waste and Emergency Response, Washington, D.C.
- EPA. 2012. Regional Screening Levels. May. <http://www.epa.gov/region9/superfund/prg/index.html>

TABLES

TABLE 1-1
Crosswalk Matrix
 162nd Combat Communications Group
 California Air National Guard
 North Highlands, California

| Required QAPP Element(s) and Corresponding QAPP Sections UFP-QAPP Manual | | Required Information | Crosswalk to Related Documents |
|---|---|--|--|
| Project Management and Objectives | | | |
| 2.1 | Title and Approval Page | - Title and Approval Page | QAPP title page, Table 1-3 |
| 2.2 | Document Format and Table of Contents | - Table of Contents - QAPP Identifying Information | - pp. Ai-Aviii - Sections 1.0 and 2.0 - Page numbering - References to <i>PA/SI Work Plan</i> |
| 2.2.1 | Document Control Format | | |
| 2.2.2 | Document Control Numbering System | | |
| 2.2.3 | Table of Contents | | |
| 2.2.4 | QAPP Identifying Information | | |
| 2.3 | Distribution List and Project Personnel Sign-Off Sheet | - Distribution List - Project Personnel Sign-Off Sheet | - Tables 1-2 and 1-3 - Project Personnel Sign-Off Sheet |
| 2.3.1 | Distribution List | | |
| 2.3.2 | Project Personnel Sign-Off Sheet | | |
| 2.4 | Project Organization | - Project Organizational Chart - Communication Pathways - Personnel Responsibilities and Qualifications Table - Special Personnel Training Requirements | - Figure 2-1 - Table 2-1 - Section 2.0 - Table 2-2 |
| 2.4.1 | Project Organizational Chart | | |
| 2.4.2 | Communication Pathways | | |
| 2.4.3 | Personnel Responsibilities and Qualifications | | |
| 2.4.4 | Special Training Requirements and Certification | | |
| 2.5 | Project Planning/Problem Definition | - Project Planning Session Documentation (including Data Needs tables) - Project Scoping Session Participants Sheet - Problem Definition, Site History, and Background - Site Maps (historical and present) | - Sections 3.0 and 4.0 - Table 3-1 - Reference to the <i>PA/SI Work Plan</i> |
| 2.5.1 | Project Planning (Scoping) | | |
| 2.5.2 | Problem Definition, Site History, and Background | | |
| 2.6 | Project Quality Objectives (PQOs) and Measurement | - Site-Specific PQOs - Measurement Performance Criteria Table | - Section 4.0-6.0 - Tables 6-1 and 6-2 - Reference to the <i>PA/SI Work Plan</i> |
| 2.6.1 | Performance Criteria | | |
| 2.6.2 | Development of PQOs Using the Systematic Planning Process | | |
| 2.6.2 | Measurement Performance Criteria | | |

TABLE 1-1

*Crosswalk Matrix
162nd Combat Communications Group
California Air National Guard
North Highlands, California*

| Required QAPP Element(s) and Corresponding QAPP Sections UFP-QAPP Manual | Required Information | Crosswalk to Related Documents |
|--|---|---|
| 2.7 Secondary Data Evaluation | <ul style="list-style-type: none"> - Sources of Secondary Data and Information - Secondary Data Criteria and Limitations Table | <ul style="list-style-type: none"> - Section 7.0 |
| 2.8 Project Overview and Schedule 2.8.1 Project Overview 2.8.2 Project Schedule | <ul style="list-style-type: none"> - Summary of Project Tasks - Reference Limits and Evaluation Table - Project Schedule/Timeline Table | Tables 6-2 and 8-2 <ul style="list-style-type: none"> - Reference to the <i>PA/SI Work Plan</i> |
| Measurement/Data Acquisition | | |
| 3.1 Sampling Tasks 3.1.1 Sampling Process Design and Rationale 3.1.2 Sampling Procedures and Requirements 3.1.2.1 Sampling Collection Procedures 3.1.2.2 Sample Containers, Volume, and Preservation 3.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures 3.1.2.4 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures 3.1.2.5 Supply Inspection and Acceptance Procedures 3.1.2.6 Field Documentation Procedures | <ul style="list-style-type: none"> - Sampling Design and Rationale - Sample Location Map - Sampling Locations and Methods/SOP Requirements Table - Analytical Methods/SOP Requirements Table - Field Quality Control Sample Summary Table - Sampling SOPs - Project Sampling SOP References Table - Field Equipment Calibration, Maintenance, Testing, and Inspection Table | <ul style="list-style-type: none"> - Sections 8.0 through 11.0 - Tables 8-1, 8-3, 8-4, 9-1, 11-1 - Reference to the <i>PA/SI Work Plan</i> |
| 3.2 Analytical Tasks 3.2.1 Analytical SOPs 3.2.2 Analytical Instrument Calibration Procedures 3.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures 3.2.4 Analytical Supply Inspection and Acceptance Procedures | <ul style="list-style-type: none"> - Analytical SOPs - Analytical SOP References Table - Analytical Instrument Calibration Table - Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table | <ul style="list-style-type: none"> - Sections 11.0 and 12.0 - Tables 11-2, 11-3, 13-3 - Reference the <i>PA/SI Work Plan</i> |

TABLE 1-1
Crosswalk Matrix
 162nd Combat Communications Group
 California Air National Guard
 North Highlands, California

| Required QAPP Element(s) and Corresponding QAPP Sections UFP-QAPP Manual | | Required Information | Crosswalk to Related Documents |
|---|---|---|---|
| 3.3 | Sample Collection Documentation, Handling, Tracking, and Custody Procedures | - Sample Collection Documentation Handling, Tracking, and Custody SOPs | - Sections 8.0 and 9.0 |
| 3.3.1 | Sample Collection Documentation | - Sample Container Identification | - Table 9-1 |
| 3.3.2 | Sample Handling and Tracking System | - Sample Handling Flow Diagram | - Figure 9-1 |
| 3.3.3 | Sample Custody | - Example Chain-of-Custody Form and Seal | |
| 3.4 | Quality Control Samples | - QC Samples Table | - Section 13.0 |
| 3.4.1 | Sampling Quality Control Samples | - Screening/Confirmatory Analysis Decision Tree | - Table 8-3 |
| 3.4.2 | Analytical Quality Control Samples | | |
| 3.5 | Data Management Tasks | - Project Documents and Records Table | - Section 19.0 |
| 3.5.1 | Project Documentation and Records | - Analytical Services Table | - Section 12.0 |
| 3.5.2 | Data Package Deliverables | - Data Management SOPs | - Reference to the <i>PA/SI Work Plan</i> |
| 3.5.3 | Data Reporting Formats | | |
| 3.5.4 | Data Handling and Management | | |
| 3.5.5 | Data Tracking and Control | | |
| Assessment/Oversight | | | |
| 4.1 | Assessments and Response Actions | - Assessments and Response Actions | - Section 15.0 |
| 4.1.1 | Planned Assessments | - Planned Project Assessments Table | - Section 18.0 |
| 4.1.2 | Assessment Findings and Corrective Action Responses | - Audit Checklists - Assessment Findings and Corrective Action Responses Table | |
| 4.2 | QA Management Reports | - QA Management Reports Table | - Section 19.1 |
| 4.3 | Final Project Report | | - Section 19.6 |

TABLE 1-1
Crosswalk Matrix
 162nd Combat Communications Group
 California Air National Guard
 North Highlands, California

| Required QAPP Element(s) and Corresponding QAPP Sections UFP-QAPP Manual | | Required Information | Crosswalk to Related Documents |
|---|--|--|--------------------------------|
| Data Review | | | |
| 5.1 | Overview | | - Section 14.0 |
| 5.2 | Data Review Steps | - Verification (Step I) Process Table | - Sections 14.1 and 14.2 |
| 5.2.1 | Step I: Verification | | |
| 5.2.2 | Step II: Validation | - Validation (Steps IIa and IIb) Process Table | - Tables 14-1 thru 14-3 |
| 5.2.2.1 | Step IIa: Validation Activities | | |
| 5.2.2.2 | Step IIb: Validation Activities | - Validation (Steps IIa and IIb) Summary Table | |
| 5.2.3 | Step III: Usability Assessment | | |
| 5.2.3.1 | Data Limitations and Actions from Usability Assessment | - Usability Assessment | |
| 5.2.3.2 | Activities | | |
| 5.3 | Streamlining Data Review | | Not applicable |
| 5.3.1 | Data Review Steps To Be Streamlined | | |
| 5.3.2 | Criteria for Streamlining Data Review | | |
| 5.3.3 | Amounts and Types of Data Appropriate for Streamlining | | |

Notes:

- UFP-QAPP Manual = *Uniform Federal Policy for Quality Assurance Project Plans*, Intergovernmental Data Quality Task Force guidance

TABLE 1-2
Distribution List
 162nd Combat Communications Group
 California Air National Guard
 North Highlands, California

| Quality Assurance Project Plan Recipients | Title | Organization | Telephone Number | Fax Number | Email Address | Document Control Number |
|--|------------------------------------|------------------------------|---------------------------|---------------|--|--|
| Ed Walker | Project Manager | DTSC | (916) 255-4988 | | EWalker@dtsc.ca.gov | To be requested with final document |
| Mark Dickerson | NGB/AZOR Program Manager | NGB | (240) 612-8445 | | Mark.Dickerson@ang.af.mil | |
| Aaron Einyre | ANG Oversight Contractor | BB&E | (248) 489-9636, x303 | 248-489-9646 | aetnyre@bbande.com | |
| Lt. Col. Gary Aten | Environmental Manager, 162nd CCG | NGB | (916) 569-2290 | | gary.aten@us.af.mil | |
| Mark Bradford | Principal-In-Charge | ERM | (916) 924-9378 | 916-920-9378 | mark.bradford@erm.com | |
| Mike Arnold | Project Manager | ERM | (425) 462 8591 | | mike.arnold@erm.com | |
| Geofrey Moss | Program Director and QA/QC Officer | ERM | (480) 998-2401 | 480-998-2106 | geofrey.moss@erm.com | |
| Karyn Wong | Site Manager | ERM | 916-924-9378 | 916-920-9378 | karyn.wong@erm.com | |
| Brian Magee | Technical Support | ERM | 916-924-9378 | 916-920-9378 | brian.magee@erm.com | |
| Jorge Acevedo | GIS Support | ERM | 916-924-9378 | 916-920-9378 | Mike.appel@erm.com | |
| Elsie King | Technical Support | ERM | 907-264-4477 | 907-258-4033 | Elsie.king@erm.com | |
| Brett VanDelinder | Laboratory Project Manager | TestAmerica, Inc. | (303) 736-0100 | | brett.vandelinder@testamericainc.com | |
| Kelly Buetner | Laboratory Project Manager | Eurofins Air Toxics, Inc. | 916-985-1000 ext. 1038 | 916-985-1020 | kbuettner@airtoxics.com | |
| Sandra Mulhearn | Data Validation Project Manager | ERM | (916) 216-4026 | 916-920-9378 | sandra.mulhearn@erm.com | |

Notes:

ANG = Air National Guard
 CCG = Combat Communications Group
 DTSC = Department of Toxic Substances Control
 ERM = ERM-West, Inc.

GIS = Geographic Information System
 NGB = National Guard Bureau
 QA/QC = Quality Assurance/Quality Control

TABLE 1-3

Project Personnel Sign-Off Sheet
 162nd Combat Communications Group
 California Air National Guard
 North Highlands, California

| Project Personnel | Title | Organization | Telephone Number | Signature | Date QAPP Read Email Receipt |
|--------------------|------------------------------------|------------------------------|------------------------|-----------|---------------------------------|
| Ed Walker | Project Manager | DTSC | (916) 255-4988 | | |
| Mark Dickerson | NGB/A7OR Program Manager | NGB | (240) 612-8445 | | |
| Aaron Etnyre | ANG Oversight Contractor | BB&E | (248) 489-9636, x303 | | |
| Lt. Col. Gary Aten | Environmental Manager, 162nd CCG | NGB | (916) 569-2290 | | |
| Mark Bradford | Principal-In-Charge | ERM | (916) 924-9378 | | |
| Mike Arnold | Project Manager | ERM | (425) 462 8591 | | |
| Geoffrey Moss | Program Director and QA/QC Officer | ERM | (480) 998-2401 | | |
| Karyn Wong | Site Manager | ERM | (916) 924-9378 | | |
| Brian Magee | Technical Support | ERM | 916-924-9378 | | |
| Jorge Acevedo | GIS Support | ERM | 503-488-5282 | | |
| Elsie King | Technical Support | ERM | 907-264-4477 | | |
| Brett VanDelinder | Laboratory Project Manager | TestAmerica, Inc. | (303) 736-0100 | | |
| Kelly Buettner | Laboratory Project Manager | Eurofins Air Toxics, Inc. | 916-985-1000 ext. 1038 | | |
| Sandra Mulhearn | Data Validation Project Manager | ERM | 916-216-4026 | | |

Notes:

ANG = Air National Guard

CCG = Combat Communications Group

DTSC = Department of Toxic Substances Control

ERM = ERM-West, Inc.

GIS = Geographic Information System

NGB = National Guard Bureau

QA/QC = Quality Assurance/Quality Control

TABLE 2-1

*Project Personnel Responsibilities
162nd Combat Communications Group
California Air National Guard
North Highlands, California*

| Project Personnel | Title & Organization | Responsibilities |
|--------------------------|---|---|
| Ed Walker | DTSC Project Manager | Provide state regulatory oversight of the project, including review and approval of documents. |
| Mark Dickerson | Program Manager, NGB/ A7OR | Assume overall responsibility for the direction of project. Provide final ANG review and approval of documents. Provide consultant oversight and direction, and overall project coordination. |
| Mr. Aaron Etnyre | Owner, BB&E, LLC (ANG Surveillance and Oversight Contractor) | Provide third-party review of all report deliverables. |
| Lt. Col. Gary Aten | Environmental Manager, 162nd CCG | Assume responsibility as contact person for site access and other day-to-day issues. |
| Mark Bradford | Principal-In-Charge, ERM | Ensure overall quality of technical and managerial aspects. Implement the QAPP and corrective measures where necessary. Ensure resources are available to meet project goals. Provide peer review and QA/QC for major project activities. |
| Geofrey Moss | Program Manager and QA/QC Officer, ERM | Monitor data quality and conduct data reviews to verify the accuracy of data. Assume role as contact person for questions and/or revisions of procedures, methods, or chain-of-custody information. Verify laboratory procedures and conduct laboratory audits. |
| Mike Arnold | Project Manager, ERM | Report to the NGB Program Manager, the ERM Principal-in-Charge, and the State and/or EPA Project Manager. |
| Karyn Wong | Site Manager, ERM | Schedule and manage field activities, data collection, data analysis, report preparation, scheduling, costing, etc. Report to the NGB Program Manager, the ERM Principal-in-Charge, and the state and/or EPA Project Manager. |
| Brian Magee | Technical Support, ERM | To provide technical support and provide oversight for activities requiring geologic interpretation. |
| Jorge Acevedo | Geographic Information System Support, ERM | Support data management activities and production of documents. Report to the ERM Project Manager. |
| Elsie King | Technical Support, ERM | To manage the ERPIMS data deliverables to the Air Force Center for Engineering and the Environment database, and ensure compliance with the NGB policy memorandum on ERPIMS data deliverables. |
| Brett VanDelinder | Analytical Laboratory Project Manager | Ensure that laboratory resources are available. Review final analytical reports. Communicate results to the ERM Project Manager. |
| Kelly Buettner | Analytical Laboratory Project Manager | Ensure that laboratory resources are available. Review final analytical reports. Communicate results to the ERM Project Manager. |
| Sandra Mulhearn | Data Validation Manager, ERM | Ensure that the accuracy of analytical data has been verified. Review the data validation deliverable. Communicate results to ERM Project Manager. |

Notes:

ANG = Air National Guard

CCG = Combat Communications Group

DTSC = Department of Toxic Substances Control

EPA = United States Environmental Protection Agency

ERM = ERM-West, Inc.

ERPIMS = Environmental Restoration Program Information Management System

GIS = Geographic Information System

NGB = National Guard Bureau

QA/QC = Quality Assurance/Quality Control

QAPP = Quality Assurance Project Plan

TABLE 2-2

*Special Personnel Training Requirements
162nd Combat Communications Group
California Air National Guard
North Highlands, California*

| Project Function | Specialized Training By Title or Description of Course | Training Provider | Training Date Extraction Totals | Personnel/ Groups Receiving Training | Personnel Titles/ Organizational Affiliation | Location of Training Records/ Certificates ¹ |
|--|--|----------------------|------------------------------------|---|---|---|
| Site manager, field sampling and handling | 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) Annual 8-hour Refresher First Aid/CPR | ERM | Annual refresher | Karyn Wong | Site Manager/ERM | ERM office in Sacramento, California. Training records will be made available upon request. |
| Field sampling and handling | 40-hour HAZWOPER Annual 8-hour Refresher | ERM | Annual refresher | Mike Quillici | Project Geologist/ERM | ERM office in Sacramento, California. Training records will be made available upon request. |

Notes:

¹ This column indicates if training records and/or certificates are located on file elsewhere, and also notes if training records and/or certificates do not exist or are not available

TABLE 3-1
Project Scoping Session Participants Sheet
 162nd Combat Communications Group
 California Air National Guard
 North Highlands, California

| Project Name: North Highlands Air National Guard, 162nd Combat Communications Group | | | Site Name: North Highlands Air National Guard Station | | |
|--|--------------------------|-------------|--|--|-------------------------|
| Projected Date(s) of Sampling: October 2012, November 2012 | | | Site Location: 3900 Roseville Road, North Highlands, California | | |
| Site Manager: Karyn Wong | | | | | |
| Date of Session: 29 May 2012 | | | | | |
| Scoping Session Purpose: 2012 Preliminary Assessment/Site Investigation | | | | | |
| Name | Title | Affiliation | Phone # | E-mail Address | Project Role |
| Ed Walker | DTSC Project Manager | DTSC | 916.255.4988 | walker@dtsc.com | DTSC review and input |
| Aaron Etnyre | NGB Consultant | BB&E | 240.489.9656 x303 | aetnyre@bbande.com | NGB contractor |
| Lt Col Gary Aten | Environmental Manager | CA ANG | 916.569.2238 | gary.aten@ang.af.mil | CA ANG review and input |
| CMSgt. Warner Ratcliff | Environmental Technician | CA ANG | 916.569.2290 | warner.ratcliff@ang.af.mil | CA ANG review and input |
| Mark Dickerson | NGB Project Manager | NGB HQ | 240.612.8445 | mark.dickerson@ang.af.mil | NGB Project Manager |
| Brian Magee | Program Support | ERM | 916.924.9378 | Brian.Magee@erm.com | Technical Support |
| Karyn Wong | Site Manager | ERM | 916.924.9378 | Karyn.Wong@erm.com | Project Manager |

Comments/Decisions:

- Discussed the One Clean Program background
- Discussed the proposed PA/SI sampling schedule for 2012
- Discussed the proposed timeline

Action Items:

ERM will provide a Draft Work Plan for regulatory review, after consideration of any comments made during the meeting.

Notes:

CA ANG = California Air National Guard
 DTSC = Department of Toxic Substances Control
 ERM = ERM-West, Inc.
 HQ = Headquarters
 NGB = National Guard Bureau

TABLE 3-2
Proposed Investigation Activities
162nd Combat Communications Group
California Air National Guard
North Highlands, California

| SOIL | | Soil Borings | | Original Soil Samples per Analyte | | |
|-----------------------|--|-------------------------|---------------------|-----------------------------------|------|--------------|
| Area of Concern | | Proposed No. of Borings | Depth (feet bgs) | VOCs | PAHs | TPH-D,-G,-MO |
| Former Hydraulic Lift | | 3 | 30 | 9 | 9 | 9 |

| SOIL VAPOR | | Soil Vapor Wells | | Original Soil Vapor Samples per Analyte | | |
|-----------------------|--|-----------------------|---------------------|--|------|-------------|
| Area of Concern | | Proposed No. of Wells | Depth (feet bgs) | Helium, oxygen, nitrogen, carbon dioxide | VOCs | Naphthalene |
| Former Hydraulic Lift | | 1 | | 3 | 3 | 3 |

Notes:

Soil samples will be collected in the following order: VOCs, TPH-G, TPH-D,-MO, PAHs.

bgs = Below ground surface

No. = Number

PAHs = Polycyclic aromatic hydrocarbons

TPH = Total petroleum hydrocarbons

TPH-D = Diesel-range total petroleum hydrocarbons

TPH-G = Gasoline-range total petroleum hydrocarbons

TPH-MO = Motor oil-range total petroleum hydrocarbons

VOCs = Volatile organic compounds

TABLE 6-1
Measurement Performance Criteria
 162nd Combat Communications Group
 California Air National Guard
 North Highlands, California

| Matrix | Analytical | | DQIs | Measurement Performance Criteria | QC Sample and/or Activity Used to Assess Measurement Performance | QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A) |
|--------|------------------------------------|---------------------|---|---|--|---|
| | Group | Concentration Level | | | | |
| SOPf | Soil | | | | | |
| | VOCs | | | | | |
| | Low | | | | | |
| | Analytical Method/SOP ³ | | | | | |
| | VOCs | | Precision - Field Sampling | < 50% RPD for field duplicates. RPD for results less than or equal to the quantitation limit will be reported as zero and considered in compliance. | Field duplicates | S&A |
| | SW8260B | | Precision - Lab and Accuracy/Bias | Must contain all analytes to be reported. QC acceptance criteria specified by DoD, if available. Otherwise, use in-house control limits. | LCS | A |
| | Lab SOP DV-MS-0010 Rev 6.4 | | Precision - Lab and Accuracy/Bias | Must contain all analytes to be reported and must use DoD QSM LCS control limits. | MS/MSD | A |
| | | | Accuracy/Bias | QC acceptance criteria specified by DoD, if available. Otherwise, use in-house control limits. | Surrogate standards | A |
| | | | Accuracy / Evaluate cross-contamination | No Target Compounds >1/2RL; no common lab contaminants >RL. | Method Blanks | A |
| | | | Accuracy/Bias | Retention time \pm 30 seconds from RT of the midpoint standard in ICAL; EICP area within -50% to +100% of ICAL midpoint standard. | Internal Standards | A |
| | | | Accuracy / Evaluate cross-contamination | No Target Compounds >1/2RL. | Trip Blanks/Field Blanks/ Equipment Blanks | S&A |
| | | | Accuracy / Representativeness | All samples must be kept at $4 \pm 2^{\circ}\text{C}$ | Cooler Temperature | S |
| | | | Usability | All samples must be analyzed within 14 days | | S&A |
| | | | Sensitivity | LOQ less than the Action Limits. | | S&A |

TABLE 6-1
Measurement Performance Criteria
 162nd Combat Communications Group
 California Air National Guard
 North Highlands, California

| Matrix | Soil | Analytical Method/SOP ³ | DQIs | Measurement Performance Criteria | QC Sample and/or Activity Used to Assess Measurement Performance | QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A) |
|---------------------|---|------------------------------------|--|---|--|---|
| Analytical Group | PAHs | | | | | |
| Concentration Level | Low | | | | | |
| SOP ¹ | PAHs SW8270C-SIM Lab SOP DV-MS-0002 Rev 6.2 | | Precision - Field Sampling | < 50% RPD for field duplicates. RPD for results less than or equal to the quantitation limit will be reported as zero and considered in compliance. | Field duplicates | S&A |
| | | | Precision - Lab and Accuracy/Bias | Must contain all analytes to be reported. QC acceptance criteria specified by DoD, if available. Otherwise, use in-house control limits. | LCS | A |
| | | | Precision - Lab and Accuracy/Bias | Must contain all analytes to be reported and must use DoD QSM LCS control limits. | MS/MSD | A |
| | | | Accuracy/Bias | QC acceptance criteria specified by DoD, if available. Otherwise, use in-house control limits. | Surrogate standards | A |
| | | | Accuracy/ Evaluate cross-contamination | No Target Compounds >1/2RL; no common lab contaminants >RL. | Method Blanks | A |
| | | | Accuracy/Bias | Retention time \pm 30 seconds from RT of the midpoint standard in ICAL; EICP area within -50% to +200% of ICAL midpoint standard. | Internal Standards | A |
| | | | Accuracy/ Evaluate cross-contamination | No Target Compounds >1/2RL. | Field Blanks/ Equipment Blanks | S&A |
| | | | Accuracy/ Representativeness | All samples must be kept at $4 \pm 2^{\circ}\text{C}$ | Cooler Temperature | S |
| | | | Usability | All samples must be extracted within 14 days and analyzed within 40 days from extraction. | | S&A |
| | | | Sensitivity | LOQ less than the Action Limits. | | S&A |

TABLE 6-1
Measurement Performance Criteria
 162nd Combat Communications Group
 California Air National Guard
 North Highlands, California

| Matrix | Soil | Analytical Method/SOP ³ | DQIs | Measurement Performance Criteria | QC Sample and/or Activity Used to Assess Measurement Performance | QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A) |
|---------------------------------|------------------|--|--|---|--|---|
| Analytical Group | TPH-D and TPH-MO | | | | | |
| Concentration Level | Medium | | | | | |
| Sampling Procedure ² | | Analytical Method/SOP ³ TPH-D and TPH-MO SW8015 Lab SOP DV-GC-0027 Rev 3.1 | Precision – Field Sampling | < 50% RPD for field duplicates, RPD for results less than or equal to the quantitation limit will be reported as zero and considered in compliance. | Field duplicates | S&A |
| SOP ¹ | | | | | | |
| | | | Precision – Lab and Accuracy/Bias | Must contain all analytes to be reported. QC acceptance criteria specified by DoD, if available. Otherwise, use in-house control limits. | LCS | A |
| | | | Precision – Lab and Accuracy/Bias | Must contain all analytes to be reported and must use DoD QSM LCS control limits. | MS/MSD | A |
| | | | Accuracy/Bias | QC acceptance criteria specified by DoD, if available. Otherwise, use in-house control limits. | Surrogate standards | A |
| | | | Accuracy/ Evaluate cross-contamination | No Target Compounds >1/2RL or less than 10% of the lowest concentration in associated samples. | Method Blanks | A |
| | | | Accuracy/Bias | Retention time \pm 3 standard deviations. | Internal Standards | A |
| | | | Accuracy/ Evaluate cross-contamination | No Target Compounds >1/2RL. | Equipment Blanks | S&A |
| | | | Accuracy/ Representativeness | All samples must be kept at $4 \pm 2^{\circ}\text{C}$ | Cooler Temperature | S |
| | | | Usability | All samples must be extracted within 14 days and analyzed within 40 days from extraction. | | S&A |
| | | | Sensitivity | LOQ less than the Action Limits. | | S&A |

TABLE 6-1
Measurement Performance Criteria
 162nd Combat Communications Group
 California Air National Guard
 North Highlands, California

| Matrix | Air | | | | |
|---------------------------------|--|---|--|---------------------|---|
| Analytical Group | VOCs | | | | |
| Concentration Level | Medium | | | | |
| Sampling Procedure ² | Analytical Method/SOP ³ | | | | |
| SOP ¹ | VOCs | | | | |
| | TO-15 | | | | |
| | SOP#6 rev.28 | | | | |
| | | Precision - Lab and Accuracy/Bias | Must contain all analytes to be reported. QC acceptance criteria specified by DoD, if available. Otherwise, use in-house control limits. | LCS/LCSD | A |
| | | Accuracy/Bias | RPD <25% for analytes detected at >5RL. | Sample duplicate | |
| | | Accuracy/Bias | QC acceptance criteria specified by DoD, if available. Otherwise, use in-house control limits. | Surrogate standards | A |
| | Accuracy/ Evaluate cross-contamination | No Target Compounds>1/2RL. | Method Blanks | A | |
| | Accuracy/Bias | Within -60% to +140% of CCV IS midpoint standard. | Internal Standards | A | |
| | Usability | All samples must be analyzed within 30 days. | | S&A | |
| | Sensitivity | LOQ less than the Action Limits. | | S&A | |

TABLE 6-1
Measurement Performance Criteria
162nd Combat Communications Group
California Air National Guard
North Highlands, California

| Matrix | Air | | | | |
|---------------------------------|--|--|--|--|---|
| Analytical Group | Fixed Gases | | | | |
| Concentration Level | Medium | | | | |
| Sampling Procedure ² | Analytical Method/SOP ³ | DQIs | Measurement Performance Criteria | QC Sample and/or Activity Used to Assess Measurement Performance | QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A) |
| SOPj | Helium, Carbon Dioxide, Oxygen, Nitrogen ASTM D-1946MOD SOP#8 rev.20 | Precision - Lab and Accuracy/Bias | Must contain all analytes to be reported. QC acceptance criteria specified by DoD, if available. Otherwise, use in-house control limits. | LCS/LCSD | A |
| | | Accuracy/Bias | RPD <25% for analytes detected at >5RL. | Sample duplicate | A |
| | | Accuracy/ Evaluate cross-contamination | No Target Compounds>1/2RL. | Method Blanks | A |
| | | Accuracy/Bias | EICP area within -70% to +130% of ICAL midpoint standard. | Internal Standards | A |
| | | Usability | All samples must be analyzed within 30 days. | | S&A |
| | | Sensitivity | LOQ less than the Action Limits. | | S&A |

Notes:

AL = Action Level
DoD = Department of Defense
DQI = Data quality indicators
EICP = Extracted Ion Current Profile
ICAL = Initial calibration
LCS/LCSD = Laboratory control sample/laboratory control sample duplicate
LOQ = Limit of quantitation
MCL = Maximum Contaminant Level
MDL = Method detection limit
MS/MSD = Matrix spike/matrix spike duplicate

QC = Quality control
QSM = Quality Systems Manual
RL = Reporting limit
RPD = Relative percent difference
RT = Retention time
SOP = Standard operating procedure
TPH-D = Diesel-range total petroleum hydrocarbons
TPH-MO = Motor oil-range total petroleum hydrocarbons
VOC = Volatile organic compound

²Reference number from QAPP Worksheet #21

³Reference number from QAPP Worksheet #23

TABLE 6-2

*Soil Reference Limits and Evaluation
162nd Combat Communications Group
California Air National Guard
North Highlands, California*

| Analyte | CAS Number | Project Action Limit (µg/kg) | Project Action Limit Reference | Laboratory-Specific ¹ | | |
|----------------------------------|------------|---------------------------------|-----------------------------------|----------------------------------|----------------|----------------|
| | | | | DL (µg/kg) | LOD (µg/kg) | LOQ (µg/kg) |
| Volatile Organic Compounds 8260B | | | | | | |
| 1,1,1,2-Tetrachloroethane | 630-20-6 | 1900 | RSL | 0.56 | 1 | 5 |
| 1,1,1-Trichloroethane | 71-55-6 | 8700000 | RSL | 0.52 | 1 | 5 |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | 560 | RSL | 0.61 | 1 | 5 |
| 1,1,2-Trichloroethane | 79-00-5 | 1100 | RSL | 0.88 | 1 | 5 |
| 1,1-Dichloroethane | 75-34-3 | 3300 | RSL | 0.21 | 0.8 | 5 |
| 1,1-Dichloroethene | 75-35-4 | 240000 | RSL | 0.59 | 1 | 5 |
| 1,1-Dichloropropene | 563-58-6 | -- | -- | 0.54 | 1 | 5 |
| 1,2,3-Trichlorobenzene | 87-61-6 | 49000 | RSL | 0.75 | 1 | 5 |
| 1,2,3-Trichloropropane | 96-18-4 | 5 | RSL | 0.81 | 1 | 5 |
| 1,2,4-Trichlorobenzene | 120-82-1 | 22000 | RSL | 0.73 | 1 | 5 |
| 1,2,4-Trimethylbenzene | 95-63-6 | 62000 | RSL | 0.58 | 1 | 5 |
| 1,2-Dibromo-3-Chloropropane | 96-12-8 | 5.4 | RSL | 0.6 | 1 | 10 |
| 1,2-Dichlorobenzene | 95-50-1 | 1900000 | RSL | 0.45 | 1 | 5 |
| 1,2-Dichloroethane | 107-06-2 | 430 | RSL | 0.7 | 1 | 5 |
| 1,2-Dichloropropane | 78-87-5 | 940 | RSL | 0.55 | 1 | 5 |
| 1,3,5-Trimethylbenzene | 108-67-8 | 780000 | RSL | 0.57 | 1 | 5 |
| 1,3-Dichlorobenzene | 541-73-1 | -- | -- | 0.48 | 1 | 5 |
| 1,3-Dichloropropane | 142-28-9 | 1600000 | RSL | 0.51 | 1 | 5 |
| 1,4-Dichlorobenzene | 106-46-7 | 2400 | RSL | 0.78 | 1 | 5 |
| 2,2-Dichloropropane | 594-20-7 | -- | -- | 0.44 | 1 | 5 |
| 2-Butanone (MEK) | 78-93-3 | 28000000 | RSL | 1.83 | 6.4 | 20 |
| 2-Chlorotoluene | 95-49-8 | 1600000 | RSL | 0.51 | 1 | 5 |
| 2-Hexanone | 591-78-6 | 210000 | RSL | 4.89 | 10 | 20 |
| 4-Chlorotoluene | 106-43-4 | 1600000 | RSL | 0.78 | 1 | 5 |
| 4-Isopropyltoluene | 99-87-6 | -- | -- | 0.49 | 1 | 5 |
| 4-Methyl-2-pentanone (MIBK) | 108-10-1 | 5300000 | RSL | 4.36 | 10 | 20 |
| Acetone | 67-64-1 | 61000000 | RSL | 5.38 | 10 | 20 |

TABLE 6-2

*Soil Reference Limits and Evaluation
162nd Combat Communications Group
California Air National Guard
North Highlands, California*

| Analyte | CAS Number | Project Action Limit (µg/kg) | Project Action Limit Reference | Laboratory-Specific ¹ | | |
|-------------------------|------------|---------------------------------|-----------------------------------|----------------------------------|----------------|----------------|
| | | | | DL (µg/kg) | LOD (µg/kg) | LOQ (µg/kg) |
| Benzene | 71-43-2 | 1100 | RSL | 0.47 | 1 | 5 |
| Bromobenzene | 108-86-1 | 300000 | RSL | 0.49 | 1 | 5 |
| Bromoform | 75-25-2 | 62000 | RSL | 0.23 | 0.8 | 5 |
| Bromomethane | 74-83-9 | 7300 | RSL | 0.5 | 1 | 10 |
| Carbon disulfide | 75-15-0 | 820000 | RSL | 0.42 | 1 | 5 |
| Carbon tetrachloride | 56-23-5 | 610 | RSL | 0.63 | 1 | 5 |
| Chlorobenzene | 108-90-7 | 290000 | RSL | 0.54 | 1 | 5 |
| Chlorobromomethane | 74-97-5 | 160000 | RSL | 0.3 | 1 | 5 |
| Chlorodibromomethane | 124-48-1 | 680 | RSL | 0.57 | 1 | 5 |
| Chloroethane | 75-00-3 | 15000000 | RSL | 0.89 | 1 | 10 |
| Chloroform | 67-66-3 | 290 | RSL | 0.29 | 1 | 10 |
| Chloromethane | 74-87-3 | 120000 | RSL | 0.77 | 1 | 10 |
| cis-1,2-Dichloroethene | 156-59-2 | 160000 | RSL | 0.56 | 1 | 5 |
| cis-1,3-Dichloropropene | 10061-01-5 | 1600000 | -- | 1.29 | 1 | 5 |
| Dibromomethane | 74-95-3 | 25000 | RSL | 0.84 | 1 | 5 |
| Dichlorobromomethane | 75-27-4 | 270 | RSL | 0.22 | 0.8 | 5 |
| Dichlorodifluoromethane | 75-71-8 | 94000 | RSL | 0.52 | 1 | 5 |
| Ethylbenzene | 100-41-4 | 5400 | RSL | 0.67 | 1 | 5 |
| Ethylene Dibromide | 106-93-4 | 34 | -- | 0.52 | 1 | 5 |
| Hexachlorobutadiene | 87-68-3 | 6200 | RSL | 0.55 | 1 | 5 |
| Isopropylbenzene | 98-82-8 | 2100000 | RSL | 0.59 | 1 | 5 |
| Methyl tert-butyl ether | 1634-04-4 | 43000 | RSL | 0.34 | 1 | 20 |
| Methylene Chloride | 75-09-2 | 56000 | RSL | 1.6 | 3.2 | 5 |
| n-Butylbenzene | 104-51-8 | 3900000 | RSL | 0.56 | 1 | 5 |
| N-Propylbenzene | 103-65-1 | 3400000 | RSL | 0.58 | 1 | 5 |
| sec-Butylbenzene | 135-98-8 | -- | -- | 0.77 | 1 | 5 |
| Styrene | 100-42-5 | 6300000 | RSL | 0.63 | 1 | 5 |
| tert-Butylbenzene | 98-06-6 | -- | -- | 0.5 | 1 | 5 |

TABLE 6-2

*Soil Reference Limits and Evaluation
162nd Combat Communications Group
California Air National Guard
North Highlands, California*

| Analyte | CAS Number | Project Action Limit (µg/kg) | Project Action Limit Reference | Laboratory-Specific ¹ | | |
|---|------------|---------------------------------|-----------------------------------|----------------------------------|----------------|----------------|
| | | | | DL (µg/kg) | LOD (µg/kg) | LOQ (µg/kg) |
| Tetrachloroethene | 127-18-4 | 22000 | RSL | 0.59 | 1 | 5 |
| Toluene | 108-88-3 | 5000000 | RSL | 0.69 | 1 | 5 |
| trans-1,2-Dichloroethene | 156-60-5 | 150000 | RSL | 0.39 | 1 | 5 |
| trans-1,3-Dichloropropene | 10061-02-6 | 1600000 | -- | 0.67 | 1 | 5 |
| Trichloroethene | 79-01-6 | 910 | RSL | 0.23 | 0.8 | 5 |
| Trichlorofluoromethane | 75-69-4 | 790000 | RSL | 1.04 | 2 | 10 |
| Vinyl chloride | 75-01-4 | 60 | RSL | 1.34 | 2 | 5 |
| Xylenes, Total | 1330-20-7 | 690000 | RSL | 0.61 | 1 | 10 |
| Polycyclic Aromatic Hydrocarbons 8270C-SIM | | | | | | |
| Anthracene | 120-12-7 | 17,000,000 | RSL | 0.72 | 2.5 | 5 |
| Acenaphthene | 83-32-9 | 3,400,000 | RSL | 0.16 | 0.267 | 5 |
| Acenaphthylene | 208-96-8 | -- | -- | 0.17 | 0.667 | 5 |
| Benzo (a) anthracene | 56-55-3 | 150 | RSL | 0.9 | 2.5 | 5 |
| Benzo (a) pyrene | 50-32-8 | 15 | RSL | 0.74 | 2.5 | 5 |
| Benzo (b) fluoranthene | 205-99-2 | 150 | RSL | 1.2 | 2.5 | 5 |
| Benzo (g,h,i) perylene | 191-24-2 | -- | -- | 1.1 | 2.5 | 5 |
| Benzo (k) fluoranthene | 207-08-9 | 1,500 | RSL | 1 | 2.5 | 5 |
| Chrysene | 218-01-9 | 15000 | RSL | 1 | 2.5 | 5 |
| Dibenz (a,h) anthracene | 53-70-3 | 15 | RSL | 1.3 | 2.5 | 5 |
| Fluoranthene | 206-44-0 | 2,300,000 | RSL | 1 | 2.5 | 5 |
| Fluorene | 86-73-7 | 2,300,000 | RSL | 0.47 | 0.667 | 5 |
| Indeno (1,2,3-cd) pyrene | 193-39-5 | 150 | RSL | 1.1 | 2.5 | 5 |
| Naphthalene | 91-20-3 | 3,600 | RSL | 0.326 | 0.667 | 5 |
| Phenanthrene | 85-01-8 | -- | -- | 1.1 | 2.5 | 5 |
| Pyrene | 129-00-0 | 1,700,000 | RSL | 1.1 | 2.5 | 5 |
| 1-Methylnaphthalene | 90-12-0 | 16,000 | RSL | 0.26 | 0.267 | 5 |
| 2-Methylnaphthalene | 91-57-6 | 230,000 | RSL | 0.309 | 0.667 | 5 |

TABLE 6-2
Soil Reference Limits and Evaluation
 162nd Combat Communications Group
 California Air National Guard
 North Highlands, California

| Analyte | CAS Number | Project Action Limit (µg/kg) | Project Action Limit Reference | Laboratory-Specific ¹ | | |
|---------------------------------------|------------|---------------------------------|-----------------------------------|----------------------------------|----------------|----------------|
| | | | | DL (µg/kg) | LOD (µg/kg) | LOQ (µg/kg) |
| Total Petroleum Hydrocarbons 8015-GRO | | | | | | |
| Gasoline-Range Organics | 8006-61-9 | -- | -- | 325 | 550 | 1200 |
| Total Petroleum Hydrocarbons 8015-DRO | | | | | | |
| Diesel-Range Organics | STL00143 | -- | -- | 678 | 2000 | 4000 |
| Motor Oil-Range Organics | STL00158 | -- | -- | 3910 | 10000 | 12000 |

Notes:

µg/L = Microgram(s) per liter

µg/kg = Microgram(s) per kilogram

CAS = Chemical Abstracts Service

DL = Detection Limit

MCL = Maximum Contaminant Level

LOD = Limit of Detection

LOQ = Limit of Quantitation

RSL = Regional Screening Level

¹ Laboratory-specific DLs, LOD, and LOQ are limits that an individual laboratory can achieve when performing a specific analytical method.
 DLs may be subject to update.

TABLE 6-3

Soil Vapor Reference Limits and Evaluation
 162nd Combat Communications Group
 California Air National Guard
 North Highlands, California

| Analyte | CAS Number | Project Action Limit (µg/m³) | Project Action Limit Reference | Laboratory-specific ¹ | | |
|----------------------------------|------------|------------------------------------|-----------------------------------|----------------------------------|----------------|----------------|
| | | | | DL (µg/m³) | LOD (µg/m³) | LOQ (µg/m³) |
| Volatile Organic Compounds IO-15 | | | | | | |
| Acetone | 630-20-6 | -- | -- | 1.216 | 1.2 | 12 |
| Benzene | 71-55-6 | 36.2 | CHHSLs | 0.374 | 0.6 | 1.6 |
| Benzyl chloride | 79-34-5 | -- | -- | 0.217 | 1 | 2.6 |
| Bromodichloromethane | 79-00-5 | -- | -- | 0.637 | 1.3 | 3.4 |
| Bromoform | 75-34-3 | -- | -- | 0.744 | 2.1 | 5.2 |
| Bromomethane | 75-35-4 | -- | -- | 0.866 | 0.9 | 19 |
| 2-Butanone (MEK) | 563-58-6 | -- | -- | 1.159 | 1.2 | 5.9 |
| Carbon disulfide | 87-61-6 | -- | -- | 1.912 | 5 | 6.2 |
| Carbon tetrachloride | 96-18-4 | 25.1 | CHHSLs | 0.333 | 1.3 | 3.1 |
| Chlorobenzene | 120-82-1 | -- | -- | 0.474 | 0.9 | 2.3 |
| Chloroethane | 95-63-6 | -- | -- | 1.375 | 1.4 | 5.2 |
| Chloroform | 96-12-8 | -- | -- | 0.42 | 1 | 2.4 |
| Chloromethane | 95-50-1 | -- | -- | 0.62 | 0.8 | 5.2 |
| Dibromochloromethane | 107-06-2 | -- | -- | 0.758 | 1.7 | 4.3 |
| 1,2-Dibromoethane (EDB) | 78-87-5 | -- | -- | 0.4 | 1.5 | 3.8 |
| 1,2-Dichlorobenzene | 108-67-8 | -- | -- | 0.812 | 1.2 | 3 |
| 1,3-Dichlorobenzene | 541-73-1 | -- | -- | 0.77 | 1.2 | 3 |
| 1,4-Dichlorobenzene | 142-28-9 | -- | -- | 0.667 | 1.2 | 3 |
| Dichlorodifluoromethane | 106-46-7 | -- | -- | 0.682 | 1 | 2.5 |
| 1,1-Dichloroethane | 594-20-7 | -- | -- | 0.328 | 0.8 | 2 |
| 1,2-Dichloroethane | 78-93-3 | 49.6 | CHHSLs | 0.356 | 0.8 | 2 |
| 1,1-Dichloroethene | 95-49-8 | -- | -- | 0.642 | 0.8 | 2 |
| cis-1,2-Dichloroethene | 591-78-6 | 15900 | CHHSLs | 0.686 | 0.8 | 2 |
| trans-1,2-Dichloroethene | 106-43-4 | 31900 | CHHSLs | 1.3 | 1.3 | 2 |

TABLE 6-3

*Soil Vapor Reference Limits and Evaluation
162nd Combat Communications Group
California Air National Guard
North Highlands, California*

| Analyte | CAS Number | Project Action Limit ($\mu\text{g}/\text{m}^3$) | Project Action Limit Reference | Laboratory-specific ¹ | | |
|---|------------|--|--------------------------------|------------------------------------|-------------------------------------|-------------------------------------|
| | | | | DL ($\mu\text{g}/\text{m}^3$) | LOD ($\mu\text{g}/\text{m}^3$) | LOQ ($\mu\text{g}/\text{m}^3$) |
| 1,2-Dichloropropane | 99-87-6 | -- | -- | 0.536 | 0.9 | 2.3 |
| cis-1,3-Dichloropropene | 108-10-1 | -- | -- | 0.467 | 0.9 | 2.3 |
| trans-1,3-Dichloropropene | 67-64-1 | -- | -- | 0.386 | 0.9 | 2.3 |
| 1,2-Dichloro-1,1,2,2-tetrafluoroethane | 71-43-2 | -- | -- | 1.007 | 1.4 | 3.5 |
| Volatile Organic Compounds TO-15 | | | | | | |
| Ethylbenzene | 108-86-1 | 420 | CHHSLs | 0.586 | 0.9 | 2.2 |
| 4-Ethyltoluene | 75-25-2 | -- | -- | 0.27 | 1 | 2.5 |
| Hexachlorobutadiene | 74-83-9 | -- | -- | 4.671 | 4.7 | 21 |
| 2-Hexanone | 75-15-0 | -- | -- | 0.533 | 1.6 | 8.2 |
| Methyl-t-Butyl Ether (MTBE) | 56-23-5 | 4000 | CHHSLs | 0.13 | 0.7 | 1.8 |
| 4-Methyl-2-pentanone (MIBK) | 108-90-7 | -- | -- | 0.385 | 0.8 | 2 |
| Methylene chloride | 74-97-5 | -- | -- | 0.511 | 0.7 | 17 |
| Naphthalene | 91-20-3 | 31.9 | CHHSLs | 1.87 | 2.1 | 10 |
| Styrene | 124-48-1 | -- | -- | 0.183 | 0.9 | 2.1 |
| 1,1,2,2-Tetrachloroethane | 75-00-3 | -- | -- | 0.378 | 1.4 | 3.4 |
| Tetrachloroethene | 67-66-3 | 180 | CHHSLs | 0.977 | 1.4 | 3.4 |
| Toluene | 74-87-3 | 135000 | CHHSLs | 0.373 | 0.8 | 1.9 |
| 1,1,2-Trichloro-1,2,2-trifluoroethane | 156-59-2 | -- | -- | 0.881 | 1.5 | 3.8 |
| 1,2,4-Trichlorobenzene | 10061-01-5 | -- | -- | 1.848 | 3 | 15 |
| 1,1,1-Trichloroethane | 74-95-3 | 991000 | CHHSLs | 0.256 | 1.1 | 2.7 |
| 1,1,2-Trichloroethane | 75-27-4 | -- | -- | 1.075 | 1.1 | 2.7 |
| Trichloroethene | 75-71-8 | 528 | CHHSLs | 0.957 | 1.1 | 2.7 |
| Trichlorofluoromethane | 100-41-4 | -- | -- | 0.494 | 1.1 | 2.8 |
| 1,2,4-Trimethylbenzene | 106-93-4 | -- | -- | 0.329 | 1 | 2.5 |
| 1,3,5-Trimethylbenzene | 87-68-3 | -- | -- | 0.482 | 1 | 2.5 |

TABLE 6-3

Soil Vapor Reference Limits and Evaluation
162nd Combat Communications Group
California Air National Guard
North Highlands, California

| Analyte | CAS Number | Project Action Limit ($\mu\text{g}/\text{m}^3$) | Project Action Limit Reference | Laboratory-specific ¹ | | |
|----------------|-------------|--|--------------------------------|------------------------------------|-------------------------------------|-------------------------------------|
| | | | | DL ($\mu\text{g}/\text{m}^3$) | LOD ($\mu\text{g}/\text{m}^3$) | LOQ ($\mu\text{g}/\text{m}^3$) |
| Vinyl chloride | 1634-04-4 | 13.3 | CHHSLs | 0.486 | 0.5 | 1.3 |
| m,p-Xylene | 75-09-2 | 317000 | CHHSLs | 0.3 | 0.9 | 2.2 |
| o-Xylene | 179601-23-1 | 315000 | CHHSLs | 0.426 | 0.9 | 2.2 |

| Naphthalene TO-17 | | | | | | |
|-------------------|------------|--|--------------------------------|------------------------------------|-------------------------------------|-------------------------------------|
| Analyte | CAS Number | Project Action Limit ($\mu\text{g}/\text{m}^3$) | Project Action Limit Reference | Laboratory-specific ¹ | | |
| | Number | | | DL ($\mu\text{g}/\text{m}^3$) | LOD ($\mu\text{g}/\text{m}^3$) | LOQ ($\mu\text{g}/\text{m}^3$) |
| Naphthalene | 91-20-3 | 31.9 | CHHSLs | 0.16 | 0.5 | 0.5 |

| Fixed Gases - ATSM D-1946 MOD | | | | | | |
|-------------------------------|------------|-----------------------------|--------------------------------|----------------------------------|----------------------|----------------------|
| Analyte | CAS Number | Project Action Limit (%) | Project Action Limit Reference | Laboratory-specific ¹ | | |
| | Number | | | DL (% by volume) | LOD (% by volume) | LOQ (% by volume) |
| Helium | 7440-59-7 | -- | -- | 0.004 | 0.006 | 0.05 |
| Carbon Dioxide | 124-38-9 | -- | -- | 0.002 | 0.004 | 0.01 |
| Oxygen | 7782-44-7 | -- | -- | 0.03 | 0.075 | 0.2 |
| Nitrogen | 7727-37-9 | -- | -- | 0.5 | 0.75 | 1 |

Notes:

$\mu\text{g}/\text{m}^3$ = Microgram(s) per cubic meter

CAS = Chemical Abstracts Service

CHHSL = California Human Health Screening Level

DL = Detection limit

LOD = Limit of detection

LOQ = Limit of quantitation

MCL = Maximum Contaminant Level

¹Laboratory-specific DLs, LOD and LOQ are limits that an individual laboratory can achieve when performing a specific analytical method.

DLs may be subject to update.

TABLE 8-1
Sampling Locations and Methods
162nd Combat Communications Group
California Air National Guard
North Highlands, California

| Sampling Location/ ID Number | Matrix | Depth (units) | Analytical Group | Number of Samples ¹ | Sampling SOP Reference ² | Rationale for Sampling Location |
|---------------------------------|------------|----------------------|---|--------------------------------|-------------------------------------|--|
| SB-HL-01-1 | Soil | 1 feet bgs | VOCs, PAHs, TPH | 1 primary | SOPf, Soil Boring | Based on result of One Clean investigation |
| SB-HL-01-7 | Soil | 7 feet bgs | VOCs, PAHs, TPH | 1 primary | SOPf, Soil Boring | Based on result of One Clean investigation |
| SB-HL-01-30 | Soil | 30 feet bgs | VOCs, PAHs, TPH | 1 primary | SOPf, Soil Boring | Based on result of One Clean investigation |
| SB-HL-02-1 | Soil | 1 feet bgs | VOCs, PAHs, TPH | 1 primary | SOPf, Soil Boring | Based on result of One Clean investigation |
| SB-HL-02-7 | Soil | 7 feet bgs | VOCs, PAHs, TPH | 1 primary | SOPf, Soil Boring | Based on result of One Clean investigation |
| SB-HL-02-30 | Soil | 30 feet bgs | VOCs, PAHs, TPH | 1 primary | SOPf, Soil Boring | Based on result of One Clean investigation |
| SB-HL-03-1 | Soil | 1 feet bgs | VOCs, PAHs, TPH | 1 primary | SOPf, Soil Boring | Based on result of One Clean investigation |
| SB-HL-03-7 | Soil | 7 feet bgs | VOCs, PAHs, TPH | 1 primary | SOPf, Soil Boring | Based on result of One Clean investigation |
| SB-HL-03-30 | Soil | 30 feet bgs | VOCs, PAHs, TPH | 1 primary | SOPf, Soil Boring | Based on result of One Clean investigation |
| SV-HL-01-depth | Soil Vapor | between 5 and 10 bgs | VOCs, Fixed Gases, Naphthalene ³ | 1 primary | SOPf, Soil Vapor Sampling | Based on result of One Clean investigation |
| SV-HL-02-depth | Soil Vapor | between 5 and 10 bgs | VOCs, Fixed Gases, Naphthalene ³ | 1 primary | SOPf, Soil Vapor Sampling | Based on result of One Clean investigation |
| SV-HL-03-depth | Soil Vapor | between 5 and 10 bgs | VOCs, Fixed Gases, Naphthalene ³ | 1 primary | SOPf, Soil Vapor Sampling | Based on result of One Clean investigation |

Notes:

bgs = below ground surface
PAH = Polynuclear aromatic hydrocarbon
SOP = Standard operating procedure
TPH = Total petroleum hydrocarbons
VOC = Volatile organic compound

¹Field duplicates are determined during the sampling event.

²From the Project Sampling SOP References table (Table 8-4).

³Naphthalene samples will be held, pending the results of the TO-15 analysis.

TABLE 8-2
Project Schedule
162nd Combat Communications Group
California Air National Guard
North Highlands, California

| Activities | Organization | Dates (MM/DD/YY) | | Deliverable | Deliverable Due Date |
|---|--------------|-----------------------------------|--------------------------------|---|----------------------|
| | | Anticipated Date(s) of Initiation | Anticipated Date of Completion | | |
| Draft Site Investigation Work Plan | ERM | 2-Jun-12 | 23-Aug-12 | Draft Site Investigation Work Plan | 24-Aug-12 |
| Draft Final Site Investigation Work Plan | ERM | 6-Nov-12 | 3-Dec-12 | Draft Final Site Investigation Work Plan | 26-Oct-12 |
| Final Site Investigation Work Plan | ERM | 4-Dec-12 | 17-Dec-12 | Final Site Investigation Work Plan | 15-Nov-12 |
| Site Investigation Field Activities | ERM | 4-Dec-12 | 15-Jan-12 | | -- |
| Draft Preliminary Assessment / Site Investigation Report | ERM | 1-Feb-13 | 28-Mar-13 | Draft Preliminary Assessment/ Site Investigation Report | 29-Jan-13 |
| Draft Final Preliminary Assessment/ Site Investigation Report | ERM | 29-Mar-13 | 25-Apr-13 | Draft Final Site Investigation Work Plan | 26-Feb-13 |
| Final Preliminary Assessment / Site Investigation Report | ERM | 26-Apr-13 | 16-May-13 | Final Preliminary Assessment/ Site Investigation Report | 2-Apr-13 |

TABLE 8-3
Sampling Summary by Analysis
 162nd Combat Communications Group
 California Air National Guard
 North Highlands, California

| Matrix | Analytical Group | Analytical and Preparation SOP Reference ¹ | Number of Primary Samples | Number of Field Duplicate Pairs | Number of Matrix Spike Samples | Number of Field Blank Samples | Number of Equipment Blank Samples | Number of Trip Blank Samples | Total Number of Samples to Lab |
|------------|------------------|---|---------------------------|---------------------------------|--------------------------------|-------------------------------|-----------------------------------|------------------------------|--------------------------------|
| Soil | VOCs | DV-MS-0010 | 9 | 1 | 1 | 0 | 1 | 1 | 13 |
| Soil | TPH-G | DV-GC-0010 | 9 | 1 | 1 | 0 | 1 | 0 | 12 |
| Soil | PAHs | DV-MS-0002 | 9 | 1 | 1 | 0 | 1 | 0 | 12 |
| Soil | TPH-d and TPH-MO | DV-GC-0027 | 9 | 1 | 1 | 0 | 1 | 0 | 12 |
| Soil Vapor | VOCs | SOP#6 rev.28 | 3 | 1 | 0 | 1 | 0 | 0 | 5 |
| Soil Vapor | Naphthalene | SOP #109 | 3 | 1 | 0 | 1 | 0 | 0 | 5 |
| Soil Vapor | Helium | SOP#8 rev.20 | 3 | 1 | 0 | 1 | 0 | 0 | 5 |

Notes:

SOP = Standard Operating Procedure

VOC = Volatile organic compound

TPH-D = Diesel-range total petroleum hydrocarbons

TPH-G = Gasoline-range total petroleum hydrocarbons

TPH-MO = Motor oil-range total petroleum hydrocarbons

PAHs = Polycyclic aromatic hydrocarbons

¹From the Analytical SOP References table (Table 11-2).

TABLE 8-4

*Project Sampling SOP References
162nd Combat Communications Group
California Air National Guard
North Highlands, California*

| Reference Number | Title, Revision Date and/or Number | Originating Organization | Equipment Type | Modified for Project Work? (Y/N) |
|------------------|------------------------------------|--------------------------|---|----------------------------------|
| SOPa | Green Practices | ERM | | N |
| SOPb | Sample Container Identification | ERM | | N |
| SOPc | Waste Management | ERM | | N |
| SOPd | Water Level Measurement | ERM | Water level meter | N |
| SOPe | Decontamination | ERM | Alconox, ASTM II water | N |
| SOPf | Drilling and Soil Boring | ERM | Hand auger, rotary hammer drill, slide hammer, drill rig | N |
| SOPg | Field Screening for Organic Vapors | ERM | Photoionization detector, volume/mass measuring device | N |
| SOPh | Lithologic Logging | ERM | | N |
| SOPi | Subsurface Clearance | ERM | | N |
| SOPj | Soil Gas Sampling | ERM | Pump, bailer, water level meter, water quality meter, flow through water cell | N |
| SOPk | Sample Handling | ERM | Nitrile gloves, safety glasses, job specific personal protective equipment | N |

Notes:

SOP = Standard Operating Procedure

TABLE 9-1
Sampling Requirements
162nd Combat Communications Group
California Air National Guard
North Highlands, California

| Matrix | Analytical Group | Concentration Level | Analytical and Preparation Method/ Lab SOP Reference | Sample Size/Volume | Containers (number, size, and type) | Preservation Requirements (chemical, temperature, light protected) | Maximum Holding Time (preparation / analysis) |
|------------|---------------------|---------------------|---|--------------------|---|---|---|
| Soil | VOCs | Low | Method 5035/8260B DV-MS-0010 | 10 grams | Terra Core® device or equivalent and 3 x 40 ml VOA Vial, pre-tared, with NaHSO ₃ or water (two vials), and MeOH (one vial) | Cool < 6°C | 48 hours for vials with water (or freeze with dry ice to extend holding time); 14 days for vials with NaHSO ₃ or MeOH |
| Soil | PAHs | Low | Method 3550/8270-SIM DV-MS-0002 | 8 ounces | 1 wide-mouth jar with a Teflon-lined lid | Cool < 6°C | 14 days/40 days |
| Soil | TPH-d and TPH-MO | Low | Method 5030B/8015C-DRO DV-GC-0027 | 6 to 8 ounces | 1 wide-mouth jar with a Teflon-lined lid | Cool < 6°C | 14 days/40 days |
| Soil | TPH-G | Low | Method 3546/8015C-GRO DV-GC-0027 | 10 grams | Terra Core® device or equivalent and 40 ml VOA Vial, pre-tared, with Methanol | Methanol, Cool < 6°C | 14 days for MeOH preserved |
| Soil Vapor | VOCs | Low | Method TO-15 SOP#6 rev.28 | 1 liter | Summa canister | None | 30 days |
| Soil Vapor | Naphthalene | Low | Method TO-17 SOP # 109 | -- | Sorbent tube | Cool 4°C | 30 days |
| Soil Vapor | Fixed Gases | Low | ASTM D-1946MOD SOP#8 rev.20 | 1 liter | Summa canister | None | 30 days |

Notes:

HCl = hydrochloric acid

MeOH = Methanol

mL = milliliter

SOP = Standard Operating Procedure

VOC = Volatile organic compounds

TPH-D = Diesel-range total petroleum hydrocarbons

TPH-G = Gasoline-range total petroleum hydrocarbons

TPH-MO = Motor oil-range total petroleum hydrocarbons

PAHs = Polycyclic aromatic hydrocarbons

TABLE 11-1
Field Equipment Calibration, Maintenance, Testing, and Inspection
162nd Combat Communications Group
California Air National Guard
North Highlands, California

| Field Equipment | Calibration Activity | Maintenance Activity | Testing Activity | Inspection Activity | Frequency | Acceptance Criteria | Corrective Action | Responsible Person | SOP Reference ¹ |
|---|---|---|---|---|------------------------|---|-------------------------------|----------------------|---|
| Photoionization Detector (PID) MiniRae 2000 or equivalent | 2-point calibration with isobutylene and zero gas | Cleaning as required and replacement of consumable filters. All maintenance to be performed by equipment rental facility. | Test operation of unit comparable to a known calibration standard gas | Condition and operation of unit will be inspected before each use | Daily, before each use | PID calibrates properly and isobutylene check is within 2 ppm of reference gas. | Contact equipment rental firm | Field Superintendent | N/A, reference manufacturer's instructions. |

Notes:
N/A = Not applicable
ppm = Parts per million
¹Specify the appropriate reference letter or number from the Project Sampling SOP References table (Table 8-4).

TABLE 11-2
Analytical SOP References
162nd Combat Communications Group
California Air National Guard
North Highlands, California

| Reference Number | Title, Revision Date, and /or Number | Definitive or Screening Data | Analytical Group | Instrument | Organization Performing Analysis | Modified for Project Work? (Y/N) |
|------------------|---|------------------------------|------------------|------------|----------------------------------|----------------------------------|
| DV-MS-0010 | Determination of Volatile Organic by GC/MS [8260B and 624j; 12/28/2011; Rev. 6.4 | Definitive | VOCs | GC/MS | TestAmerica | N |
| DV-MS-0002 | Polynuclear Aromatic Hydrocarbons by GC/MS Selected Ion Monitoring (SIM) [SW 846 Method 8270C and 8270D]; 8/31/11; Rev. 6.2 | Definitive | PAHs | GC/MS | TestAmerica | N |
| DV-GC-0010 | Gasoline Range Organics (GRO) by GC-FID [SW846 Method 8015 and others]; 07/29/2011; Rev. 7.1 | Definitive | GRO/TPH-G | GC | TestAmerica | N |
| DV-GC-0027 | Diesel and Residual Range Organics (DRO and RRO) and Terphenyls by GC/FID [SW846 Method 8015 and others] | Definitive | TPH-d and TPH-MO | GC/FID | TestAmerica | N |
| SOP#8 rev 20 | Analysis of Oxygen, Nitrogen, Methane, Ethane, Carbon Monoxide, Carbon Dioxide, Hydrogen and NMOC by Modified ASTM D-1946, 04/09/12, revision 20 | Definitive | Helium | GC | Eurofins Air Toxics | N |
| SOP #109 | Analysis of Volatile and Semivolatile Organic Compounds in Vapor by Thermal Desorption GC/MS Full Scan Using Modified EPA Method TO-17, Vapor Intrusion Application | Definitive | Naphthalene | GC/MS | Eurofins Air Toxics | N |
| SOP#6 rev 28 | Analysis of Volatile Organic Compounds in Summa Polished Canisters, 08/20/12, revision 8 | Definitive | VOCs | GC/MS | Eurofins Air Toxics | N |

Notes:

EPA = United States Environmental Protection Agency
GC = Gas chromatography
ICP = Inductively coupled plasma
MS = Mass spectrometry
SOP = Standard Operating Procedure
VOC = Volatile organic compound
PAH = Polynuclear aromatic hydrocarbon
TPH-D = Total petroleum hydrocarbons - diesel range
TPH-G = Total petroleum hydrocarbons - gasoline range

TABLE 11-3
Analytical Instrument Calibration
162nd Combat Communications Group
California Air National Guard
North Highlands, California

| Instrument | Calibration Procedure | Frequency of Calibration | Acceptance Criteria¹ | Corrective Action (CA) | Person Responsible for CA | SOP Reference² |
|-------------------|--|--|---|--|------------------------------------|----------------------------------|
| GCMS - 8260 | Check of mass spectral ion intensities (tuning procedure) using BFB (8260B) | Prior to ICAL and at the beginning of each 12-hour period. | Refer to method/SOP for specific ion criteria. | Retune instrument and verify. | Lab Manager / Analyst ³ | DV-MS-0010 |
| | Minimum five-point initial calibration for target analytes, lowest concentration standard at or near the reporting limit. (ICAL) | Initial calibration prior to sample analysis | 1. Average Response Factor for SPCCs: ≥ 0.30 for chlorobenzene, and 1,1,2,2-tetrachloroethane; ≥ 0.10 for chloromethane, bromoform, and 1,1-dichloroethane 2. RSD for RFs for CCCs: $\leq 30\%$ and one option below: Option 1: RSD for each analyte $\leq 15\%$ Option 2: Linear regression $r \geq 0.995$ Option 3: Non linear regression $r^2 \geq 0.990$ and 6 points must be used. | Terminate analysis; correct the problem; recalibrate. Problem must be corrected. No samples may be run until ICAL has passed. | Lab Manager / Analyst ³ | DV-MS-0010 |
| | Second-source calibration verification | Once after each ICAL | All project analytes within $\pm 20\%$ of true value. | Correct problem, and verify second source standard. Rerun verification. If still fails, repeat initial calibration. | Lab Manager / Analyst ³ | DV-MS-0010 |
| GCMS - 8260 | Retention Time Window Position Establishment | Once per ICAL, for each analyte and surrogate. | Set position using the mid-point standard of the ICAL when ICAL is not performed. On days when ICAL is not performed, use initial CCV. | NA | Analyst | DV-MS-0010 |
| | Daily calibration verification | Daily, prior to sample analysis and every 12 hours of analysis time. | 1. Avg RF for SPCCs: ≥ 0.30 for chlorobenzene and 1,1,2,2-tetrachloroethane; ≥ 0.1 for chloromethane, bromoform, and 1,1-dichloroethane; 2. %D/Drift for all target compounds and surrogates $\leq 20\%D$. | Correct problem, then rerun CCV. If that fails, then repeat ICAL. Reanalyze all sample since the last successful CCV. | Lab Manager / Analyst ³ | DV-MS-0010 |

TABLE 11-3
Analytical Instrument Calibration
162nd Combat Communications Group
California Air National Guard
North Highlands, California

| Instrument | Calibration Procedure | Frequency of Calibration | Acceptance Criteria¹ | Corrective Action (CA) | Person Responsible for CA | SOP Reference² |
|-------------------|---|--|--|--|---|----------------------------------|
| GC/MS - 8270C SIM | Check of mass spectral ion intensities, i.e., Tune | Prior to initial calibration or Continuing calibration verification, every 12 hours | Refer to criteria listed in the method SOP for Tune criteria, including DDT, Benzidine and Pentachlorophenol requirements. | Return the instrument and verify (instrument maintenance may be needed). | Lab Manager / Analyst ³ | DV-MS-0002 |
| | Minimum five-point initial calibration for all target analytes | Initial calibration prior to sample analysis. Perform instrument re-calibration once per year minimum. | Target analytes %RSD for RT < 15%. option (if %RSD is > 15%)-linear regression $r^2 > 0.99$, $r \geq 0.995$. | Correct problem then repeat initial calibration. If the calibration is not considered linear by either %RSD or linear regression, then correct the problem and re-calibrate. If the calibration is not considered linear by either %RSD or linear regression, then correct the problem and re-calibrate. | Lab Manager / Analyst ³ | DV-MS-0002 |
| | Initial calibration verification (ICV) must be from a 2nd source. | Immediately following five-point initial calibration | All analytes within 20% of expected value | Correct problem then repeat initial calibration | Lab Manager / Analyst ³ | DV-MS-0002 |
| | Continuing calibration verification (CCV) | Daily, before sample analysis and every 12 hours of analysis time | | Correct problem then repeat initial calibration and re-analyze all samples since last successful CCV. | Lab Manager / Analyst ³ | DV-MS-0002 |
| | Continuing calibration check | | All target compounds $\pm 20\%$. | Continuing calibration check | Lab Manager / Analyst ³ | DV-MS-0002 |
| GC/MS - TO-15 | Internal Standards | Every sample/ standard and blank | Retention time ± 30 seconds from retention time of the mid-point std. in the CCV/ICAL (sample/standard). EICP area within -50% to +100% of ICAL mid-point std for the CCV and -50% to +100% of the prior CCV for the samples. (See federal programs SOP DV-QA-024P for program specific requirements) | Inspect mass spectrometer and GC for malfunctions; mandatory re-analysis of samples analyzed while system was malfunctioning (dilution of the sample may be required, see the supervisor or the technical director for advice). | Lab Manager / Analyst ³ | DV-MS-0002 |
| | Initial calibration (ICAL) per laboratory SOP, with minimum five standards | Prior to sample analysis | % RSD ≤ 30 with two compounds allowed out to $\leq 40\%$ RSD for QUAD and 5820 (4 allowed out for LL). | Correct problem then repeat Initial Calibration Curve. | Department Manager / Analyst ³ | SOP6 rev.28 |
| | Second-source initial calibration verification (ICV), prepared at lower half of the calibration range | Once per ICAL | Recoveries for 85% of Standard compounds must be 70-130%. No recovery may be <50%. If specified, in house control limits may be used. | Check the system and reanalyze the standard. Re-prepare the standard if necessary to determine the source of the error. Re-calibrate the instrument if the primary standard is found to be in error. | Department Manager / Analyst ³ | SOP6 rev.28 |

TABLE 11-3
Analytical Instrument Calibration
162nd Combat Communications Group
California Air National Guard
North Highlands, California

| Instrument | Calibration Procedure | Frequency of Calibration | Acceptance Criteria ¹ | Corrective Action (CA) | Person Responsible for CA | SOP Reference ² |
|-------------|--|---|---|---|---|----------------------------|
| GC - Helium | Continuing calibration verification (CCV), same source as ICAL | At the start of each day after the BFB Tune check. | 70-130% | Compounds exceeding the criterion and associated data will be flagged and narrated with the exception of high bias associated with non-detects. If more than two compounds from the standard list recover outside of 70-130%, samples are not analyzed unless data meets project needs. Check the system and reanalyze the standard. Re-prepare the standard if necessary. Re-calibrate the instrument if the criteria cannot be met. | Department Manager / Analyst ³ | SOP# rev.28 |
| | Initial Calibration Curve (ICAL) | Prior to sample analysis | RSD ≤ 15% | Correct problem then repeat Initial Calibration | Department Manager / Analyst ³ | SOP#8 rev.20 |
| | Second Source Verification (LCS) | All analytes - once per Initial Calibration, and with each analytical batch. | %R between 85-115% | Check the system and reanalyze the standard. Re-calibrate the instrument in the criteria cannot be met. | Department Manager / Analyst ³ | SOP#8 rev.20 |
| | Continuing calibration verification (CCV) | Daily prior to sample analysis and after every 20 reportable samples. | %D ± 15% | Check the system and reanalyze the standard. Re-calibrate the instrument in the criteria cannot be met. | Department Manager / Analyst ³ | SOP#8 rev.20 |
| | Six-point initial calibration for all target analytes | Initial calibration prior to sample analysis. Perform instrument re-calibration once per year minimum. Immediately following five-point initial calibration | RSD of CF ≤ 20% Linear – least squares regression r ² ≥ 0.995 | Correct problem then repeat initial calibration | Lab Manager/Analyst | DV-GC-0027 |
| | Initial calibration verification (ICV), must be from a 2nd source. | Before sample analysis, after every 10 samples, and at the end of the analysis sequence | All analytes within ≤15% of expected value | Correct problem then repeat initial calibration | Lab Manager/Analyst | DV-GC-0027 |
| | Continuing calibration verification (CCV) | | All analytes within ≤15% of expected value and within the RTW. | Correct problem then repeat initial CCV (re-calibrate if necessary) and re-analyze all samples since last successful CCV. | Lab Manager/Analyst | DV-GC-0027 |
| | Retention time window calculated for each analyte (see section 10.4 for how to calculate RTWs) | System set-up, with each new column or major instrument maintenance. Update the mid-RTW as the start of the run or daily. | Each analyte of the LCS, MS/MSD and CCV must be within the calculated RTW. | Correct the problem and re-process or re-analyze samples. For questions, see the supervisor or technical director. | Lab Manager/Analyst | DV-GC-0027 |
| | | | | | | |
| | | | | | | |

TABLE 11-3
Analytical Instrument Calibration
162nd Combat Communications Group
California Air National Guard
North Highlands, California

| Instrument | Calibration Procedure | Frequency of Calibration | Acceptance Criteria ¹ | Corrective Action (CA) | Person Responsible for CA | SOP Reference ² |
|----------------|---|---|---|---|---------------------------|----------------------------|
| GC - 8015 GRCO | Six-point initial calibration for all target analytes | Initial calibration prior to sample analysis. Perform instrument re-calibration once per year minimum. | RSD of CF ≤ 20% Linear - least squares regression r ² ≥ 0.99, r ≥ 0.995 | Correct problem then repeat initial calibration | Lab Manager/Analyst | DV-GC-0010 |
| | Initial calibration verification (ICV), must be from a 2nd source. | Immediately following five-point initial calibration | All analytes within ≤15% of expected value | Correct problem then repeat initial calibration | Lab Manager/Analyst | DV-GC-0010 |
| | Continuing calibration verification (CCV) | Before sample analysis, after every 10 samples, and at the end of the analysis sequence | All analytes within ≤15% of expected value and within the RTW. | Correct problem then repeat initial CCV (re-calibrate if necessary) and re-analyze all samples since last successful CCV. | Lab Manager/Analyst | DV-GC-0010 |
| | Retention time window calculated for each analyte (see section 10.4 for how to calculate RTWs). | System set-up, with each new column or major instrument maintenance. Update the mid-RTW as the start of the run or daily. | Each analyte of the LCS, MS/MSD and CCV must be within the calculated RTW. | Correct the problem and re-process or re-analyze samples. For questions, see the supervisor or technical director. | Lab Manager/Analyst | DV-GC-0010 |

Notes:

% RSD = Percent Relative Standard Deviation
CA = Corrective Action
CB = Calibration blank
CCC = Calibration Check Compounds
CCV = Continuing calibration verification
COD = Coefficient of Determination

EICP = Extracted Ion Current Profile
GC = Gas Chromatograph
ICAL = Initial Calibration
ICS = Interference check solution
ICV = Initial Calibration Verification

LOD = Limit of Detection
RF = Response Factor
SOP = Standard Operating Procedure
SPCC = System Performance Check Compounds
VOC = Volatile organic compounds

¹This is a summary of the acceptance criteria; refer to the method SOP for specific or more information.

²SOPs are reviewed/revised on an annual schedule. The current version will be followed at the time of sample receipt.

³The analyst initiates the corrective action and the lab manager and analyst are responsible for the corrective action.

TABLE 13-1

*Requirements for Level II Data Reports
162nd Combat Communications Group
California Air National Guard
North Highlands, California*

| <i>Requirement</i> | <i>Explanation</i> |
|---|--|
| Cover Sheet | A cover sheet on the laboratory's letterhead listing the report number and signature of the Laboratory Director certifying the reported results. |
| Cross Reference | A cross-reference listing the field sample ID(s), the laboratory ID(s), and the matrix of each sample should be included in the data report. |
| Case Narrative | A detailed explanation of any problems encountered while analyzing project samples, any necessary corrective action, any applied qualifiers, and a key defining qualifiers. |
| Results | Method of analysis, list of target analytes, adjusted LOQs, units of measure, results, dilution factor, field sample ID, laboratory sample ID, date and time collected, date prepared, date and time analyzed, and any applied qualifiers. |
| List of Data Qualifiers | A list of all Data Qualifiers and their meanings. |
| Associated Method Blank(s) | List of target analytes, adjusted LOQs, dilution factor, laboratory sample ID, date prepared, date analyzed, and any applied qualifiers. |
| Associated Laboratory Control Sample(s) (Blank Spike) | List of spiked analytes, adjusted LOQs, spike amount, concentration detected, percent recovery, acceptable recovery limits, dilution factor, laboratory sample ID, date prepared, date analyzed, and any applied qualifiers. |
| Matrix Spike(s)/ Matrix Spike Duplicates | List of spiked analytes, adjusted LOQs, spike amount, concentration detected, percent recovery, acceptable recovery limits, calculated RPD, acceptable RPD limit, dilution factor, native sample ID (if a project sample), laboratory sample ID, date prepared, date analyzed, and any applied qualifiers. |
| Laboratory Duplicate | List of target analytes, adjusted LOQs, detected results in both samples, calculated RPDs, acceptable RPD limit, dilution factor(s), native sample ID (if a project sample), laboratory sample ID(s), date prepared, date analyzed, and any applied qualifiers. |
| Surrogate Recoveries | Surrogate recoveries and acceptable limits should be summarized for all organic analyses that utilize surrogates. |
| Chain-of-Custody | The original Chain-of-Custody Record(s) should be included with the data report(s). |

Notes:

ID = Identification

LOQ = Limit of Quantitation

RPD = Relative Percent Difference

TABLE 13-2

*Requirements for CLP Level IV Validatable Data Reports
162nd Combat Communications Group
California Air National Guard
North Highlands, California*

| <i>Parameter</i> | <i>Requirement</i> | <i>Information Provided On Form</i> |
|---------------------|---|--|
| ----- | Level II Data Report Requirements + Those Shown Below | ----- |
| Organic Compounds | Form I | Analysis Data Sheet |
| | Form II | Surrogate recovery |
| All Analyses | Form III | Matrix Spike/Matrix Spike Duplicate Recovery |
| All Analyses | Form IV | Method Blank Summary |
| GC/MS analyses only | Form V | Instrument Performance Check |
| | Form VI | Initial Calibration Data |
| | Form VII | Continuing Calibration Data |
| GC/MS analyses only | Form VIII | Internal Standard Area and Retention Time Summary |
| | Form IX | Extraction Prep Log |
| All Analyses | Quantitation Report | Raw Data (including sample preparation data), Chromatograms, and Area Quantitation Reports |
| | Electronic Data Deliverable (EDD) | Tabulated Summary of All Data Results |

Notes:

EDD = Electronic Data Deliverable

GC = Gas chromatography

MS = Mass spectrometry

TABLE 13-3
Analytical Instrument and Equipment Maintenance
162nd Combat Communications Group
California Air National Guard
North Highlands, California

| Instrument/ Equipment | Maintenance Activity | Testing Activity | Inspection Activity | Frequency | Acceptance Criteria | Corrective Action | Responsible Person | SOP Reference ¹ |
|--------------------------|--|--|--|---|---|--|-----------------------------------|-------------------------------------|
| GC-MS | Clean sources, maintain vacuum pumps | Tuning | Instrument performance and sensitivity | Service vacuum pumps twice per year, other maintenance as needed | Tune and CCV pass criteria | Recalibrate instrument | Analyst | DV-MS-0010; DV-MS-0002 |
| GC-MS | Change septum, clean injection port, change or clip column, install new liner, change trap | Response factors and chromatogram review | Instrument performance and sensitivity | As needed | Tune and CCV pass criteria | Re-inspect injector port, cut additional column, reanalyze CCV, recalibrate instrument | Analyst | DV-MS-0010; DV-MS-000; |
| GC and GC/MS | Change syringe needles/syringes | Instrument performance checks | Visually inspect for dirt or deterioration | Every 3 months or as needed | GC: CCV pass GC/MS; tune and CCV pass | Replace syringe or syringe needle | Trained analyst or R&D department | SOP#8 rev.20, SOP#6 rev.28, SOP#109 |
| GC and GC/MS | Gas drying and purifying cartridges | Instrument performance checks | Visually inspect for dirt or deterioration | Every 6 to 12 months or as needed | Lack of moisture, CCV pass | Replace cartridge | Trained analyst or R&D department | SOP#8 rev.20, SOP#6 rev.28, SOP#109 |
| GC and GC/MS | Injection port maintenance | Instrument performance checks | Liner insert, o-rings, septa, column clip | Weekly for liner; monthly for o-rings; daily for septa; or when instrument performance declines | Restoration of operational parameters, GC/MS; tune and CCV pass | Replacement of internal components as needed | Trained analyst or R&D department | SOP#8 rev.20, SOP#6 rev.28, SOP#109 |
| GC/MS | Detector maintenance | Column change, failing tune | Change detector and/or pump oil | Oil level/quality visually examined monthly; oil physically changed every 6 months | Tune passes; scan does not indicate presence of air/water | Refill or exchange the oil; clean parts; reanalyze tune | Trained analyst or R&D department | SOP#6 rev.28 |

Notes:

CCV = Continuing calibration verification

GC = Gas chromatography

MS = Mass spectrometry

SOP = Standard Operating Procedures

TABLE 14-1

*Laboratory Report Goal: Completeness Check
 162nd Combat Communications Group
 California Air National Guard
 North Highlands, California*

| Date Completed & PM Initials | Screening Check |
|------------------------------|--|
| | 1. Are all analyses that are requested on the Chain-of-Custody and any change orders present in the data package? |
| | 2. Does the data package include a copy of the Chain-of-Custody forms? |
| | 3. Has the laboratory placed any data qualifier flags on the analytical results? |
| | 4. Does the laboratory's case narrative identify problems, including an explanation of flagged data? |
| | 5. Does the data package include reports for: |
| | a. Method and trip blanks? |
| | b. Matrix spikes? |
| | c. Matrix spike duplicates and/or sample duplicates? |
| | d. A blank spike/laboratory control sample/second source check sample? |
| | e. Surrogates? |
| | 6. Based on any missing information and/or gross quality control exceedences, should the laboratory perform additional analytical work on the samples before holding times have expired or the leftover sample is discarded? (Data collected to characterize investigation-derived waste will not be further reviewed by a contractor QA Officer unless there is a specific concern about the quality of the data or unless requested by the State Agency Project Manager.) |

Notes:

QA = Quality Assurance

TABLE 14-2
Laboratory Report Goal: Data Verification
162nd Combat Communications Group
California Air National Guard
North Highlands, California

| Date Completed & PM Initials | Review Item |
|------------------------------|---|
| | 1. Case Narrative Have any anomalies, deficiencies, and QC problems been identified in the case narrative? What corrective action, if any, was taken? |
| | 2. Chain-of-Custody Documentation |
| | Are the original Chain-of-Custody forms with ID numbers and laboratory receipt signatures present? |
| | Are there copies of internal tracking documents, as applicable? |
| | 3. Sample Analysis Results Are sample analysis results included for environmental samples, with quantitation limits (include dilutions and reanalyses)? |
| | 4. QC Summary: Is the following information included? (Initial and continuing calibrations)* |
| | Method blanks, continuing calibration blanks, and preparation blanks |
| | Surrogate percent recoveries |
| | Internal standard percent recoveries* |
| | Matrix spike percent recoveries |
| | Laboratory duplicate relative percent differences |
| | Laboratory QC check sample, laboratory control sample recoveries |
| | Field duplicates, if identified, reproducibility will be evaluated |
| | Acceptance criteria, if not already established by the method/DQO |
| | Definitions for any laboratory data qualifiers used |
| | Method of standard additions (INORGANIC) as necessary |
| | ICP serial dilution (INORGANIC) as necessary |

TABLE 14-2
Laboratory Report Goal: Data Verification
162nd Combat Communications Group
California Air National Guard
North Highlands, California

| Date Completed & PM Initials | Review Item |
|------------------------------|---|
| | 5. Specifically review the following: Was a check for timeliness and errors conducted, including requested deliverables, preservation, holding times, and Chain-of-Custody? |
| | Was a duplicate sample/matrix spike/matrix spike duplicate/postdigest spike reviewed against precision and accuracy criteria specified by the method or by project DQOs? |
| | Were compound quantitation and reported detection limits reviewed, checking reporting limits against contract required limits, verifying dry weights, calculations, and dilutions? |
| | 6. Does the Verification Report include the following information? Case narrative including, but not limited to, an overall summary of data acceptability and comparison to DQOs and DQIs (PARCC), a list of recommended changes, a summary of all laboratory contacts, in which communications with the laboratory, if any, would be identified, and any other problems associated with the actual analysis which might impact the sample integrity or data quality. |
| | Marking of recommended changes directly on copies of the laboratory reports for the client's ease in performing data entry. |
| | Tabulated summary of all data results supplied electronically by email, compact disk or on 3.5-inch floppy disks in a commonly used software format. |

Notes:

DQI = Data quality indicators

DQO = Data quality objective

ICP = Inductively coupled plasma

ID = Identification

PARCC = Precision, accuracy, representativeness, completeness and comparability

QC = Quality control

PM = Project Manager

* = Initial and continuing calculations and internal standards are reviewed for Level IV validation and not Level II review (as is the instrument performance check)

TABLE 14-3

*Laboratory Report Goal: Data Validation
 162nd Combat Communications Group
 California Air National Guard
 North Highlands, California*

| Date Completed & PM Initials | Review Item |
|------------------------------|---|
| | 1. Case Narrative Have any anomalies, deficiencies, and QC problems been identified in the case narrative? What corrective action, if any, was taken? |
| | 2. Chain-of-Custody Documentation |
| | Are the original Chain-of-Custody forms with ID numbers and laboratory receipt signatures present? |
| | Are there copies of internal tracking documents, as applicable? |
| | 3. Sample Analysis Results Are sample analysis results included for environmental samples, with quantitation limits (including dilutions and reanalyses)? |
| | 4. QC Summary Is the following information included? (Initial and continuing calibrations) |
| | Method blanks, continuing calibration blanks, and preparation blanks |
| | Surrogate percent recoveries |
| | Internal standard percent recoveries |
| | Matrix spike percent recoveries |
| | Laboratory duplicate relative percent differences |
| | Laboratory QC check sample, laboratory control sample recoveries |
| | Field duplicates, if identified, reproducibility will be evaluated |
| | Acceptance criteria, if not already established by the method/DQO |
| | Definitions for any laboratory data qualifiers used |
| | Gas chromatograph breakdown products |
| | Retention times and acceptance windows (ORGANIC) |
| | ICP interference check sample (INORGANIC) |
| | Method of standard additions (INORGANIC) as necessary |
| | ICP serial dilution (INORGANIC) as necessary |

TABLE 14-3

*Laboratory Report Goal: Data Validation
162nd Combat Communications Group
California Air National Guard
North Highlands, California*

| Date Completed & PM Initials | Review Item |
|------------------------------|---|
| | 5. Raw data, chromatograms, and area quantitation reports (ORGANIC), sequential measurement readout records for ICP, graphite furnace atomic absorption (AA), flame AA, cold vapor mercury, cyanide, and/or other inorganic analyses (INORGANIC), including but not limited to the following: |
| | Environmental samples (include dilutions and reanalyses) |
| | Instrument tuning, for analyses of gas chromatography/mass spectrometry |
| | Initial calibration and continuing calibrations |
| | Method blanks, continuing calibration, and preparation blanks |
| | Surrogate recoveries and internal standard recoveries, where applicable |
| | Matrix spike (MS) |
| | Laboratory duplicate or matrix spike duplicate (MSD) |
| | Laboratory QC check sample, or laboratory control samples, as applicable |
| | Retention time windows |
| | Percent moisture for soil samples |
| | Sample extraction and cleanup logs (ORGANIC) |
| | Enhanced spectra of target analytes and tentatively identified compounds (TICs) with the associated best match spectra for MS data |
| | Sample digestion and/or sample preparation logs (INORGANIC) |
| | Instrument analysis log for each instrument used (INORGANIC) |
| | Postdigest spikes (INORGANIC) |
| | Method of standard additions when applicable (INORGANIC) |
| | ICP serial dilution (INORGANIC) |
| | Instrument tuning for ICP/MS, when applicable (INORGANIC) |
| | 6. Specifically review the following: Was a check for timeliness and errors conducted, including requested deliverables, preservation, holding times, and Chain-of-Custody? |
| | Was a duplicate sample/matrix spike/matrix spike duplicate/post-digest spike reviewed against precision and accuracy criteria specified by the method or by project DQOs? |

TABLE 14-3

*Laboratory Report Goal: Data Validation
162nd Combat Communications Group
California Air National Guard
North Highlands, California*

| Date Completed & PM Initials | Review Item |
|---|---|
| | Was compound quantitation and reported detection limits reviewed, checking reporting limits against contract required limits, verifying dry weights, calculations, and dilutions? |
| | Were target list compounds identified, indicating proper identification of analytes? |
| | Was sample result verification conducted, in which the final reports are reviewed against all raw instrumental data and logs and all applicable worksheets to check anomalies, data reduction/calculations, transcription, linear ranges, and dilutions? |
| | 7. OPTIONAL (as requested for data validation on a case-by-case basis) |
| | Detection limits (DLs) |
| | Instrument detection limits (IDLs) |
| | ICP linear range (INORGANIC) |
| | 8. Does the Validation Report include the following information? |
| | Case narrative including, but not limited to, an overall summary of data acceptability and comparison to DQOs (PARCC), a list of recommended changes, a summary of all laboratory contacts with which communications with the laboratory, if any, would be identified, and any other problems associated with the actual analysis which might impact the sample integrity or data quality |
| | Marking of recommended changes directly on copies of the laboratory reports for the client's ease in performing data entry |
| | Tabulated summary of all data results supplied electronically by email or on compact discs in a commonly used software format |

Notes:

AA = Atomic absorption

DL = Detection limit

DQI = Data quality indicators

DQO = Data quality objective

ICP = Inductively coupled plasma

ID = Identification

IDL = Instrument detection limit

MS = Matrix spike

MSD = Matrix spike duplicate

PARCC = Precision, accuracy, representativeness, completeness and comparability

PM = Project Manager

QC = Quality control

TIC = Tentatively identified compounds

APPENDIX A

*ADDITIONAL APPLICABLE
NGB/A7OF MEMORANDUMS*



NATIONAL GUARD BUREAU

3500 FETCHET AVENUE
JOINT BASE ANDREWS MD 20762-5157

MEMORANDUM FOR NGB/A7OR NATIONAL CONTRACTORS

31 DEC 2009

FROM: NGB/A7O

SUBJECT: A7O 09-01 Requirements for Geospatial Data Deliverables

This memorandum supersedes CEV 05-2, 2 Mar 2005, and A7CV 08-01, 17 Jan 2008. A7CV 07-03, 15 Aug 2007 remains in effect. Please insert this memorandum into your copy of the Environmental Restoration Program Air National Guard Investigation Guidance, September 2009 and remove the two superseded documents.

In order to ensure that digital data collected during contract work for the Environmental Restoration Program (ERP) is compatible with our GIS system, the attached guidance is provided.

Attachment 1 is the ANG Electronic Data Deliverables Requirements Document that specifies how electronic data is to be delivered to ANG. Attachment 2 is the ANG Environmental Restoration Mission Data Set Control Document that further defines how data collected for ERP projects is to be configured and submitted. Both of these documents are living documents and updates will be provided periodically.

To obtain GIS data for past ERP projects, the ANG Geo Integration Office has developed a form to request this data (Atch 3). Provide this completed form to the appropriate ANG Program Manager.

The point of contact for this issue is the Chief of the Environmental Restoration Branch, Mr. Russell Dyer, NGB/A7OR, (301) 836-8149, or email russell.dyer@ang.af.mil.

BENJAMIN W. LAWLESS, P.E, YF-03
Chief, Operations Division

cc:
NGB-ZC-AQ-E

Attachments:

1. Electronic Data Deliverables Requirements Document
2. Environmental Restoration Mission Data Set Control Document
3. GIO Geospatial Data Request Form

Air National Guard Geo Integration Office

Electronic Data Deliverables Requirements



October, 2009

**Prepared by the Air National Guard Geo Integration Office
Andrews AFB, Maryland**

Document History

[illegible]

SPECIFICATIONS FOR ELECTRONIC DATA DELIVERABLES

Any maps, drawings, figures, sketches, databases, spreadsheets, or text files prepared in support of this contract shall be provided in both hard copy and digital form. The hard copy deliverables and their distribution are defined in a previous section of this statement of work.

1. **Air National Guard (ANG) Enterprise-Standard Software Applications**

The ANG utilizes the following software applications to create, edit and manage electronic data. All electronic data deliverables created under this contract shall be delivered in a format compatible with the following applications:

| Functional Area | Software Application |
|--------------------------------|--|
| Office Productivity | Microsoft Office 2003 or 2007 (Professional Edition) |
| Document Publishing | Adobe Acrobat 8 or later |
| Desktop GIS | ESRI ArcGIS 9.2 or later |
| Computer-Aided Design/Drafting | AutoCAD 2006 or later |

2. **Text and Spreadsheet Documents**

Reports and other text documents, both draft and final versions, shall be provided in a Microsoft Word format AND Adobe Portable Document Format (PDF) to facilitate Government review and retention. Spreadsheet files shall be provided in Microsoft Excel format.

3. **Relational Databases**

Databases shall be provided in Microsoft Access format, unless otherwise specified, as approved by the Government. Prior to database development, the Contractor shall provide the Government with a Technical Approach Document for approval, which describes the Contractor's technical approach to designing and developing the database.

4. **Map Figures**

All map figures shall be produced using geospatial data. In addition to the delivery of the final figure (*.pdf or *.jpg), the map template (*.mxd) shall also be delivered. Common Installation Picture (CIP) data layers that are displayed on a map figure must follow the Air Force Cartographic Standards.

5. **Geospatial Datasets**

Datasets used to create digital map figures as part of this deliverable shall be placed in the following folders (only folders with data should be created):

- **Project** – Data layers developed or modified as a requirement for this contract. These data layers shall be developed in accordance to the standards listed below.
- **CIP** – The geodatabase or CAD files obtained from the base or ANG used for the base map in the map figures. This data shall be used as is and shall not be modified without the approval from the ANG GIO.
- **External Sources** – Data layers obtained from external sources such as commercial (excluding the ESRI dataset), local, state, and other Federal Agencies. The contractor

shall ensure that the metadata information is accurate and conform to the ANG GIO metadata standards. The contractor shall utilize and deliver this dataset in its original format.

- **CAD** – Any CAD files used with the available base map data. This data is not required to be in SDSFIE unless the data conversion is required in the contract.
- **GPS** – Original files generated by the GPS equipment. This folder shall be included in the final deliverable.

6. **Data Format**

Digital geographic maps and the related data sets shall be developed using double precision, and the data sets shall be delivered in one of the following formats (in order of preference):

- Personal GeoDatabase format for ArcGIS 9.2 or later
- ArcGIS 9.x Shapefile (.shp) format

ArcGIS is a geographic information system (GIS) software suite developed by the Environmental Systems Research Institute (ESRI) of Redlands, California, and comprises the software used to support ANG GeoBase integration efforts. **Any deviation from this established standard shall require prior written approval.**

7. **Geospatial Data Standards**

The Contractor shall develop all geographic information in a structure consistent with the Spatial Data Standards for Facilities, Infrastructure and Environment (SDSFIE), Version 2.6. At a minimum, all developed data will be required to contain valid primary key identifiers, and other SDSFIE attributes, as requested. The ANG Quality Assurance Plans (QAPs) outline the specific requirements for spatial data layers for each service.

Electronic copies of the Standard are available from SDSFIE's Internet homepage at URL address: <http://www.sdsfie.org>. Electronic copies of the standard may also be acquired by contacting the ANG Geo Integration Office.

The Contractor is instructed to use the SDSFIE personal geodatabase builder in the SDSFIE toolset. This will create a compliant personal geodatabase from which the Contractor can populate the mandatory attributes, including primary and foreign key fields.

The Contractor shall submit a written request for approval of any deviations from the Government's established GIS standard. No deviations from the Government's established GIS standard will be permitted unless prior written approval of such deviation has been received from the Government.

All GIS data will be delivered in with the correct geometry and topology. Point, linear, polygon features (within and across feature classes/layers/levels) which share a common boundary/edge, will have coincident geometry (e.g. will not overlap or have gaps between features). The coincident geometry will be defined by a cluster tolerance that is

appropriate for the scale and accuracy of the data. All polygon/polyline features will close. For linear features, all features should be snapped together so a continuous network is maintained.

8. **Projection and Datum Standards**

All geographic data shall be stored in a coordinate system specified by the Base Civil Engineer (BCE). The specified coordinate system shall be that which is used for existing base mapping efforts, and must also be a projected coordinate system. If a coordinate system is not specified by the BCE then all geospatial data in the applicable zone of the State Plane Coordinate System, using the World Geodetic System of 1984 (WGS 84) as the earth datum and units of English feet or as defined by the base CIP. The projection, datum and coordinate system must be defined and then documented in the metadata for both CADD and GIS and provided whenever the data is submitted. Data deliverables shall integrate directly with existing base mapping products without post-processing of any kind. All ESRI shapefile deliverables shall include a projection file (*.prj). Acceptable shape geometry includes: polygon, polyline, point, polygon Z, polyline Z, and point Z.

9. **Accuracy Standards**

Geospatial data can be collected from existing digital or hardcopy sources, from satellite or aerial imagery, or through field collection. The preferred accuracy for coordinates defining features is 1 Foot/.3 Meters or better - 3.25ft /1 m Root Mean Square Error (RMSE). The Subject Matter Expert (SME) for the primary functional dataset will be consulted when making determination as to valid and preferred sources. Valid sources for geospatial data development are described below:

- **Field Survey** – The use of Global Positioning Survey (GPS) or other survey equipment to directly capture geospatial features from the field.
- **Computer Aided Design (CAD)** – The conversion of geospatial features from spatially referenced digital CAD files. These are, typically, real property master plans, construction design, or as-built drawings.
- **Imagery** – The “heads up” digitization or extraction of features from orthorectified digital imagery (aerial or satellite platforms).
- **Hardcopy Documents** – The manual digitization of hard copy (non-electronic) documents or the heads up digitization/raster vector conversion of soft copy documents. To be geo-referenced, the map must include bench mark points or spatially referenced locations.

The level of spatial accuracy should depend on the application of the data. For example, Real Property geospatial features that will require measurements in the Real Property Inventory Requirements (RIPR) model should be mapped with the highest possible accuracy.

Map or drawing scales shall be determined by the Base Civil Engineer. Recommended A/E/C/ Surveying and Mapping Standards of the Federal Geographic Data Committee’s (FGDC) “Geospatial Positioning Accuracy Standards Part 4: Standards for A/E/C and

Facility Management”.

Mapping accuracy for the agreed scales shall conform to the FGDC “Geospatial Positioning Accuracy Standards Part 3: National Standard for Spatial Data Accuracy”.

Copies of the FGDC Accuracy Standard can be obtained by contacting:

FGDC Secretariat
c/o U.S. Geological Survey
590 National Center
Reston, Virginia 22092
(703) 648-5514

FGDC standards can also be found on the Internet at: <http://www.fgdc.gov>

10. Metadata Standards

For each geospatial digital file delivered containing geographic information (regardless of format), the Contractor shall deliver the file in one of the following formats (in order of preference):

- ANG GIO metadata standards (see below)
- FDGC Content standard for digital geospatial metadata (CSDGM), revised June 1998.

Copies of the FGDC metadata standard can be obtained by contacting:

FGDC Secretariat
c/o U.S. Geological Survey
590 National Center
Reston, Virginia 22092
(703) 648-5514

FGDC standards can also be found on the Internet at: <http://www.fgdc.gov>

Metadata submissions will be reviewed against current Defense Installations Spatial Data Infrastructure (DISDI) or ARNG/ANG metadata requirements. Where possible, the contractor may update missing attribute information; otherwise the contractor will identify missing required metadata attribute values for population by the Installation/State/Territory.

11. Data Transfer

All electronic data submittals shall be delivered on compact disk (CD-ROM) or digital video disc (DVD) with read-only memory in ISO-9660 format. The Contractor shall include information and the means required (if necessary) for the retrieval of the archived data from the CD-ROM.

All electronic media deliverables shall be permanently labeled and include, at a minimum, the following information:

- The Contract Number (and Delivery Order Number if applicable) and date.
- The format and version of operating system software.
- The name and version of utility software used for preparing (e.g., compression/decompression) (if applicable) and copying files to the media.
- The sequence number of the digital media.
- A list of the filenames on the digital media (as space on the label permits).

Each CD-ROM or DVD shall include an ASCII text file labeled README.TXT. The README file is to describe the contents of the disc (e.g. file names, data dictionary, file contents, etc.) and any other pertinent information that may be required by the Government.

12. Data Review Methodology

Digital geographic maps, related data, and text documents shall be included for review in the draft and final contract submittals. The reviews shall include a visual demonstration of the data on one of the computer systems located at the Government's facility. The Government shall conduct actual loading of the data to the ANG GIO enterprise server environment.

Data shall be analyzed for subject content and system compatibility. The Contractor, prior to approval of the final submittal, shall incorporate review comments to data and text.

For GIS data deliverables, the Government shall review the geographic data structure and may make recommendations on changes necessary to the structure prior to acceptance of data for subject content, system compatibility, and to ensure compliance with SDSFIE (including appropriate SDSFIE version at the time of data submission) and metadata standards. The Contractor, prior to the approval and acceptance of the final submittal, shall incorporate review comments to data and text. The Contractor will incorporate the necessary changes to data until the data meets the appropriate standards of acceptability.

OWNERSHIP

The Government, for itself and such others as it deems appropriate, will have unlimited rights under this contract to all information and materials developed under this contract and furnished to the Government and documentation thereof, reports, and listings, and all other items pertaining to the work and services pursuant to this agreement including any copyright. Unlimited rights under this contract are rights to use, duplicate, or disclose text, data, drawings, and information, in whole or in part in any manner and for any purpose whatsoever without compensation to, or approval from, the Contractor. The Government will at all reasonable times have the right to inspect the work and will have access to and the right to make copies of the above-mentioned items. All text, electronic digital files, data, and other products generated under this contract shall become the property of the Government. By

reference, the following DFAR clauses are included in this contract as a part of the requirements herein:

DFAR 252.227-7013, "Rights in Technical Data - Noncommercial Items."

DFAR 252.227-7017, "Identification and Assertion of Use, Release, or Disclosure Restrictions."

DFAR 252.227-7020, "Rights in Special Works."

DFAR 252.227-7028, "Technical Data or Computer Software Previously Delivered to the Government"

DFAR 252.227-7037, "Validation of Restrictive Markings on Technical Data."

DFAR 252.227-7025, "Limitations on the Use or Disclosure of Government-Furnished Information Marked with Restrictive Legends."

DFAR 252.227-7014, "Rights in Noncommercial Computer Software and Noncommercial Computer Software Documentation."

REFERENCES

CADD/GIS Technology Center, A/E/C CADD Standard (ERDC/ITL TR-01-6), 2001.

CADD/GIS Technology Center, Spatial Data Standards for Facilities, Infrastructure and Environment, 2006.

Federal Geographic Data Committee (FGDC) Standard 001-1998, Content Standards for Digital Geospatial Metadata (CSDGM) Version 2.

FGDC Standard 007.3-1998, Geospatial Positioning Accuracy Standards, Part 3: National Standard for Spatial Data Accuracy.

FGDC Standard 007.4-2002, Geospatial Positioning Accuracy Standards, Part 4: Standards for Architecture, Engineering, and Construction (A/E/C) and Facility Management.

ANG GIO Metadata Standards

ANG Metadata Standards for Vector Data

ANG GIO will publish and maintain the ANG GIO Metadata Standards document. The document will be based on and adhere to Headquarters Air Force CSDGM metadata profile while ensuring that it also adheres to the translation requirements of the Defense Installation Spatial Data Infrastructure Group (DISDIG) Metadata Profile. The ANG GIO Metadata Standards document will include the minimum required elements to best serve the ANG user community and maintain compliance with DoD standards. Thus, ANG GIO Vector Metadata specifications will adhere to the standards established in the Federal Geographic Data Committee (FGDC) Content Standards for Digital Geospatial Metadata (CSDGM).

As previously mentioned the ANG GIO Metadata Profile will also include translation and authoring tools for migration and quality assurance to the DISDI Geospatial Metadata Profile (DGMP) and the North American Profile (NAP). The ANG GIO Program Office will maintain configuration management and certification requirements for these COTs tools as related to Air Force Information Assurance.

ANG Metadata Standards for Imagery

The ANG GIO is coordinating with the DISDIG to develop metadata standards for raster data sets, including satellite imagery, orthophotography, DTM, and others. This effort is not complete at the time of this writing. Until a DoD requirement is established, ANG GIO Raster Metadata specifications will adhere to the standards established in the Federal Geographic Data Committee (FGDC) Content Standards for Digital Geospatial Metadata (CSDGM).

Section 1 – Identification

| FGDC CSDGM - Content Standard for Digital Geospatial Metadata | | | NGB/ANG GIO Metadata Standard | |
|---|----------------------------|--------------|--|---|
| Number | Name | Requirement | Description | Examples/Valid Values |
| 1 | Identification Information | | | |
| 1.1 (8) | Citation | | | |
| 1.1 (8.1) | Originator | Required | The name of an organization or individual that developed the data set. | <p>When the originator is within the USAF, use only approved USAF Office Designations required by AFI 33-360v1 Attachment 4 Section C:</p> <p>Example Values: "133 CES/CEPT" "133 SWS/CEA 3" "GC/CETS" "Earthdata, Inc." "Unknown"</p> |
| 1.1 (8.2) | Publication Date | Required | <p>The date of release or current version of the file. This represents the date that a given layer and associated metadata file were written to CD-ROM or otherwise transmitted for final delivery/approval.</p> <p>For USAF IGI&S organizations, the date in which either the data set was made accessible for download or was sent to the US Government representative as or on behalf of the IGI&S office receiving the data.</p> | Valid Value Format: yyyymmdd |
| 1.1 (8.3) | Publication Time | Not Required | | |

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|--------------|-------|----------|---|--|
| 1.1 (8.4) | Title | Required | <p>The name by which the data set is referred.</p> <p>The USAF IGI&S Community will use the following semantic names for each layer vector data layer</p> | <p>The following valid values are examples for the USAF CIP:</p> <p>Towers</p> <p>Slabs</p> <p>Buildings</p> <p>Sheds</p> <p>Installation Boundaries</p> <p>Range Complex Boundaries</p> <p>Live Firing Ranges</p> <p>Shorelines</p> <p>Rivers and Streams</p> <p>River and Stream Centerlines</p> <p>Lakes and Ponds</p> <p>Athletic Fields</p> |
|--------------|-------|----------|---|--|

Athletic Courts
Golf Courses
Swimming Pools
Levees and Berms
Dams
Fences
Gates
Walls
Campgrounds
Playgrounds
Parks
Trails
Elevation Contours
Airfield Centerlines
Airfield Surfaces
Tunnels
Footbridges
Walkways
Railroads
Railroad Bridges
Road Bridges
Driveways
Parking Lots
Road Centerlines
Road Areas
Mooring Facilities

1.1
(8.5)

Edition

Not Required

| | | | | |
|--------------|-------------------------|---------------------|--|--|
| 1.1 (8.6) | Geospatial Form | Required | The mode in which the geospatial data are represented. | (the listed domain is partially from pp. 88-91 in Anglo-American Committee on Cataloguing of Cartographic Materials, 1982, Cartographic materials: A manual of interpretation for AACR2: Chicago, American Library Association): "atlas" "audio" "diagram" "document" "globe" "map" "model" "multimedia presentation" "profile" "raster digital data" "remote-sensing image" "section" "spreadsheet" "tabular digital data" "vector digital data" "video" "view" free text |
| 1.1 (8.7) | Series Information | Not Required | | |
| 1.1 (8.7.1) | Series Name | Not Required | | |
| 1.1 (8.7.2) | Issue Identification | Not Required | | |
| 1.1 (8.8) | Publication Information | | | |

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| 1.1 (8.8.1) | Publication Place | Required | <p>The name of the place where the data set was published or released. For the USAF, this will contain the name of the service, a single space, followed by the installation/facility name.</p> <p>For joint facilities (e.g., a Joint Reserve Base), the host service should be identified as the originator, or if no host service exists, the facility should be identified as a Joint Base (e.g. JRB).</p> | <p>Service names:</p> <p>“USA”</p> <p>“USN”</p> <p>“USMC”</p> <p>“USAF”</p> <p>“JRB”</p> <p>Example values:</p> <p>“USA Fort Bliss”</p> <p>“USAF Edwards Air Force Base”</p> <p>“USN Naval Station Norfolk”</p> <p>“USMC MCAS Miramar”</p> <p>“JRB Willow Grove”</p> |
| 1.1 (8.8.2) | Publisher | Required | The name of the individual or organization that published the data set. | <p>When the publisher is within the USAF, use only approved USAF Office Designations required by AFI 33-360v1 Attachment 4 Section C:</p> <p>Example Values:</p> <p>"133CES/CEPT"</p> <p>"133SWS/CEA 3"</p> <p>"GC/CETS"</p> <p>"Earthdata, Inc."</p> <p>"Unknown"</p> |
| 1.1 (8.9) | Other Citation Details | Not Required | | |
| 1.1 (8.10) | Online Linkage | Not Required | | IF AUTOPOPULATED THE VALUE MUST BE DELETED. |
| 1.1 (8.11) | Larger Work Citation | | | |
| 1.1 (8.11.1) | Citation | | | |
| 1.2 | Description | | | |
| 1.2.1 | Abstract | Required | A summary of the intentions with which the data set was developed. For the USAF CIP, the SDSFIE entity type definition for the respective layer will be used. | Valid Values: SDSFIE entity type definitions |

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| 1.2.2 | Purpose | Required | A summary of the intentions with which the data set was developed. Must be the following valid value: | Valid Value: "Provides installation mapping and visualization capabilities for the U.S. Department of Defense. Provides situational awareness as a fundamental layer of the U. S. Air Force Common Installation Picture." |
| 1.2.3 | Supplemental Information | Not Required | | |
| 1.3 | Time Period of Content | | | |
| 1.3 (9) | Time Period Information | | | |
| 1.3 (9.1) | Single Date/Time | | | |
| 1.3 (9.1.1) | Calendar Date | 9.1, 9.2 OR 9.3 are Required | The latest date to which the data content represents conditions on the ground. This field is used to capture neither the publication date of a study or of a hardcopy map nor the date the hardcopy was converted to digital format, but rather the date the conditions at the location were measured or derived. For hardcopy maps, if the content date is unknown, the map publication date can be used. If only the month and year are known, but not specific day within the given month, enter zeros ("0") in the place of "dd" as shown. | Format: yyyymmdd Example values: "20020101" (representing 01 Jan 02) "20031128" (representing 28 Nov 03) "19980100" (representing Jan 98) |
| 1.3 (9.1.2) | Time of Day | Not Required | | |
| OR 1.3 (9.2) | Multiple Dates/Time | | | |
| 1.3 (9.1) | Single Date/Time | | | |

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|----|-------------|-------------------------|---|--|---|
| | 1.3 (9.1.1) | Calendar Date | 9.1, 9.2 OR 9.3 are Required | The latest date to which the data content represents conditions on the ground. This field is used to capture neither the publication date of a study or of a hardcopy map nor the date the hardcopy was converted to digital format, but rather the date the conditions at the location were measured or derived. For hardcopy maps, if the content date is unknown, the map publication date can be used. If only the month and year are known, but not specific day within the given month, enter zeros ("0") in the place of "dd" as shown. | Format: yyyymmdd <i>Example values:</i> "20020101" (representing 01 Jan 02) "20031128" (representing 28 Nov 03) "19980100" (representing Jan 98) |
| | 1.3 (9.1.2) | Time of Day | Not Required | | |
| OR | 1.3 (9.3) | Range of Dates/Times | | | |
| | 1.3 (9.3.1) | Beginning Date | 9.1, 9.2 OR 9.3 are Required | The earliest date to which the data content represents conditions on the ground. This field is used to capture neither the publication date of a study or of a hardcopy map nor the date the hardcopy was converted to digital format, but rather the date the conditions at the location were measured or derived. For hardcopy maps, if the content date is unknown, the map publication date can be used. If only the month and year are known, but not specific day within the given month, enter zeros ("0") in the place of "dd" as shown. | Format: yyyymmdd <i>Example values:</i> "20020101" (representing 01 Jan 02) "20031128" (representing 28 Nov 03) "19980100" (representing Jan 98) |
| | 1.3 (9.3.2) | Beginning Time | Not Required | | |

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|-------------|----------------------------------|------------------------------|--|--|
| 1.3 (9.3.3) | Ending Date | 9.1, 9.2 OR 9.3 are Required | The latest date to which the data content represents conditions on the ground. This field is used to capture neither the publication date of a study or of a hardcopy map nor the date the hardcopy was converted to digital format, but rather the date the conditions at the location were measured or derived. For hardcopy maps, if the content date is unknown, the map publication date can be used. If only the month and year are known, but not specific day within the given month, enter zeros ("0") in the place of "dd" as shown. | Format: yyyymmdd <i>Example values:</i> "20020101" (representing 01 Jan 02) "20031128" (representing 28 Nov 03) "19980100" (representing Jan 98) |
| 1.3 (9.3.4) | Ending Time | Not Required | | |
| 1.3.1 | Currentness Reference | Required | Reference for the Time Period of Content. Must be one of the following valid values: | Valid Values "Ground condition date", "Publication date for source materials", "Date of the last transaction that altered the dataset", or Free Text |
| 1.4 | Status | | | |
| 1.4.1 | Progress | Required | The state of the data set. Must be the following value: | Valid Values: "Complete as currency reference" "In development" - incomplete/initial layer creation, "Undergoing maintenance" - currently being significantly updated or altered Free Text |
| 1.4.2 | Maintenance and Update Frequency | Required | The frequency with which changes and additions are made to the data set after the initial data set is completed. Must be the following value: NOTE: The data may be updated on a regular or frequent basis at the installation | Valid values: "Annually", "As Needed", "As Requested", "As Funded", "Irregularly", "None Planned", "Other", or "According to transactions that alter the dataset" |

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| 1.5 | Spatial Domain | | | |
| 1.5.1 | Bounding Coordinates | See below | The outermost limits of coverage of a data set expressed by latitude and longitude values in the order western-most (CSDGM element 1.5.1.1), eastern-most (1.5.1.2), northern-most (1.5.1.3), and southern-most (1.5.1.4). These bounding coordinates are provided to enable spatial search within certain applications. | Valid Values: Latitude: -90.00 to 90.00 Longitude: -180.00 to 199.99 |
| 1.5.1.1 | West Bounding Coordinates | Required | Western-most coordinate of the limit of coverage expressed in longitude. | [-104.813310] |
| 1.5.1.2 | East Bounding Coordinates | Required | Eastern-most coordinate of the limit of coverage expressed in longitude. | [-104.709946] |
| 1.5.1.3 | North Bounding Coordinates | Required | Northern-most coordinate of the limit of coverage expressed in latitude. | [39.748218] |
| 1.5.1.4 | South Bounding Coordinates | Required | Southern-most coordinate of the limit of coverage expressed in latitude. | [39.660283] |
| 1.5.2 | Data Set G-Polygon | | | |
| 1.5.2.1 | Data Set G-Polygon Outer G-Ring | | | |
| 1.5.2.1.1 | G-Ring Point | | | |
| 1.5.2.1.1.1 | G-Ring Latitude | Not Required | | |
| 1.5.2.1.1.2 | G-Ring Longitude | Not Required | | |
| OR 1.5.2.1.1 | G-Ring | | | |
| 1.5.2.2 | Data Set G-Polygon Exclusion G-Ring | | | |
| 1.5.2.1.1 | G-Ring Point | | | |

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|-----|-------------|-------------------------|---------------------|--|--|
| | 1.5.2.1.1.1 | G-Ring Latitude | Not Required | | |
| | 1.5.2.1.1.2 | G-Ring Longitude | Not Required | | |
| | | G-Ring | Not Required | | |
| 1.6 | | Keywords | | | |
| | 1.6.1 | Theme | | | |
| | 1.6.1.1 | Theme Keyword Thesaurus | Required | Reference to a formally registered thesaurus or a similar authoritative source of theme keywords. | Use at least: "NGB/ANG GIO Vocabulary" Additional values may include: "DoD Vocabulary Registry" "GIS Dictionary" Other industry or DoD vocabulary books or registries |
| | 1.6.1.2 | Theme Keyword | Required | Common-use words or phrase words used to describe the subject of the data set. Required values include: Common name of mapped site. Keywords must be consistent at least with the NGB/ANG GIO Vocabulary, if not with all other items listed in 1.6.1.1 Theme Keyword Thesaurus | Example Minimum Required Keyword Values: <ul style="list-style-type: none"> •Layer name, as per CDSGM element 1.1 (8.4) e.g. "Buildings"; •SDSFIE entity type OR ESRI feature class name •SDSFIE Entity Class OR ESRI feature dataset name •"Common Installation Picture" AND "CIP" •"Installation Geospatial Information and Services", "IGI&S", AND "GeoBase" • Installation Host, Wing, and MAJCOM names AND symbols |
| | 1.6.2 | Place | | | |
| | 1.6.2.1 | Place Keyword Thesaurus | Required | Reference to a formally registered thesaurus or a similar authoritative source of place keywords. | Valid Values: "Automated Civil Engineer System - Real Property Module (ACES-RP)" "Geographic Names Information System" free text |
| | 1.6.2.2 | Place Keyword | Required | Geographic locations characterized by the data set. | Valid Values: <ul style="list-style-type: none"> •Installation name, as per CDSGM element 1.1 (8.1.1) - "USAF St Paul Air National Guard Base" |

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| | | | | <ul style="list-style-type: none"> •Installation Code - "QJKL" •City - "St. Paul" (if applicable) •State - "MN" •Country - "USA" |
| 1.6.3 | Stratum | | | |
| 1.6.3.1 | Stratum Keyword Thesaurus | Not Required | | |
| 1.6.3.2 | Stratum Keyword | Not Required | | |
| 1.6.4 | Temporal | | | |
| 1.6.4.1 | Temporal Keyword Thesaurus | Not Required | | |
| 1.6.4.2 | Temporal Keyword | Not Required | | |
| 1.7 | Access Constraints | Required | Restrictions and legal prerequisites for accessing the data set. These include any access constraints applied to assure the protection of privacy or intellectual property, and any special restrictions on obtaining the data set. | |
| | | | | |
| 1.8 | Use Constraints | Required | Restrictions and legal prerequisites for using the data set after access is granted. These include constraints applied to assure the protection of privacy or intellectual property, and any special restrictions or limitations on using the data set. | Valid value: "This data may not be sufficient for project-specific design and construction." |
| 1.9 | Point of Contact | | | |
| 1.9 (10) | Contact | | | |

| | | | | | |
|---------------|--|------------------------------------|--|--|--|
| | | Information | | | |
| 1.9 (10.1) | | Contact Person Primary | | | |
| 1.9 (10.1.1) | | Contact Person | DO NOT USE CONTACT PERSON AS PRIMARY. | | |
| 1.9 (10.1.2) | | Contact Organization | | | |
| OR 1.9 (10.2) | | Contact Organization Primary | | | |
| 1.9 (10.1.2) | | Contact Organization | Required | The office symbol of the IGI&S GeoBase program office or CEPT element for the installation. | Valid Values: When the originator is within the USAF, use only approved USAF Office Designations required by AFI 33-360v1 Attachment 4 Section C "ACC A7CIG" Example Values: "133 CES/CEPT" "132 SWS/CEA 3" "Earthdata, Inc." "Unknown" |
| 1.9 (10.1.1) | | Contact Person | Required | The Point of Contact (POC) person for the CIP is the IGI&S GeoBase program manager or CEPT element superintendent for the installation. | Example: "John Smith" "John Q Public" |

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| 1.9 (10.3) | Contact Position | Required | Title of the POC or mission knowledge expert. | Valid Values: "Civil Service (Civ)" – Civilian "Contractor (Contr)" – Contractor Military titles including: "Captain (Capt)" "Lieutenant (Lt)" "Master Sergeant (MSgt)" "Technical Sergeant (TSgt)" Also follow these titles with applicable position titles, such as: "OIC" Officer in Charge "NCOIC" Non-commissioned Officer in Charge "Chief, Technical Services Element" etc. |
| 1.9 (10.4) | Contact Address | | | |
| 1.9 (10.4.1) | Address Type | Required | The type of address provided. Must be one of the following valid values: | Valid Values: "mailing" "physical" "mailing and physical" "P.O. Box" Other (describe) |
| 1.9 (10.4.2) | Address | Required | Address line for the POC or mission knowledge expert. | Example Values: "4908 Dominica Way" "614 Militia Drive" "P.O. Box 100" |
| 1.9 (10.4.3) | City | Required | The address city for the POC or mission knowledge expert. | Example Values: "Washington" (for Washington DC) "Vandenberg AFB" "St Paul" "San Diego" |
| 1.9 (10.4.4) | State or Province | Required | The address state or territory for the POC or mission knowledge expert. Use accepted two-letter Postal state/territory codes for this field. | Example Values: "DC" – Washington, DC "MN" – Minnesota "PR" – Puerto Rico "GU" – Guam |

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| 1.9 (10.4.5) | Postal Code | Required | The ZIP code for the POC or mission knowledge expert. Nine digit ZIP codes, with dashes, preferred, but five digit zip codes will be accepted. | Example Values: "22030-1260" "55124" |
| 1.9 (10.4.6) | Country | Required | POC or mission knowledge expert address country. | Use ISO 3166-1 alpha-3 letter country codes. Example Values: "USA" "DEU" "KOR" |
| 1.9 (10.5) | Contact Voice Telephone | Required | POC or mission knowledge expert Telephone number, including all applicable area codes and extensions. Commercial numbers are preferred, and should be preceded with "COMM" as shown. However, if only DSN numbers are available, enter that number here and precede the number with "DSN" as shown: | Include at least a commercial phone number. If a DoD Direct Service Number is available, record that as a second record in the recurring entry for this field. Example Values: COMM 123-456-7890, COMM 123-456-7890 ext: 345, DSN 123-456-7890, DSN 123-4567 |
| 1.9 (10.6) | Contact TDD/TTY Telephone | Not Required | | |
| 1.9 (10.7) | Contact Facsimile Telephone | Not Required | | |
| 1.9 (10.8) | Contact Electronic Mail Address | Required | The email address for the POC or mission knowledge expert. | Use organizational mailboxes if available. Examples Values: "133CES.CEPT@ang.af.mil" "john.smith@basename.af.mil" |
| 1.9 (10.9) | House of Service | Required | Time period when individuals can speak to the organization or individual. | Example: "0700-1600 Central Time" |

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|-------------|---------------------------------|--------------|------------------------------------|--|
| 1.9 (10.10) | Contact Instructions | Not Required | | |
| 1.10 | Browse Graphic | | | |
| 1.10.1 | Browse Graphic File Name | Not Required | | |
| 1.10.2 | Browse Graphic File Description | Not Required | | |
| 1.10.3 | Browse Graphic File Type | Not Required | | |
| 1.11 | Data Set Credit | Not Required | | |
| 1.12 | Security Information | | | |
| 1.12.1 | Security Classification System | Required | Name of the classification system. | Valid Values: "Unclassified Approved for Public Release" "Unclassified" "Controlled Unclassified Information" "Classified Information" |

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| 1.12.2 | Security Classification | Required | Name of the handling restrictions on the data set. Classified data (CONFIDENTIAL, RESTRICTED, SECRET, or TOP SECRET) will not be present on an unclassified network or environment. | Valid Values: //UNCLASS/APR //UNCLASS //UNCLASS/FOUO //UNCLASS/FOUO/LES //UNCLASS/DoD UCNI //UNCLASS/CSA1987 //UNCLASS/TD //UNCLASS/LIMDIS //UNCLASS/SSI //UNCLASS/CVI //UNCLASS/SGI //UNCLASS/CUI/STD //UNCLASS/CUI/CONSPEC //UNCLASS/CUI/CONEN //CONFIDENTIAL //RESTRICTED //SECRET //TOP SECRET |
| 1.12.3 | Security Handling Description | Required | | Valid Values: "Unclassified Approved for Public Release" "Unclassified" "Unclassified For Official Use Only" "Unclassified For Official Use Only Law Enforcement Sensitive" "Department of Defense Unclassified Controlled Nuclear Information" "Unclassified controlled Sensitive information under the Computer Security Act of 1987" "Unclassified controlled information in Technical Documents" "Unclassified controlled information from NGA under Limited Distribution" "Unclassified controlled Sensitive Security Information" "Unclassified controlled Chemical |

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| | | | | Vulnerability Information" "Unclassified controlled Safeguards Information" "Controlled Unclassified Information" "Controlled Unclassified Information with Standard Dissemination" "Controlled Unclassified Information with Specified Dissemination" "Confidential" "Restricted" "Secret" "Top Secret" |
| 1.13 | Native Data Set Environment | Required | A description of the data set in the producer's processing environment, including items such as the name of the software (including version), the computer operating system, file name (including host-, path-, and filenames), and the data set size. | Overwrite the auto populated value with one of the following: "MS SQL Server <version>, ArcSDE <version> geodatabase" " MS SQL Server <version> Spatial <version> GIS database" "MS Access <version> personal geodatabase <version>" "AutoCAD <version> Spatial Data File (.sdf)" |
| 1.14 | Cross Reference | | | |
| 1.14 (8.1) | Originator | Not Required | | |
| 1.14 (8.2) | Publication Date | Not Required | | |
| 1.14 (8.3) | Publication Time | Not Required | | |
| 1.14 (8.4) | Title | Not Required | | |
| 1.14 (8.5) | Edition | Not Required | | |
| 1.14 (8.6) | Geospatial Form | Not Required | | |
| 1.14 (8.7) | Series Information | | | |
| 1.14 (8.7.1) | Series Name | Not Required | | |
| 1.14 (8.7.2) | Issue Identification | Not Required | | |
| 1.14 (8.8) | Publication Information | | | |

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|---------------|------------------------|---------------------|--|
| 1.14 (8.8.1) | Publication Place | Not Required | |
| 1.14 (8.8.2) | Publisher | Not Required | |
| 1.14 (8.9) | Other Citation Details | Not Required | |
| 1.14 (8.10) | Online Linkage | Not Required | PLEASE DELETE THE VALUE OF THIS FIELD IF IT IS AUTOPOPULATED. |
| 1.14 (8.11) | Larger Work Citation | | |
| 1.14 (8.11.1) | Citation | Not Required | |

Section 2 – Data Quality Information

| FGDC CSDGM - Content Standard for Digital Geospatial Metadata | | NGB/ANG GIO Metadata Standard | | |
|---|--------------------------|-------------------------------|-------------|-----------------------|
| Number | Name | Requirement | Description | Examples/Valid Values |
| 2 | Data Quality Information | | | |
| 2.1 | Attribute Accuracy | | | |

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|---------|---|---------------------|--|--|
| 2.1.1 | Attribute Accuracy Report | Required | An explanation of the accuracy of the identification of the entities and assignments of values in the data set and a description of the tests used. | <p>Valid Values: "The accuracy of the attribute values in this data set has not yet been determined."</p> <p>"The accuracy of the attribute values has been determined ..." then add a statement of its accuracy and technical details as additional text.</p> <p>The statement of accuracy may be expressed in the following format: "... to be accurate XX% of the time. The margin of error in determining accuracy was +/-X%. The methods for testing were as follows:" described with additional text.</p> |
| 2.1.2 | Quantitative Attribute Accuracy Assessment | | | |
| 2.1.2.1 | Attribute Accuracy Value | Not Required | | |
| 2.1.2.2 | Attribute Accuracy Explanation | Not Required | | |

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| 2.2 | Logical Consistency Report | Required | An explanation of the fidelity of relationships in the data set and tests used. | <p>Describe the topology, both internal to the map layer and external to other CIP or MDS map layers, and all other business rules associated with the composition of data in the data set. Describe also the logical and topological test used to see if the data was compliant with these business rules.</p> <p>Example Value: "Airfield centerlines intersect at airfield traffic intersections. Airfield centerline edges connect from junction to junction until meeting a dead-end or the outside edge of all airfield surfaces."</p> |
| 2.3 | Completeness Report | Required | Enter data about omissions, selection criteria, generalizations, definitions used, and other rules to derive the data set. Use this field to record if any features were excluded from the data set for any reason. | <p>If no omissions are present – Valid Value: "Complete data set according to {title of this guidance document}, {release of this guidance document}."</p> <p>If omissions are present – Valid Value: Free text, describing any map features/elements that exist on the ground but have been omitted from the data set due to constraints.</p> <p>Example Values: "New boundary from 2005 land transfer to {jurisdiction} not shown as the boundary re-survey has not yet been performed."</p> |
| 2.4 | Positional Accuracy | | | |
| 2.4.1 | Horizontal Positional Accuracy | | | |
| 2.4.1.1 | Horizontal Positional Accuracy Report | Required | A narrative explanation of the accuracy of the horizontal coordinate measurements. | <p>Valid Values: "Horizontal positional accuracy for this dataset is yet to be determined."</p> |

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| | | | | | "Horizontal positional accuracy for this dataset has been determined by the following methodology:" then add in text the detailed processes and methods used to derive the horizontal positional accuracy measurement. |
| 2.4.1.2 | Quantitative Horizontal Positional Accuracy Assessment | | | | |
| 2.4.1.2 .1 | Horizontal Positional Accuracy Value | Required | Use this field to record the horizontal positional accuracy of digital geospatial data sources. The valid value will be circular error, as defined by FGDC STD 007.3-1998, NSSDA, (digital sources) using a 95% confidence level. | Valid Values: "Unknown" "Tested to meet X.X meters horizontal accuracy at 95% confidence level." | |
| 2.4.1.2 .2 | Horizontal Positional Accuracy Explanation | Required | The identification of the test that yielded the Horizontal Positional Accuracy Value. | "National Standard for Spatial Data Accuracy (NSSDA)" "ASPRS Accuracy Standard for Large Scale Maps (ASPRS)" "National Map Accuracy Standard (NMAS)" Identify also the standard sampling method and sample size determination for your dataset. | |
| 2.4.2 | Vertical Positional Accuracy | | | | |

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| 2.4.2.1 | Vertical Positional Accuracy Report | Required for Elevation Contours and all CIP layers that express elevation values as Z-values in the geometry of the vectors or as attribute values. | An explanation of the accuracy of the vertical coordinate measurements and a description of the tests used. | Valid Values: "Vertical positional accuracy for this dataset is yet to be determined." "Vertical positional accuracy for this dataset has been determined by the following methodology:", then add in text the detailed processes and methods used to derive the vertical positional accuracy measurement. |
| 2.4.2.2 | Quantitative Vertical Positional Accuracy Assessment | | | |
| 2.4.2.2 .1 | Vertical Positional Accuracy Value | Required | Use this field to record the vertical positional accuracy of digital geospatial data sources. The valid value will be linear error, as defined by FGDC STD 007.3-1998, NSSDA, (digital sources) using a 95% confidence level. | Valid Values: "Unknown" "Tested to meet X.X meters vertical accuracy at 95% confidence level." |
| 2.4.2.2 .2 | Vertical Positional Accuracy Explanation | Required | The identification of the test that yielded the Vertical Positional Accuracy Value. | "National Standard for Spatial Data Accuracy (NSSDA)" "National Map Accuracy Standard (NMAS)" Identify also the standard sampling method and sample size determination for your dataset. |
| 2.5 | Lineage | | | |
| 2.5.1 | Source Information | | | |
| 2.5.1 (8) | Citation | | | |

| | | | | |
|----------------|------------------|---------------------|--|---|
| 2.5.1 (8.1) | Originator | Required | The name of an organization or individual that developed the data set. | <p>When the originator is within the USAF, use only approved USAF Office Designations required by AFI 33-360v1 Attachment 4 Section C:</p> <p>Example Values: "133CES/CEPT" "133SWS/CEA 3" "GC/CETS" "Space Imaging, Inc." "Unknown"</p> |
| 2.5.1 (8.2) | Publication Date | Required | <p>The date of release or current version of the file. This represents the date that a given layer and associated metadata file were written to CD-ROM or otherwise transmitted for final delivery/approval.</p> <p>For USAF IGI&S organizations, the date in which either the data set was made accessible for download or was sent to the US Government representative as or on behalf of the IGI&S office receiving the data.</p> | <p>Valid Value Format: yyyyymmdd</p> |
| 2.5.1 (8.3) | Publication Time | Not Required | | |

| | | | | |
|----------------|-------|----------|--|---|
| 2.5.1 (8.4) | Title | Required | <p>The name by which the data set is referred.</p> <p>The USAF IGI&S Community will use the following semantic names for each layer in the Common Installation Picture (CIP)</p> | <p>The following example valid values are acceptable for the USAF CIP:</p> <p>Towers</p> <p>Slabs</p> <p>Buildings</p> <p>Sheds</p> <p>Installation Boundaries</p> <p>Range Complex Boundaries</p> <p>Live Firing Ranges</p> <p>Shorelines</p> <p>Rivers and Streams</p> <p>River and Stream Centerlines</p> <p>Lakes and Ponds</p> <p>Athletic Fields</p> <p>Athletic Courts</p> <p>Golf Courses</p> <p>Swimming Pools</p> |
|----------------|-------|----------|--|---|

2.5.1
(8.5) Edition

Levees and Berms
Dams
Fences
Gates
Walls
Campgrounds
Playgrounds
Parks
Trails
Elevation Contours
Airfield Centerlines
Airfield Surfaces
Tunnels
Footbridges
Walkways
Railroads
Railroad Bridges
Road Bridges
Driveways
Parking Lots
Road Centerlines
Road Areas
Mooring Facilities

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|------------------|-------------------------|---------------------|--|--|
| 2.5.1 (8.6) | Geospatial Form | Required | The mode in which the geospatial data are represented. | (the listed domain is partially from pp. 88-91 in Anglo-American Committee on Cataloguing of Cartographic Materials, 1982, Cartographic materials: A manual of interpretation for AACR2: Chicago, American Library Association): "atlas" "audio" "diagram" "document" "globe" "map" "model" "multimedia presentation" "profile" "raster digital data" "remote-sensing image" "section" "spreadsheet" "tabular digital data" "vector digital data" "video" "view" free text |
| 2.5.1 (8.7) | Series Information | | | |
| 2.5.1 (8.7.1) | Series Name | Not Required | | |
| 2.5.1 (8.7.2) | Issue Identification | Not Required | | |
| 2.5.1 (8.8) | Publication Information | Not Required | | |

| | | | | |
|------------------------|------------------------|---------------------|--|--|
| 2.5.1 (8.8.1) | Publication Place | Required | <p>The name of the place where the data set was published or released. For the USAF, this will contain the name of the service, a single space, followed by the installation/facility name.</p> <p>For joint facilities (e.g., a Joint Reserve Base), the host service should be identified as the originator, or if no host service exists, the facility should be identified as a Joint Base (e.g. JRB).</p> | <p>Service names: "USA" "USN" "USMC" "USAF" "JRB" "ARS"</p> <p>Example values: "USA Fort Bliss" "USAF Edwards Air Force Base" "USN Naval Station Norfolk" "USMC MCAS Miramar" "JRB Willow Grove" "ARS Minneapolis"</p> |
| 2.5.1 (8.8.2) | Publisher | Required | The name of the individual or organization that published the data set. | <p>When the publisher is within the USAF, use only approved USAF Office Designations required by AFI 33-360v1 Attachment 4 Section C:</p> <p>Example Values: "133 CES/CEPT" "133 SWS/CEA 3" "GC/CETS" "Space Imaging, Inc." "Unknown"</p> |
| 2.5.1 (8.9) | Other Citation Details | Not Required | | |
| 2.5.1 (8.10) | Online Linkage | Not Required | | |
| 2.5.1 (8.11) | Larger Work Citation | Not Required | | IF AUTOPOPULATED THE VALUE MUST BE DELETED. |
| 2.5.1 (8.11.1)) | Citation | | | |

| | | | | |
|---------------|-------------------------------|--|---|--|
| 2.5.1.2 | Source Scale Denominator | Required only if the data set was derived from a fixed-scale printed map. | The denominator of the representative fraction on a map (for example, on a 1:24,000-scale map, the Source Scale Denominator is 24000). | Source Scale Denominator > 1 |
| 2.5.1.3 | Type of Source Media | Required | The medium of the source data set. | <p>"paper"</p> <p>"stable-base material"</p> <p>"microfiche"</p> <p>"microfilm"</p> <p>"audiocassette"</p> <p>"chart"</p> <p>"filmstrip"</p> <p>"transparency"</p> <p>"videocassette"</p> <p>"videodisc"</p> <p>"videotape"</p> <p>"physical model"</p> <p>"computer program"</p> <p>"disc"</p> <p>"cartridge tape"</p> <p>"magnetic tape"</p> <p>"online"</p> <p>"CD-ROM"</p> <p>"electronic bulletin board"</p> <p>"electronic mail system"</p> <p>free text</p> |
| 2.5.1.4 | Source Time Period of Content | | | |
| 2.5.1.4 (9) | Time Period Information | | | |
| 2.5.1.4 (9.1) | Single Date/Time | | | |

| | | | | | |
|----|--------------------|-------------------------|---|--|---|
| | 2.5.1.4 (9.1.1) | Calendar Date | 9.1, 9.2 OR 9.3 are Required | The latest date to which the data content represents conditions on the ground. This field is used to capture neither the publication date of a study or of a hardcopy map nor the date the hardcopy was converted to digital format, but rather the date the conditions at the location were measured or derived. For hardcopy maps, if the content date is unknown, the map publication date can be used. If only the month and year are known, but not specific day within the given month, enter zeros ("0") in the place of "dd" as shown. | Format: yyyymmdd <i>Example values:</i> "20020101" (representing 01 Jan 02) "20031128" (representing 28 Nov 03) "19980100" (representing Jan 98) |
| | 2.5.1.4 (9.1.2) | Time of Day | Not Required | | |
| OR | 2.5.1.4 (9.2) | Multiple Dates/Time | | | |
| | 2.5.1.4 (9.1) | Single Date/Time | | | |
| | 2.5.1.4 (9.1.1) | Calendar Date | 9.1, 9.2 OR 9.3 are Required | The latest date to which the data content represents conditions on the ground. This field is used to capture neither the publication date of a study or of a hardcopy map nor the date the hardcopy was converted to digital format, but rather the date the conditions at the location were measured or derived. For hardcopy maps, if the content date is unknown, the map publication date can be used. If only the month and year are known, but not specific day within the given month, enter zeros ("0") in the place of "dd" as shown. | Format: yyyymmdd <i>Example values:</i> "20020101" (representing 01 Jan 02) "20031128" (representing 28 Nov 03) "19980100" (representing Jan 98) |
| | 2.5.1.4 (9.1.2) | Time of Day | Not Required | | |
| OR | 2.5.1.4 (9.3) | Range of Dates/Times | | | |

| | | | | |
|--------------------|------------------------------------|---|--|--|
| 2.5.1.4 (9.3.1) | Beginning Date | 9.1, 9.2 OR 9.3 are Required | The earliest date to which the data content represents conditions on the ground. This field is used to capture neither the publication date of a study or of a hardcopy map nor the date the hardcopy was converted to digital format, but rather the date the conditions at the location were measured or derived. For hardcopy maps, if the content date is unknown, the map publication date can be used. If only the month and year are known, but not specific day within the given month, enter zeros ("0") in the place of "dd" as shown. | Format: yyyymmdd <i>Example values:</i> "20020101" (representing 01 Jan 02) "20031128" (representing 28 Nov 03) "19980100" (representing Jan 98) |
| 2.5.1.4 (9.3.2) | Beginning Time | Not Required | | |
| 2.5.1.4 (9.3.3) | Ending Date | 9.1, 9.2 OR 9.3 are Required | The latest date to which the data content represents conditions on the ground. This field is used to capture neither the publication date of a study or of a hardcopy map nor the date the hardcopy was converted to digital format, but rather the date the conditions at the location were measured or derived. For hardcopy maps, if the content date is unknown, the map publication date can be used. If only the month and year are known, but not specific day within the given month, enter zeros ("0") in the place of "dd" as shown. | Format: yyyymmdd <i>Example values:</i> "20020101" (representing 01 Jan 02) "20031128" (representing 28 Nov 03) "19980100" (representing Jan 98) |
| 2.5.1.4 (9.3.4) | Ending Time | Not Required | | |
| 2.5.1.4 .1 | Source Currentness Reference | Required | Reference for the Time Period of Content. Must be one of the following valid values: | Valid Values "Ground condition date", "Publication date for source materials", "Date of the last transaction that altered the dataset", or Free Text |

| | | | | |
|---------|--------------------------------------|----------|--|---|
| 2.5.1.5 | Source Citation Abbreviation | Required | The abbreviated name of an organization or individual that developed the data set. | When the originator is within the USAF, use only approved USAF Office Designations required by AFI 33-360v1 Attachment 4 Section C: Example Values: "133 CES/CEPT" "133 SWS/CEA 3" "GC/CETS" "SI, Inc." "Unknown" |
| 2.5.1.6 | Source Contribution | Required | Brief statement identifying the information contributed by the source to the data set. | Example: "IKONOS Precision 1-Meter" |
| 2.5.2 | Process Step | | | |
| 2.5.2.1 | Process Description | Required | Specific description of the technical processes used to create or convert the source(s) into the dataset being documented. | Write process steps clearly and concisely enough that another could repeat the process with the same source data and software and provide the same result. Example of sequential Process Steps: "Opened an edit session with Explosive Arcs as the target layer." "Selected buildings sited to store explosives." "Buffered selected buildings with the stand-off distances approved for each building by the Defense Safety Explosive Board (DSEB) as proscribed in AFMAN 91-201 Explosive Safety Standards" "Saved edits and closed the edit session." |
| 2.5.2.2 | Source Used Citation Abbreviation | Required | Brief statement identifying the organization and information contributed by the source(s) to the data set. | Example: "Space Imaging IKONOS Precision 1-Meter" |

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|----|------------------|---------------------------------------|--|---|--|
| | 2.5.2.3 | Process Date | 9.1, 9.2 OR 9.3 are Required | The latest date to which the process step was executed to create the data set. If only the month and year are known, but not specific day within the given month, enter zeros ("0") in the place of "dd" as shown. | Format: yyyymmdd Example values: "20020101" (representing 01 Jan 02) "20031128" (representing 28 Nov 03) "19980100" (representing Jan 98) |
| | 2.5.2.4 | Process Time | Not Required | | |
| | 2.5.2.5 | Source Produced Citation Abbreviation | Not Required | | |
| | 2.5.2.6 | Process Contact | | | |
| | 2.5.2.6 (10.1) | Contact Person Primary | DO NOT USE CONTACT PERSON AS PRIMARY. | | |
| | 2.5.2.6 (10.1.1) | Contact Person | | | |
| | 2.5.2.6 (10.1.2) | Contact Organization | | | |
| OR | 2.5.2.6 (10.2) | Contact Organization Primary | Required | The office symbol of the IGI&S GeoBase program office or CEPT element for the installation. | Valid Values: When the originator is within the USAF, use only approved USAF Office Designations required by AFI 33-360v1 Attachment 4 Section C "ACC A7CIG" Example Values: "133 CES/CEPT" "133 SWS/CEA 3" "GC/CETS" "Space Imaging, Inc." "Unknown" |

| | | | | |
|----------------------|----------------------|---|---|---|
| 2.5.2.6 (10.1.2) | Contact Organization | Required | The Point of Contact (POC) person for the CIP is the IGI&S GeoBase program manager or CEPT element superintendent for the installation. | Example: "John Smith" "John Q Public" |
| 2.5.2.6 (10.1.1) | Contact Person | Required | The Point of Contact (POC) person for the CIP is the IGI&S GeoBase program manager or CEPT element superintendent for the installation. | Example: "John Smith" "John Q Public" |
| 2.5.2.6 (10.3) | Contact Position | Required | Title of the POC person who processed the data. | Valid Values: "Civil Service (Civ)" – Civilian "Contractor (Contr)" – Contractor Military titles including: "Captain (Capt)" "Lieutenant (Lt)" "Master Sergeant (MSgt)" "Technical Sergeant (TSgt)" Also follow these titles with applicable position titles, such as: "OIC" Officer in Charge "NCOIC" Non-commissioned Officer in Charge "Chief, Technical Services Element" etc. |
| 2.5.2.6 (10.4) | Contact Address | | | |
| 2.5.2.6 (10.4.1) | Address Type | Only required if different from the Originator | The type of address provided. Must be one of the following valid values: | Valid Values: "mailing" "physical" "mailing and physical" "P.O. Box" Other (describe) |
| 2.5.2.6 (10.4.2) | Address | Only required if different from the Originator | Address line for the POC or mission knowledge expert. | Example Values:"4908 Dominica Way" "614 Militia Drive" "P.O. Box 100" |

| | | | | |
|---------------------|---------------------------------|---|---|---|
| 2.5.2.6 (10.4.3) | City | Only required if different from the Originator | The address city for the POC or mission knowledge expert. | Example Values: "Washington" (for Washington DC) "Vandenberg AFB" "Honolulu" "San Diego" |
| 2.5.2.6 (10.4.4) | State or Province | Only required if different from the Originator | The address state or territory for the POC or mission knowledge expert. Use accepted two-letter Postal state/territory codes for this field. | Example Values: "DC" – Washington, DC "VA" – Virginia "PR" – Puerto Rico "GU" – Guam |
| 2.5.2.6 (10.4.5) | Postal Code | Only required if different from the Originator | The ZIP code for the POC or mission knowledge expert. Nine digit ZIP codes, with dashes, preferred, but five digit zip codes will be accepted. | Example Values: "22030-1260" "55124" |
| 2.5.2.6 (10.4.6) | Country | Only required if different from the Originator | POC or mission knowledge expert address country. | Use ISO 3166-1 alpha-3 letter country codes. Example Values: "USA" "DEU" "KOR" |
| 2.5.2.6 (10.5) | Contact Voice Telephone | Only required if different from the Originator | POC or mission knowledge expert Telephone number, including all applicable area codes and extensions. Commercial numbers are preferred, and should be preceded with "COMM" as shown. However, if only DSN numbers are available, enter that number here and precede the number with "DSN" as shown: | Include at least a commercial phone number. If a DoD Direct Service Number is available, record that as a second record in the recurring entry for this field. Example Values: COMM 123-456-7890, COMM 123-456-7890 ext: 345, DSN 123-456-7890, DSN 123-4567 |
| 2.5.2.6 (10.6) | Contact TDD/TTY Telephone | Not Required | | |
| 2.5.2.6 (10.7) | Contact Facsimile Telephone | Not Required | | |
| 2.5.2.6 (10.8) | Contact Electronic Mail Address | Only required if different from the Originator | The email address for the POC or mission knowledge expert. | Example Values: "john.smith@basename.af.mil", "john.smith@ang.af.mil" |

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|-----|--------------------|----------------------|---|--|--|
| | 2.5.2.6 (10.9) | House of Service | Only required if different from the Originator | Time period when individuals can speak to the organization or individual. | Example: "0700-1600 Central Time" |
| | 2.5.2.6 (10.10) | Contact Instructions | Not Required | | |
| 2.6 | | Cloud Cover | Required for Imagery | Area of a data set obstructed by clouds, expressed as a percentage of the spatial extent. | 0 <= Cloud Cover <= 100 "Unknown" |

Section 3 – Spatial Data Organization Information

(Using GIS COTs software such as ESRI products all fields auto populated. Autodesk products currently do not auto populate)

| FGDC CSDGM - Content Standard for Digital Geospatial Metadata | | | NGB/ANG GIO Metadata Standard | | |
|---|---|--|--|---|--------------------------|
| Number | Name | | Requirement | Description | Examples/Valid Values |
| 3 | Spatial Data Organization Information | | Required Elements, but frequently auto populated. | The mechanism used to represent spatial information in the data set. | As auto populated |
| 3.1 | Indirect Spatial Reference | | | | |
| 3.2 | Direct Spatial Reference Method | | | | |
| 3.3 | Point and Vector Object Information | | | | |
| 3.3.1 | SDTS Terms Description | | | | |
| 3.3.1.1 | SDTS Point and Vector Object Type | | | | |
| 3.3.1.2 | Point and Vector Object Count | | | | |
| 3.3.2 | VPF Terms Description | | | | |
| 3.3.2.1 | VPF Topology Level | | | | |
| 3.3.2.2- 3.3.2.3 | VPF Point and Vector Object Information | | | | |
| 3.3.2.2 | VPF Point and Vector Object Type | | | | |

| | |
|-----------------|-------------------------------|
| 3.3.2.3 | Point and Vector Object Count |
| 3.4 | Raster Object Information |
| 3.4.1 | Raster Object Type |
| 3.4.2- 3.4.4 | (Raster Count Information) |
| 3.4.2 | Row Count |
| 3.4.3 | Column Count |
| 3.4.4 | Vertical Count |

Section 4 – Spatial Reference Information

(Using GIS COTs software such as ESRI products all fields auto populated. Autodesk products currently do not auto populate)

| FGDC CSDGM - Content Standard for Digital Geospatial Metadata | | USAF CIP Metadata Standard | | |
|---|---|--|---|--------------------------|
| Number | Name | Requirement | Description | Examples/Valid Values |
| 4 | Spatial Reference Information | Horizontal spatial reference information frequently auto populates using COTS GIS products. | The mechanism used to represent spatial information in the data set. | As auto populated |
| 4.1 | Horizontal Coordinate System Definition | | | |
| 4.1.1 | Geographic | | | |
| 4.1.1.1 | Latitude Resolution | | | |
| 4.1.1.2 | Longitude Resolution | | | |
| 4.1.1.3 | Geographic Coordinate Units | | | |
| OR 4.1.2 | Planar | | | |
| 4.1.2.1 | Map Projection | | | |
| 4.1.2.1.1 | Map Projection Name | | | |
| OR 4.1.2.1.2 | Albers Conical Equal Area | | | |
| 4.1.2.1.23.1 | Standard Parallel | | | |
| 4.1.2.1.23.2 | Longitude of Central Meridian | | | |
| 4.1.2.1.23.3 | Latitude of Projection Origin | | | |

| | | |
|----|--------------|--|
| | 4.1.2.1.23.4 | False Easting |
| | 4.1.2.1.23.5 | False Northing |
| OR | 4.1.2.1.3 | Azimuthal Equidistant |
| | 4.1.2.1.23.2 | Longitude of Central Meridian |
| | 4.1.2.1.23.3 | Latitude of Projection Origin |
| | 4.1.2.1.23.4 | False Easting |
| | 4.1.2.1.23.5 | False Northing |
| OR | 4.1.2.1.4 | Equidistant Conic |
| | 4.1.2.1.23.1 | Standard Parallel |
| | 4.1.2.1.23.2 | Longitude of Central Meridian |
| | 4.1.2.1.23.3 | Latitude of Projection Origin |
| | 4.1.2.1.23.4 | False Easting |
| | 4.1.2.1.23.5 | False Northing |
| OR | 4.1.2.1.5 | Equirectangular |
| | 4.1.2.1.23.1 | Standard Parallel |
| | 4.1.2.1.23.2 | Longitude of Central Meridian |
| | 4.1.2.1.23.4 | False Easting |
| | 4.1.2.1.23.5 | False Northing |
| OR | 4.1.2.1.6 | General Vertical Near-sided Perspective |
| | 4.1.2.1.23.7 | Height of Perspective Point Above Surface |
| | 4.1.2.1.23.8 | Longitude of Projection Center |
| | 4.1.2.1.23.9 | Latitude of Projection Center |
| | 4.1.2.1.23.4 | False Easting |
| | 4.1.2.1.23.5 | False Northing |
| OR | 4.1.2.1.7 | Gnomonic |
| | 4.1.2.1.23.8 | Longitude of Projection Center |
| | 4.1.2.1.23.9 | Latitude of Projection Center |
| | 4.1.2.1.23.4 | False Easting |
| | 4.1.2.1.23.5 | False Northing |
| OR | 4.1.2.1.8 | Lambert Azimuthal Equal Area |
| | 4.1.2.1.23.8 | Longitude of Projection Center |
| | 4.1.2.1.23.9 | Latitude of Projection Center |
| | 4.1.2.1.23.4 | False Easting |

| | | |
|----|-----------------|---------------------------------------|
| | 4.1.2.1.23.5 | False Northing |
| OR | 4.1.2.1.10 | Mercator |
| | 4.1.2.1.23.1 | Standard Parallel |
| OR | 4.1.2.1.23.6 | Scale Factor at Equator |
| | 4.1.2.1.23.2 | Longitude of Central Meridian |
| | 4.1.2.1.23.4 | False Easting |
| | 4.1.2.1.23.5 | False Northing |
| OR | 4.1.2.1.11 | Modified Stereographic for Alaska |
| | 4.1.2.1.23.4 | False Easting |
| | 4.1.2.1.23.5 | False Northing |
| OR | 4.1.2.1.12 | Miller Cylindrical |
| | 4.1.2.1.23.2 | Longitude of Central Meridian |
| | 4.1.2.1.23.4 | False Easting |
| | 4.1.2.1.23.5 | False Northing |
| OR | 4.1.2.1.13 | Oblique Mercator |
| | 4.1.2.1.23.10 | Scale Factor at Center Line |
| | 4.1.2.1.23.11 | Oblique Line Azimuth |
| | 4.1.2.1.23.11.1 | Azimuthal Angle |
| | 4.1.2.1.23.11.2 | Azimuth Measure Point Longitude |
| OR | 4.1.2.1.23.12 | Oblique Line Point |
| | 4.1.2.1.2.12.1 | Oblique Line Latitude |
| | 4.1.2.1.2.12.2 | Oblique Line Longitude |
| | 4.1.2.1.2.12.1 | Oblique Line Latitude |
| | 4.1.2.1.2.12.2 | Oblique Line Longitude |
| | 4.1.2.1.23.3 | Latitude of Projection Origin |
| | 4.1.2.1.23.4 | False Easting |
| | 4.1.2.1.23.5 | False Northing |
| | 4.1.2.1.14 | Orthographic |
| | 4.1.2.1.23.8 | Longitude of Projection Center |
| | 4.1.2.1.23.9 | Latitude of Projection Center |
| | 4.1.2.1.23.4 | False Easting |
| | 4.1.2.1.23.5 | False Northing |
| OR | 4.1.2.1.15 | Polar Stereographic |
| | 4.1.2.1.23.13 | Straight Vertical Longitude from Pole |

| | | |
|----|---------------|-----------------------------------|
| | 4.1.2.1.23.1 | Standard Parallel |
| OR | 4.1.2.1.23.14 | Scale Factor at Projection Origin |
| | 4.1.2.1.23.4 | False Easting |
| | 4.1.2.1.23.5 | False Northing |
| OR | 4.1.2.1.16 | Polyconic |
| | 4.1.2.1.23.2 | Longitude of Central Meridian |
| | 4.1.2.1.23.3 | Latitude of Projection Origin |
| | 4.1.2.1.23.4 | False Easting |
| | 4.1.2.1.23.5 | False Northing |
| OR | 4.1.2.1.17 | Robinson |
| | 4.1.2.1.23.8 | Longitude of Projection Center |
| | 4.1.2.1.23.4 | False Easting |
| | 4.1.2.1.23.5 | False Northing |
| OR | 4.1.2.1.18 | Sinusoidal |
| | 4.1.2.1.23.2 | Longitude of Central Meridian |
| | 4.1.2.1.23.4 | False Easting |
| | 4.1.2.1.23.5 | False Northing |
| OR | 4.1.2.1.19 | Space Oblique Mercator (Landsat) |
| | 4.1.2.1.23.15 | Landsat Number |
| | 4.1.2.1.23.16 | Path Number |
| | 4.1.2.1.23.4 | False Easting |
| | 4.1.2.1.23.5 | False Northing |
| OR | 4.1.2.1.20 | Stereographic |
| | 4.1.2.1.23.8 | Longitude of Projection Center |
| | 4.1.2.1.23.9 | Latitude of Projection Center |
| | 4.1.2.1.23.4 | False Easting |
| | 4.1.2.1.23.5 | False Northing |
| OR | 4.1.2.1.21 | Transverse Mercator |
| | 4.1.2.1.23.17 | Scale Factor at Central Meridian |
| | 4.1.2.1.23.2 | Longitude of Central Meridian |
| | 4.1.2.1.23.3 | Latitude of Projection Origin |
| | 4.1.2.1.23.4 | False Easting |
| | 4.1.2.1.23.5 | False Northing |
| OR | 4.1.2.1.22 | van der Grinten |

| | | |
|----|-----------------|---|
| | 4.1.2.1.23.2 | Longitude of Central Meridian |
| | 4.1.2.1.23.4 | False Easting |
| | 4.1.2.1.23.5 | False Northing |
| OR | 4.1.2.1.23 | Map Projection Parameters |
| | 4.1.2.1.23.1 | Standard Parallel |
| | 4.1.2.1.23.2 | Longitude of Central Meridian |
| | 4.1.2.1.23.3 | Latitude of Projection Origin |
| | 4.1.2.1.23.4 | False Easting |
| | 4.1.2.1.23.5 | False Northing |
| | 4.1.2.1.23.6 | Scale Factor at Equator |
| | 4.1.2.1.23.7 | Height of Perspective Point Above Surface |
| | 4.1.2.1.23.8 | Longitude of Projection Center |
| | 4.1.2.1.23.9 | Latitude of Projection Center |
| | 4.1.2.1.23.10 | Scale Factor at Center Line |
| | 4.1.2.1.23.11 | Oblique Line Azimuth |
| | 4.1.2.1.23.11.1 | Azimuthal Angle |
| | 4.1.2.1.23.11.2 | Azimuth Measure Point Longitude |
| | 4.1.2.1.23.12 | Oblique Line Point |
| | 4.1.2.1.2.12.1 | Oblique Line Latitude |
| | 4.1.2.1.2.12.2 | Oblique Line Longitude |
| | 4.1.2.1.2.12.1 | Oblique Line Latitude |
| | 4.1.2.1.2.12.2 | Oblique Line Longitude |
| | 4.1.2.1.23.13 | Straight Vertical Longitude from Pole |
| | 4.1.2.1.23.14 | Scale Factor at Projection Origin |
| | 4.1.2.1.23.15 | Landsat Number |
| | 4.1.2.1.23.16 | Path Number |
| | 4.1.2.1.23.17 | Scale Factor at Central Meridian |
| | 4.1.2.1.23.18 | Other Projection's Definition |
| | 4.1.2.2 | Grid Coordinate System |
| | 4.1.2.2.1 | Grid Coordinate System Name |
| | 4.1.2.2.2 | Universal Transverse Mercator (UTM) |
| | 4.1.2.2.2.1 | UTM Zone Number |

| | | |
|----|-----------------|---------------------------------------|
| | 4.1.2.1.21 | Transverse Mercator |
| | 4.1.2.1.23.17 | Scale Factor at Central Meridian |
| | 4.1.2.1.23.2 | Longitude of Central Meridian |
| | 4.1.2.1.23.3 | Latitude of Projection Origin |
| | 4.1.2.1.23.4 | False Easting |
| | 4.1.2.1.23.5 | False Northing |
| | 4.1.2.2.3 | Universal Polar Stereographic (UPS) |
| | 4.1.2.2.3.1 | UPS Zone Identifier |
| | 4.1.2.1.15 | Polar Stereographic |
| | 4.1.2.1.23.13 | Straight Vertical Longitude from Pole |
| | 4.1.2.1.23.1 | Standard Parallel |
| OR | 4.1.2.1.23.14 | Scale Factor at Projection Origin |
| | 4.1.2.1.23.4 | False Easting |
| | 4.1.2.1.23.5 | False Northing |
| | 4.1.2.2.4 | State Plane Coordinate System (SPSC) |
| | 4.1.2.2.4.1 | SPCS Zone Identifier |
| OR | 4.1.2.1.8 | Lambert Azimuthal Equal Area |
| | 4.1.2.1.23.8 | Longitude of Projection Center |
| | 4.1.2.1.23.9 | Latitude of Projection Center |
| | 4.1.2.1.23.4 | False Easting |
| | 4.1.2.1.23.5 | False Northing |
| OR | 4.1.2.1.21 | Transverse Mercator |
| | 4.1.2.1.23.17 | Scale Factor at Central Meridian |
| | 4.1.2.1.23.2 | Longitude of Central Meridian |
| | 4.1.2.1.23.3 | Latitude of Projection Origin |
| | 4.1.2.1.23.4 | False Easting |
| | 4.1.2.1.23.5 | False Northing |
| OR | 4.1.2.1.13 | Oblique Mercator |
| | 4.1.2.1.23.10 | Scale Factor at Center Line |
| | 4.1.2.1.23.11 | Oblique Line Azimuth |
| | 4.1.2.1.23.11.1 | Azimuthal Angle |
| | 4.1.2.1.23.11.2 | Azimuth Measure Point Longitude |

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| OR | 4.1.2.1.23.12 | Oblique Line Point |
| | 4.1.2.1.2.12.1 | Oblique Line Latitude |
| | 4.1.2.1.2.12.2 | Oblique Line Longitude |
| | 4.1.2.1.2.12.1 | Oblique Line Latitude |
| | 4.1.2.1.2.12.2 | Oblique Line Longitude |
| | 4.1.2.1.23.3 | Latitude of Projection Origin |
| | 4.1.2.1.23.4 | False Easting |
| | 4.1.2.1.23.5 | False Northing |
| OR | 4.1.2.1.16 | Polyconic |
| | 4.1.2.1.23.2 | Longitude of Central Meridian |
| | 4.1.2.1.23.3 | Latitude of Projection Origin |
| | 4.1.2.1.23.4 | False Easting |
| | 4.1.2.1.23.5 | False Northing |
| | 4.1.2.2.5 | ARC Coordinate System |
| | 4.1.2.2.5.1 | ARC System Zone Identifier |
| | 4.1.2.1.5 | Equirectangular |
| | 4.1.2.1.23.1 | Standard Parallel |
| | 4.1.2.1.23.2 | Longitude of Central Meridian |
| | 4.1.2.1.23.4 | False Easting |
| | 4.1.2.1.23.5 | False Northing |
| OR | 4.1.2.1.3 | Azimuthal Equidistant |
| | 4.1.2.1.23.2 | Longitude of Central Meridian |
| | 4.1.2.1.23.3 | Latitude of Projection Origin |
| | 4.1.2.1.23.4 | False Easting |
| | 4.1.2.1.23.5 | False Northing |
| | 4.1.2.2.6 | Other Grid System's Definition |
| 4.1.2.3 | | Local Planar |
| | 4.1.2.3.1 | Local Planar Description |
| | 4.1.2.3.2 | Local Planar Georeference Information |
| 4.1.2.4 | | Planar Coordinate Information |
| | 4.1.2.4.1 | Planar Coordinate Encoding Method |
| | 4.1.2.4.2 | Coordinate Representation |
| | 4.1.2.4.2.1 | Abscissa Resolution |

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|-----|-------------|---------------------------------------|--|--|---|
| | 4.1.2.4.2.2 | Ordinate Resolution | | | |
| OR | 4.1.2.4.3 | Distance and Bearing Representation | | | |
| | 4.1.2.4.3.1 | Distance Resolution | | | |
| | 4.1.2.4.3.2 | Bearing Resolution | | | |
| | 4.1.2.4.3.3 | Bearing Units | | | |
| | 4.1.2.4.3.4 | Bearing Reference Direction | | | |
| | 4.1.2.4.3.5 | Bearing Reference Meridian | | | |
| | 4.1.2.4.4 | Planar Distance Units | | | |
| OR | 4.1.3 | Local | | | |
| | 4.1.3.1 | Local Description | | | |
| | 4.1.3.2 | Local Georeference Information | | | |
| | 4.1.4 | Geodetic Model | | | |
| | 4.1.4.1 | Horizontal Datum Name | | | |
| | 4.1.4.2 | Ellipsoid Name | | | |
| | 4.1.4.3 | Semi-major Axis | | | |
| | 4.1.4.4 | Denominator of Flattening Ratio | | | |
| 4.2 | | Vertical Coordinate System Definition | | | |
| | 4.2.1 | Altitude System Definition | | | |
| | 4.2.1.1 | Altitude Datum Name | Required for Elevation Contours and all CIP layers with z-values or elevation attributes | The reference frame or system from which altitudes (elevations) are measured. The term "altitude" is used instead of the common term "elevation" to conform to the terminology in Federal Information Processing Standards 70-1 and 173. | Examples: "Earth Gravitational Model of 1996" "North American Vertical Datum of 1988" |

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| 4.2.1.2 | Altitude Resolution | Required for Elevation Contours and all CIP layers with z-values or elevation attributes | The minimum distance possible between two adjacent altitude values, expressed in Altitude Distance Units of measure. | Altitude Resolution > 0.0 |
| 4.2.1.3 | Altitude Distance Units | Required for Elevation Contours and all CIP layers with z-values or elevation attributes | Measurement units for vertical coordinates. | Example Values: "Meters" "US Survey Feet" Free text |
| 4.2.1.4 | Altitude Encoding Method | Required for Elevation Contours and all CIP layers with z-values or elevation attributes | The means used to encode the altitudes. | Valid Values: "Explicit elevation coordinate included with horizontal coordinates" (z-values) "Attribute values" |
| 4.2.2 | Depth System Definition | | | |
| 4.2.2.1 | Depth Datum Name | | | |
| 4.2.2.2 | Depth Resolution | | | |
| 4.2.2.3 | Depth Distance Units | | | |
| 4.2.2.4 | Depth Encoding Method | | | |

Section 5 – Entity and Attribute Information

| FGDC CSDGM - Content Standard for Digital Geospatial Metadata | | NGB/ANG GIO Metadata Standard | | |
|---|---|-------------------------------|-------------|-----------------------|
| Number | Name | Requirement | Description | Examples/Valid Values |
| 5 | Entity and Attribute Information | | | |
| 5.1 | Detailed Description | | | |
| 5.1.1 | Entity Type | | | |

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|-------------------|---|--|--|---|
| 5.1.1.1 | Entity Type Label | Required but must be automated from SDSFIE libraries to implement | the name of the entity type. | SDSFIE Entity Type Name |
| 5.1.1.2 | Entity Type Definition | | the description of the entity type. | SDSFIE Entity Type Definition |
| 5.1.1.3 | Entity Type Definition Source | | the authority of the definition. | "SDSFIE Version X.X" |
| 5.1.2 | Attribute | Required but must be automated from SDSFIE libraries to implement | | |
| 5.1.2.1 | Attribute Label | | the name of the attribute. | SDSFIE Attribute Name |
| 5.1.2.2 | Attribute Definition | | the description of the attribute. | SDSFIE Attribute Definition |
| 5.1.2.3 | Attribute Definition Source | | the authority of the definition. | "SDSFIE Version X.X" |
| 5.1.2.4 | Attribute Domain Values | Required but must be automated from SDSFIE libraries to implement | | |
| 5.1.2.4.1 | Enumerated Domain | | | |
| 5.1.2.4.1.1 | Enumerated Domain Value | | The name or label of a member of the set. | SDSFIE Enumerated Domain Value |
| 5.1.2.4.1.2 | Enumerated Domain Value Definition | | The description of the value. | SDSFIE Enumerated Domain Value Definition |
| 5.1.2.4.1.3 | Enumerated Domain Value Definition Source | | The authority of the definition. | "SDSFIE Version X.X" |
| 5.1.2.4.1 (5.1.2) | Attribute | | | |
| OR 5.1.2.4.2 | Range Domain | Required but must be automated from SDSFIE libraries to implement | | |
| 5.1.2.4.2.1 | Range Domain Minimum | | The least value that the attribute can be assigned. | SDSFIE Range Domain Minimum |
| 5.1.2.4.2.2 | Range Domain Maximum | | The greatest value that the attribute can be assigned. | SDSFIE Range Domain Maximum |
| 5.1.2.4.2.3 | Attribute Units of Measure | Not Required | | |

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|-----|-------------------|--------------------------------------|--|---|--|
| | 5.1.2.4.2.4 | Attribute Measurement Resolution | Not Required | | |
| | 5.1.2.4.2 (5.1.2) | Attribute | | | |
| OR | 5.1.2.4.3 | Codeset Domain | | | |
| | 5.1.2.4.3.1 | Codeset Name | Required but must be automated from SDSFIE libraries to implement | The title of the codeset. | SDSFIE Domain Name |
| | 5.1.2.4.3.2 | Codeset Source | | The authority for the codeset. | "SDSFIE Version X.X" |
| OR | 5.1.2.4.4 | Unrepresentable Domain | | | |
| | 5.1.2.5 | Beginning Date of Attribute Values | Required | The earliest or only date date for which the attribute values are current. In cases when a range of dates are provided, this is the earliest date for which the information is valid. If only the month and year are known, but not specific day within the given month, enter zeros ("0") in the place of "dd" as shown. | Format: yyyymmdd Example values: "20020101" (representing 01 Jan 02) "20031128" (representing 28 Nov 03) "19980100" (representing Jan 98) |
| | 5.1.2.6 | Ending Date of Attribute Values | Not Required | | |
| | 5.1.2.7 | Attribute Value Accuracy Information | | | |
| | 5.1.2.7.1 | Attribute Value Accuracy | Not Required | | |
| | 5.1.2.7.2 | Attribute Value Accuracy Explanation | Not Required | | |
| | 5.1.2.8 | Attribute Measurement Frequency | Not Required | | |
| 5.2 | | Overview Description | | | |

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| 5.2.1 | Entity and Attribute Overview | Required | Detailed summary of the information contained in a data set. | Valid Value: “Attributes organized by the Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE), Version X.X.” if Custom (non-SDS) Fields, Domains, or Domain Values are added include also the following statement: “Several custom fields, domains, or domain values have been added to store additional information not accommodated by the standard SDFSIE attribute tables.” |
| 5.2.2 | Entity and Attribute Detail Citation | Required | Reference to the complete description of the entity types, attributes, and attribute values for the data set. | Valid Value: "www.sdsfie.org" |

Section 6 – Distribution Information

| FGDC CSDGM - Content Standard for Digital Geospatial Metadata | | NGB/ANG GIO Metadata Standard | | |
|---|--------------------------|-------------------------------|--|-----------------------|
| Number | Name | Requirement | Description | Examples/Valid Values |
| 6 | Distribution Information | Not required | Relevant access and use constraints are described in CSDGM metadata elements 1.7, Access Constraints, and 1.8, Use Constraints. | |
| 6.1 | Distributor | | | |
| 6.1 (10) | Contact Information | | | |
| 6.1 (10.1) | Contact Person Primary | | | |
| 6.1 (10.1.1) | Contact Person | | | |
| 6.1 (10.1.2) | Contact | | | |

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|-----|--------------|---------------------------------------|
| | | Organization |
| OR | 6.1 (10.2) | Contact Organization Primary |
| | 6.1 (10.1.2) | Contact Organization |
| | 6.1 (10.1.1) | Contact Person |
| | 6.1 (10.3) | Contact Position |
| | 6.1 (10.4) | Contact Address |
| | 6.1 (10.4.1) | Address Type |
| | 6.1 (10.4.2) | Address |
| | 6.1 (10.4.3) | City |
| | 6.1 (10.4.4) | State or Province |
| | 6.1 (10.4.5) | Postal Code |
| | 6.1 (10.4.6) | Country |
| | 6.1 (10.5) | Contact Voice Telephone |
| | 6.1 (10.6) | Contact TDD/TTY Telephone |
| | 6.1 (10.7) | Contact Facsimile Telephone |
| | 6.1 (10.8) | Contact Electronic Mail Address |
| | 6.1 (10.9) | House of Service |
| | 6.1 (10.10) | Contact Instructions |
| 6.2 | | Resource Description |
| 6.3 | | Distribution Liability |

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| 6.4 | Standard Order Process |
| 6.4.1 | Non-digital Form |
| 6.4.2 | Digital Form |
| 6.4.2.1 | Digital Transfer Information |
| 6.4.2.1.1 | Format Name |
| 6.4.2.1.2 | Format Version Number |
| OR 6.4.2.1.3 | Format Version Date |
| 6.4.2.1.4 | Format Specification |
| 6.4.2.1.5 | Format Information Content |
| 6.4.2.1.6 | File Decompression Technique |
| 6.4.2.1.7 | Transfer Size |
| 6.4.2.2 | Digital Transfer Option |
| 6.4.2.2.1 | Online Option |
| 6.4.2.2.1.1 | Computer Contact Information |
| 6.4.2.2.1.1.1 | Network Address |
| 6.4.2.2.1.1.1.1 | Network Resource Name |
| OR 6.4.2.2.1.1.2 | Dialup Instructions |
| 6.4.2.2.1.1.2.1 | Lowest BPS |
| 6.4.2.2.1.1.2.2 | Highest BPS |
| 6.4.2.2.1.1.2.3 | Number DataBits |

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| 6.4.2.2.1.1.2.4 | Number StopBits |
| 6.4.2.2.1.1.2.5 | Parity |
| 6.4.2.2.1.1.2.6 | Compression Support |
| 6.4.2.2.1.1.2.7 | Dialup Telephone |
| 6.4.2.2.1.1.2.8 | Dialup File Name |
| 6.4.2.2.1.2 | Access Instructions |
| 6.4.2.2.1.3 | Online Computer and Operating System |
| 6.4.2.2.2 | Offline Option |
| 6.4.2.2.2.1 | Offline Media |
| 6.4.2.2.2.2 | Recording Capacity |
| 6.4.2.2.2.2.1 | Recording Density |
| 6.4.2.2.2.2.2 | Recording Density Units |
| 6.4.2.2.2.3 | Recording Format |
| 6.4.2.2.2.4 | Compatibility Information |
| 6.4.3 | Fees |
| 6.4.4 | Ordering Instructions |
| 6.4.5 | Turnaround |
| 6.5 | Custom Order Process |
| 6.6 | Technical Prerequisites |
| 6.7 | Available Time Period |
| 6.7 (9) | Time Period |

| | |
|--------------|-------------------------|
| | Information |
| 6.7 (9.1) | Single Date/Time |
| 6.7 (9.1.1) | Calendar Date |
| 6.7 (9.1.2) | Time of Day |
| OR 6.7 (9.2) | Multiple Dates/Time |
| 6.7 (9.1) | Single Date/Time |
| 6.7 (9.1.1) | Calendar Date |
| 6.7 (9.1.2) | Time of Day |
| OR 6.7 (9.3) | Range of Dates/Times |
| 6.7 (9.3.1) | Beginning Date |
| 6.7 (9.3.2) | Beginning Time |
| 6.7 (9.3.3) | Ending Date |
| 6.7 (9.3.4) | Ending Time |

Section 7 – Metadata Reference Information

| FGDC CSDGM - Content Standard for Digital Geospatial Metadata | | NGB/ANG GIO Metadata Standard | | |
|---|--------------------------------|-------------------------------|---|--|
| Number | Name | Requirement | Description | Examples/Valid Values |
| 7 | Metadata Reference Information | | | |
| 7.1 | Metadata Date | Required | Date the metadata file was created or last updated. | Format: yyyyymmdd Example values: "20040101" (representing 01 Jan 04) "20031128" (representing 28 Nov 03) |
| 7.2 | Metadata Review Date | Not Required | | |

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|---------------|------------------------------|--|---|---|
| 7.3 | Metadata Future Review Date | Not Required | | |
| 7.4 | Metadata Contact | | | |
| 7.4 (10) | Contact Information | | | |
| 7.4 (10.1) | Contact Person Primary | | | |
| 7.4 (10.1.1) | Contact Person | DO NOT USE CONTACT PERSON AS PRIMARY. | | |
| 7.4 (10.1.2) | Contact Organization | DO NOT USE CONTACT PERSON AS PRIMARY. | | |
| OR 7.4 (10.2) | Contact Organization Primary | | | |
| 7.4 (10.1.2) | Contact Organization | Required | <p>If the metadata was prepared by the USAF: The office symbol of the office that prepared the metadata record for this data set.</p> <p>If the metadata was prepared by any organization outside of the DoD: The name of the organization and office that prepared the metadata.</p> | <p>Valid Values: When the originator is within the USAF, use only approved USAF Office Designations required by AFI 33-360v1 Attachment 4 Section C "ACC A7CIG"</p> <p>Example Values: "133 CES/CEPT" "133 SWS/CEA 3" "GC/CETS" "Earthdata, Inc." "Unknown"</p> |
| 7.4 (10.1.1) | Contact Person | Required | The Point of Contact (POC) person(s) who prepared the metadata record. | Example: "John Smith" "John Q Public" |

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| 7.4 (10.3) | Contact Position | Required | Title of the POC person(s) who prepared the metadata record. | Valid Values: "Civil Service (Civ)" – Civilian "Contractor (Contr)" – Contractor Military titles including: "Captain (Capt)" "Lieutenant (Lt)" "Master Sergeant (MSgt)" "Technical Sergeant (TSgt)" Also follow these titles with applicable position titles, such as: "OIC" Officer in Charge "NCOIC" Non-commissioned Officer in Charge "Chief, Technical Services Element" etc. |
| 7.4 (10.4) | Contact Address | | | |
| 7.4 (10.4.1) | Address Type | Required | The type of address provided. Must be one of the following valid values: | Valid Values: "mailing" "physical" "mailing and physical" "P.O. Box" Other (describe) |
| 7.4 (10.4.2) | Address | Required | Address line for the POC person(s) who prepared the metadata record. | Example Values: "1240 Main Street" "614 Militia Drive" "P.O. Box 100" |
| 7.4 (10.4.3) | City | Required | The address city for the POC persons(s) who prepared the metadata record. | Example Values: "Washington" (for Washington DC) "Vandenberg AFB" "Honolulu" "San Diego" |
| 7.4 (10.4.4) | State or Province | Required | The address state or territory for the POC person(s) who prepared the metadata record. Use accepted two-letter Postal state/territory codes for this field. | Example Values: "DC" – Washington, DC "VA" – Virginia "PR" – Puerto Rico "GU" – Guam |

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| 7.4 (10.4.5) | Postal Code | Required | The ZIP code for the POC person(s) who prepared the metadata record. Nine digit ZIP codes, with dashes, preferred, but five digit zip codes will be accepted. | Example Values: "22030-1260" "80330" |
| 7.4 (10.4.6) | Country | Required | POC person(s) who prepared the metadata records address country. | Use ISO 3166-1 alpha-3 letter country codes. Example Values: "USA" "DEU" "KOR" |
| 7.4 (10.5) | Contact Voice Telephone | Required | POC person(s) who prepared the metadata record's telephone number, including all applicable area codes and extensions. Commercial numbers are preferred, and should be preceded with "COMM" as shown. However, if only DSN numbers are available, enter that number here and precede the number with "DSN" as shown: | Include at least a commercial phone number. If a DoD Direct Service Number is available, record that as a second record in the recurring entry for this field. Example Values: COMM 123-456-7890, COMM 123-456-7890 ext: 345, DSN 123-456-7890, DSN 123-4567 |
| 7.4 (10.6) | Contact TDD/TTY Telephone | Not Required | | |
| 7.4 (10.7) | Contact Facsimile Telephone | Not Required | | |
| 7.4 (10.8) | Contact Electronic Mail Address | Required | The email address for the POC person(s) who created the metadata record. | Use organizational mailboxes if available. Examples Values: "133CES@ang.af.mil" "Sam.kubera@ang.af.mil" |
| 7.4 (10.9) | House of Service | Required | Time period when individuals can speak to the organization or individual. | Example: "0700-1600 Central Standard Time" |
| 7.4 (10.10) | Contact Instructions | Not Required | | |

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|-----|-----------------------------|---------------------|---|---|
| 7.5 | Metadata Standard Name | Required | The name of the metadata standard used to document the data set. | Valid Value: "FGDC Content Standard for Digital Geospatial Metadata" |
| 7.6 | Metadata Standard Version | Required | Identification of the version of the metadata standard used to document the data set. Must be one of the following values: | Valid Values: "Version 2 - 1998 (FGDC-STD-001 June 1998)" "FGDC-STD-001-1998" |
| 7.7 | Metadata Time Convention | Not Required | | |
| 7.8 | Metadata Access Constraints | Required | Restrictions and legal prerequisites for accessing the metadata. These include any access constraints applied to assure the protection of privacy or intellectual property, and any special restrictions or limitations on obtaining the metadata. | Valid Values: If metadata is unclassified but not as yet approved for public release under FOIA or controlled as Controlled Unclassified Information (CUI): "Access to this unclassified metadata is limited to those who work within or for the US Department of Defense, unless or until it is approved for public release or determined to require access controls as Controlled Unclassified Information (CUI)." If this unclassified metadata is approved for public release under FOIA: "This unclassified metadata has been approved for public release under FOIA." If this unclassified metadata is determined to be CUI: "This unclassified metadata is Controlled Unclassified Information and can be withheld from public release under FOIA". |

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| 7.9 | Metadata Use Constraints | Required | Restrictions and legal prerequisites for using the metadata after access is granted. These include any metadata use constraints applied to assure the protection of privacy or intellectual property, and any special restrictions or limitations on using the metadata. | Valid Value: "Metadata for this dataset contains some Personally Identifiable Information (PII) but this PII is not required to be controlled under the Privacy Act." <i>NOTE: If PII is used to extract records USAF IGI&S GeoBase systems, then a System of Records Notice (SORN) would need to be submitted that would describe these systems as Privacy Act Systems of Record (AFI 33-332, AFI 33-202 V1) and a notice published in the Federal Register, describing the collection of PII in USAF IGI&S systems and allowing the public to comment before implementation.</i> |
| 7.10 | Metadata Security Information | | | |
| 7.10.1 | Metadata Security Classification System | Required | Name of the classification system for the metadata. | Valid Values: "Unclassified Approved for Public Release" "Unclassified" "Controlled Unclassified Information" "Classified Information" |

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|--------|-------------------------------------|----------|---|--|
| 7.10.2 | Metadata Security Classification | Required | Name of the handling restrictions on the metadata. | Valid Values: //UNCLASS/APR //UNCLASS //UNCLASS/FOUO //UNCLASS/FOUO/LES //UNCLASS/DoD UCNI //UNCLASS/CSA1987 //UNCLASS/TD //UNCLASS/LIMDIS //UNCLASS/SSI //UNCLASS/CVI //UNCLASS/SGI //UNCLASS/CUI/STD //UNCLASS/CUI/CONSPEC //UNCLASS/CUI/CONEN //CONFIDENTIAL //RESTRICTED //SECRET //TOP SECRET |
|--------|-------------------------------------|----------|---|--|

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|--------|--|--|--|--|
| 7.10.3 | Metadata Security Handling Description | Required | Additional information about the restrictions on handling the metadata. | Valid Values: Unclassified Approved for Public Release Unclassified Unclassified For Official Use Only Unclassified For Official Use Only Law Enforcement Sensitive Department of Defense Unclassified Controlled Nuclear Information Unclassified controlled Sensitive information under the Computer Security Act of 1987 Unclassified controlled information in Technical Documents Unclassified controlled information from the National Geospatial-Intelligence Agency (NGA) under Limited Distribution Unclassified controlled Sensitive Security Information Unclassified controlled Chemical Vulnerability information Unclassified controlled Safeguards Information Controlled Unclassified Information with Standard Dissemination Controlled Unclassified Information with Specified Dissemination Confidential Restricted Secret Top Secret |
| 7.11 | Metadata Extensions | May be used if FGDC endorsed CSDGM extensions have been used to prepare the metadata. | A reference to extended elements to the standard which may be defined by a metadata producer or a user community. Extended elements are elements outside the Standard, but needed by the metadata producer. If extended elements are created, they must follow the guidelines in Appendix D, Guidelines for Creating Extended Elements to the Content Standard for Digital Geospatial Metadata. | Valid Values (0 or more): "Geospatial Metadata: Extensions for Remote Sensing Metadata" No Value |

| | | | | |
|--------|----------------|--|---|--|
| 7.11.1 | Online Linkage | Not Required | | PLEASE DELETE THE VALUE OF THIS FIELD IF IT IS AUTOPOPULATED. |
| 7.11.2 | Profile Name | <p>May be used if FGDC endorsed CSDGM profiles have been used to prepare the metadata.</p> <p>Regardless, must be used to express the profile of the CSDGM being used.</p> | The name given to a document that describes the application of the Standard to a specific user community. | <p>Valid Values (1 or more): "USAF 2009 CIP CSDGM Profile"</p> <p>"Biological Data Profile of the Content Standard for Digital Geospatial Metadata"</p> <p>"Metadata Profile for Shoreline Data"</p> |

AIR NATIONAL GUARD ENVIRONMENTAL RESTORATION MISSION DATA SET CONTROL DOCUMENT



**Version 1.0
November 2009**

**NGB/A7OR
Headquarters Air National Guard
3500 Fetchet Avenue
Andrews AFB, MD 20762**

DOCUMENT HISTORY

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ACRONYMS

| | |
|--------|--|
| A7OR | Environmental Restoration Branch |
| AOC | Area of Concern |
| ANG | Air National Guard |
| CADD | Computer-Aided Design and Drafting |
| CAS | Chemical Abstracts Service |
| CIP | Common Installation Picture |
| CSDGM | Content Standard for Digital Geospatial Metadata |
| EPA | U.S. Environmental Protection Agency |
| ERMDS | Environmental Restoration Mission Data Set |
| FGDC | Federal Geospatial Data Committee |
| GIS | Geographic Information System |
| GPS | Global Positioning System |
| HQ | Headquarters |
| IAW | In Accordance With |
| IRP | Installation Restoration Program |
| MDL | Mission Data Layer |
| MDS | Mission Data Set |
| MLG | Mean Low Gulf |
| NGB | National Guard Bureau |
| NSSDA | National Standard for Spatial Data Accuracy |
| NGVD | National Geodetic Vertical Datum |
| OU | Operable Unit |
| PDF | Portable Document Format |
| POC | Point of Contact |
| QA | Quality Assurance |
| QC | Quality Control |
| RIP | Regional Installation Picture |
| SDSFIE | Spatial Data Standards for Facilities, Infrastructure, and Environment |
| SI | Site Investigation |
| SPCS | State Plane Coordinate System |
| SQL | Sequel Server |
| TLV | Threshold Limit Value |
| UTM | Universal Transverse Mercator |
| WGS | World Geodetic System |

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1. INTRODUCTION

This Control Document defines the baseline geospatial and tabular data required for the Installation Restoration Program (IRP) at the Air National Guard (ANG). The ANG Environmental Restoration Mission Data Set (ERMDS) includes a defined data model which includes specific entity type names, attribute table definitions, and specific data structures to fulfill the ANG's expectations of IRP data deliverables.

2. DATA DESCRIPTION

The ANG ERMDS is a standardized data set comprised of three data formats: 14 geospatial vector layers, 10 ancillary tables, and 1 geospatial raster layer. The ANG ERMDS data model is compliant with the Computer-Aided Design and Drafting/Geographic Information Systems (CADD/GIS) Technology Center's Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE) version 2.6 or later versions as defined by the ANG GIO. Metadata shall be completed in accordance with the ANG GIO Metadata Standards included in the Electronic Data Deliverables Requirements Attachment for an ANG ERMDS data layer to be considered complete

2.1 GEOSPATIAL DATA

The ANG ERMDS consists of 15 geospatial data layers, 14 vector and 1 raster. The 14 vector geospatial data layers are listed in Table 1. The one required geospatial raster data layer pertains to any raster plume data generated through any plume modeling software. Map layers (features) will be developed in the applicable zone of the State Plane Coordinate System, using the World Geodetic System of 1984 (WGS 84) as the earth datum and units of English feet or as defined by the base Common Installation Picture (CIP). Acceptable shape geometry includes polygon, polyline, point, polygon Z, polyline Z, and point Z. Metadata will contain spatial accuracy information for each layer.

| SDSFIE Entity Type | Object Type | SDSFIE Entity Class | SDSFIE Entity Set | Table Name |
|--|-------------|-------------------------------|-----------------------|------------|
| borehole_point | Point | geology_subsurface | geology | gesubbhl |
| field_sample_collection_location_point | Point | env_haz_characterization | environmental_hazards | ehchaspt |
| operable_unit_area | Polygon | env_haz_pollution_remediation | environmental_hazards | ehremopu |
| env_remediation_excavation_area | Polygon | env_haz_pollution_remediation | environmental_hazards | ehremexa |
| environmental_restoration_site | Polygon | env_haz_sites | environmental_hazards | ehsitirp |
| groundwater_contour_line | Line | env_haz_characterization | environmental_hazards | ehchagwc |
| groundwater_pollution_isoline_area | Polygon | env_haz_groundwater_pollution | environmental_hazards | ehgwtiso |
| groundwater_quality_monitoring_station_point | Point | env_haz_characterization | environmental_hazards | ehchagwm |
| piezometer_point | Point | hydrography_subsurface | hydrography | hysubpiz |
| polluted_area_of_concern_area | Polygon | env_haz_general_pollution | environmental_hazards | ehpolaoc |
| sediment_sample_point | Point | landform_bathymetry | landform | lfbthsmp |
| soil_pollution_isoline_line | Line | env_haz_soil_pollution | environmental_hazards | ehsoiiso |
| surface_water_quality_monitoring_station_point | Point | env_haz_characterization | environmental_hazards | ehchaswm |
| water_well_point | Point | improvement_wells | improvement | imwelwel |

Table 1 – List of vector data layers

2.2 TABULAR DATA

The ANG ERMDS consists of 10 ancillary tables.

| Entity Type | Table Name | Entity Class | Entity Set |
|--------------------------------|------------|---------------------------------|-----------------------|
| ANALYTICAL_TEST_PROCEDURE | ehfhtes | env_haz_field_measurement_si | environmental_hazards |
| COMMON_MEDIA | cmmedmed | common_media | common |
| ENV_FIELD_SAMPLE_OCCURENCE | ehfmsam | env_haz_field_measurement_si | environmental_hazards |
| ENV_FLD_SAMP_ANALYTICAL_RESULT | ehfmrres | env_haz_field_measurement_si | environmental_hazards |
| ENVIRONMENTAL_SITE | ehenmsit | env_haz_environmental_manage_si | environmental_hazards |
| GROUNDWATER_LEVEL_DATA | imwliglv | improvement_wells_si | improvement |
| PIEZOMETER | hysuiprd | hydrography_subsurface_si | hydrography |
| POSITIONAL_LOCATION | cmgencrd | common_general | common |
| WATER_MASTER | imwlmas | improvement_wells_si | improvement |

Table 2 – List of ancillary tables

3. ERMDS TIER COMPILATION CRITERIA

This section describes the criteria to be evaluated when determining the minimum ERMDS requirements at an ANG Installation as defined by NGB/A7OR. All data compiled for the ERMDS should be constructed utilizing the same coordinate system as the Installation CIP.

3.1 TIER 1 - CLOSED IRP SITES

The TIER 1 process for data collection and construction of the ERMDS for closed IRP sites should ensure at a minimum that these ERMDS feature classes and tables are constructed and populated as defined in Section 4 of this document:

| Entity Type | Object Type | Table Name | Entity Class | Entity Set |
|--|-------------|------------|---------------------------------|-----------------------|
| field_sample_collection_location_point | Point | ehchaspt | env_haz_characterization | environmental_hazards |
| env_remediation_excavation_area | Polygon | ehremexa | env_haz_pollution_remdiation | environmental_hazards |
| environmental_restoration_site | Polygon | ehsitirp | env_haz_sites | environmental_hazards |
| water_well_point | Point | imwelwel | improvement_wells | improvement |
| COMMON_MEDIA | Table | cmmedmed | common_media | common |
| ENVIRONMENTAL_SITE | Table | ehenmsit | env_haz_environmental_manage_si | environmental_hazards |
| POSITIONAL_LOCATION | Table | cmgencrd | common_general | common |

Table 3 – Tier 1 Minimum Requirement

3.1.1 Tier 1 Information Gathering and Evaluation

1. Review Scoping Document to determine the location and nature of: reports, analytical and field measurement data, maps, and survey reports.
2. Determine and identify if any new reports were completed since the creation of the scoping document.
3. Collect any additional documents from HQ ANG repository. Collect all documents from Installation and Contractors, in Printable Document Format (PDF), which are not located at HQ ANG.

4. Collect all pertinent electronic data (i.e. analytical and field measurement data, maps, and survey reports), in its native format (i.e. SQL, Access, Excel, CAD, GIS, etc.), from contractors and reliable readily available sources.

3.1.2 Tier 1 Construction

1. Establish an SDSFIE v2.6 compliant personal geodatabase repository for data warehousing utilizing the same coordinate system as the Installation CIP
2. Load the established IRP and Area of Concern (AOC) site boundaries into data warehouse repository.
3. Quality Assurance/Quality Control (QA/QC) IRP and AOC site boundaries against the electronic source files and maps from the various reports.
4. Record the reference of document(s) used for the established IRP and AOC site boundaries in the metadata file.
5. Document the construction of each Geodatabase feature class with feature class level metadata.

3.2 TIER 2 – OPEN IRP SITES

This section describes the TIER 2 process for data collection and construction for the ERMDS at all open IRP sites. All information available in hardcopy and electronic format will be gathered and compiled into the ERMDS data warehouse according to this ANG ERMDS Control Document. Ensure all applicable feature classes that are defined in Section 4 of this document are constructed for the ERMDS.

3.2.1 Tier 2 Information Gathering and Evaluation

1. Review Scoping Document to determine the location and nature of: reports, analytical and field measurement data, maps, and survey reports.
2. Determine and identify if any new reports were completed since the creation of the scoping document.
3. Collect any additional documents from HQ ANG repository. Collect all documents from Installation and Contractors, in PDF, which are not located at HQ ANG.
4. Collect all pertinent electronic data (i.e. analytical and field measurement data, maps, and survey reports), in its native format (i.e. SQL, Access, Excel, CAD, GIS, etc.), from contractors and reliable readily available sources.

3.2.2 Tier 2 Construction

1. Establish an SDSFIE v2.6 compliant personal geodatabase repository for data warehousing utilizing the same coordinate system as the Installation CIP
2. Load the established IRP and AOC site boundaries into data warehouse repository.
3. QA/QC IRP and AOC site boundaries against the electronic source files and maps from the various reports.
4. QA/QC metadata between IRP and AOC site boundary and all applicable documents identified with the site.
5. Establish Sampling Locations:

- a. Use existing surveyor reports to establish electronic coordinates for as many sampling locations as possible. Record approach and source in each record of the Geodatabase feature class.
 - b. Digitize remaining sampling locations from available drawings with ties to established reference points. Record approach and source in each record of the Geodatabase feature class.
 - c. QA/QC sampling locations against electronic source files and maps from the various reports where the data was compiled from.
6. Load all electronic analytical and field measurement data received from HQ and contractors. Record approach and source in each record of the geodatabase object class.
7. QA/QC linkages between sampling location and analytical data applicable to each station identified.
8. Document the construction of each Geodatabase feature class with feature class level metadata.

3.2.3 Tier 2 Document Search and Data Extraction

1. Analytical Data (Laboratory Data Only)
 - a. Review all documents for analytical data.
 - b. Determine what data are not already in electronic form.
 - c. Determine what of the identified data not in electronic form has available attribute information. All data should be captured when at all possible to link it with a known location.
 - d. Establish a template as a guide for hand entering data (may be more than one depending on contractor and formats).
 - e. Hand enter data into template.
 - f. QA/QC template against data tables in the document.
 - g. Load all hand entered analytical data from template(s) into SDSFIE structures. Record approach and source in each record of the Geodatabase object class.
2. Cross-sections
 - a. Load the cross-section feature class by connecting the appropriate sampling locations together to form the plan view line of the cross-section. Record approach and source in each record of the Geodatabase feature class.
 - b. QA/QC the cross-section feature class against electronic source files and maps from the various reports the data were compiled from.
 - c. Link cross-section maps to plan view cross-section lines establishing the necessary link for cross-section map retrieval.
 - d. QA/QC linkages between plan view cross-section lines and applicable cross-sections identified.
3. Well Construction and Borehole Logs, etc.
 - a. Review all documents for well construction and borehole logs, etc.

- b. Construct a PDF of all available logs with proper identification for entry into the metadata to the appropriate sampling location.
- c. Record the approach and source in each record of the Geodatabase feature class.
- d. QA/QC metadata between PDF's and sampling locations.

3.3 CONSIDERATIONS FOR CONSTRUCTING AN ERMDS

This section describes some of the considerations that should be made when constructing an ERMDS.

3.3.1 Multiple Results for an Analyte for One Sample

When multiple results for the same analyte for the same sample exists, then the most appropriate result should be selected for inclusion in the database. This decision should consider the result from the most appropriate analytical method, dilution, or reanalysis. The primary samples should be chosen over QC samples (lab duplicates). When there are multiple results for the same analyte for the same sample without identifiable differences between the results, the result that would be most protective of the environment—a detect over a non-detect, or the higher of multiple detects—should be selected.

3.3.2 Multiple Results for an Analyte at a Single Location

Multiple results for the same analyte may appear for a single sample location. The multiple samples may be from (1) samples taken at the same location at different depths, (2) samples taken at the same location on different dates, (3) metal samples may be analyzed for both filtered and unfiltered fractions and (4) samples taken from multiple types of matrices.

Some locations will over time be more than one type of sampling point (soil boring, temporary well, monitoring well, etc.)

3.3.3 Laboratory Results

Laboratory results of all normal analytical samples and field collected duplicate samples should be included in the data warehouse.

Laboratory QC results including surrogate spike samples, laboratory control samples, laboratory control sample duplicates, laboratory duplicates, matrix spikes, matrix spike duplicates, method blanks, etc. do not represent field conditions and so should not be included in the data warehouse.

3.3.4 Data Qualifiers

The Analytical Result object table has two qualifier fields. The 'parvq_d' field contains the lab qualifier and the 'qa_flags_d' field contains the validation qualifier.

The values for the lab qualifier field (parvq_d) should be set to the following:

| | |
|------|---|
| 'CE' | Co-elution |
| 'EQ' | Estimated quantification - Not Primary Result, Test was not performed |
| 'ET' | Equal to |
| 'GT' | Greater Than |
| 'I' | Interference present |
| 'IV' | Indeterminate - Significant differences between runs |
| 'LT' | Less Than |
| 'NA' | Not Available - result not available |

| | |
|------|---|
| 'ND' | Not Detected |
| 'S' | Indicates the value is determined by the method of standard addition. |
| 'TI' | Tentatively identified compound. |
| 'TR' | Trace - Above MDL below PQL |
| 'UR' | Unresolved Peaks Due to Matrix Interference or Impurities |

The values for the validation qualifier field (qa_flags_d) should be set to the following:

| | |
|-----|--|
| 'B' | The analyte was found in an associated blank, as well as in the sample. |
| 'F' | The analyte was positively identified but the associated numerical value is below the RL. |
| 'J' | The analyte was positively identified, the quantization is an estimation. |
| 'M' | A matrix effect was present. |
| 'R' | The data are unusable due to deficiencies in the ability to analyze the sample and meet QC criteria. |
| 'S' | To be applied to all field screening data. |
| 'T' | Tentatively identified compound (using GC/MS). |
| 'U' | The analyte was analyzed for, but not detected. The associated numerical value is at or below the MDL. |

3.3.5 Sampling Depths

The sampling depths recorded in the database depend on both the sample and the type of sample being taken. Groundwater samples should be recorded in the database with a start and end depth of "0 ft". Soil borings start and end depth should come from either the corresponding chain of custody or, if not available, from a historical report. The database should show exact values for start and end depths.

4. ERMDS CONTENT

This section describes the minimum attribute requirements for the ANG ERMDS as defined by NGB/A7OR in March 2009. Each table in this section provides the field names and a definition of the information to populate in each attribute field.

Each attribute field that represents either a Primary or Foreign Key is highlighted in yellow with table linkages. These fields are highlighted since these parameters will play a key role in joining various tables with spatial data.

4.1 COMMON

"Common" information describes the overall data set or components of data that are common to all entity sets.

4.1.1 Common General

"Common general" information describes the components of data that are common to all entity sets, entity classes, entity types, entities, and attribute tables. Examples are described in the following subsections.

4.1.1.1 Positional Location

The "Positional Location" table contains the detailed coordinate and positional location information of points and nodes (e.g., latitude, longitude, elevation, UTM coordinates, etc.).

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| Entity Type | Table Name | Entity Class | Entity Set |
|----------------------------|------------|----------------|------------|
| POSITIONAL_LOCATION | cmgencrd | common_general | common |

| Minimum Attributes | Attribute Description |
|--------------------|---|
| COORD_ID | Primary Key. Used to link the record to the appropriate point coordinate record(s). |
| X_SPCS | The State Plane Coordinate System (SPCS) X coordinate for the monument. |
| Y_SPCS | The State Plane Coordinate System (SPCS) Y coordinate for the monument. |
| X_UTM | The Universal Transverse Mercator (UTM) X coordinates for the monument. |
| Y_UTM | The Universal Transverse Mercator (UTM) Y coordinates for the monument. |
| LATITUDE | The angular distance measured North or South on the Earth's surface from the Equator to the meridian of the point. The value is expressed in decimal degrees between -90 and 90 (positive values North, and negative values South, of the Equator). |
| LONGITUDE | The angular distance measured East or West on the Earth's surface from the Greenwich Meridian to the meridian of the point. The value is expressed in decimal degrees between 180 and 180. |
| ORIG_ELEV | The original elevation developed on the monument with significant digits appropriate for the accuracy. |
| ADJ_ELEV | The current adjusted elevation of the monument (equal to the original elevation if no adjustment has been made). |
| SPCS_U_D | Unit of measure for SPCS coordinates. |
| UTM_U_D | Unit of measure for UTM coordinates. |
| ELEV_U_D | Unit of measure for elevation (z) coordinates. |
| MEDIA_ID | Foreign Key linked to table COMMON_MEDIA. |

4.1.2 Common Media

“Common Media” refers to information about the component digital forms of data that are associated with and are common to many graphic entities, and their descriptive attributes.

4.1.2.1 Media

The “Media” table contains information about any external image, graphic, CAD file, or other representation of the feature (e.g., types of media, date when media were developed/modified, organization that developed the media, etc.).

| Entity Type | Table Name | Entity Class | Entity Set |
|---------------------|------------|--------------|------------|
| COMMON_MEDIA | cmmedmed | common_media | common |

| Minimum Attributes | Attribute Description |
|--------------------|--|
| MEDIA_ID | Primary Key. Used to link the record to associated multimedia records that reference data such as imagery, video, audio, scanned documents, drawings, and other digital media. |
| MEDIA_TYPE | A description of the type of media used. |
| DATE_DEV | The date the media were developed. Format for date is YYYYMMDD. |
| DEVEL_ORG | The name of the organization that developed the media. |
| NARRATIVE | A description or other unique information concerning the subject item |
| FEAT_DESC | A brief description of the feature. |
| IMG_FILE | Full path to an image file (GIF, JPG, BMP, etc.). |

4.2 ENVIRONMENTAL HAZARDS

Environmental hazards data include information on the identification and management of natural and manmade substances, materials, and conditions, which are, or have the potential to be, detrimental to life and ecosystems on the Earth.

4.2.1 Environmental Hazards Characterization

Environmental hazards characterization data include information on those activities, processes, and equipment involved in collecting and analyzing a representative part of a larger item for the purpose of determining, or showing, evidence of quality or composition.

4.2.1.1 Field Sample Location

The “Field Sample Collection Location” table contains information about the physical location at which one or more environmental hazards field samples are collected [e.g., type of location (borehole vs. well); method used to determine location (Global Positioning System [GPS], field survey, digitized); unit of measure for elevations; etc.].

| Entity Type | Object Type | Entity Class | Entity Set | Table Name |
|--|-------------|--------------------------|-----------------------|------------|
| field_sample_collection_location_point | Point | env_haz_characterization | environmental_hazards | ehchaspt |

| Minimum Attributes | Attribute Description |
|--------------------|---|
| SAM_PT_ID | Primary Key. A unique, user defined identifier for field sample collection location. |
| MEDIA_ID | Foreign Key linked to table COMMON_MEDIA. |
| COORD_ID | Foreign Key linked to table POSTIONAL_LOCATION. |
| HAZSITE_ID | Foreign Key linked to table ENVIRONMENTAL_SITE. |
| INSTLN_ID | Foreign Key. Used to link the record to the applicable INSTALLATION record. |
| LTCCODE_D | Code describing the type of location that is undergoing sampling (e.g., BH = borehole, WL = well). |
| LOCDESC | Descriptor providing any additional information to describe the sampling location in text format (e.g., monitoring well located 10 feet Northeast of Building 624 within spill area). |
| LOCALIAS | A local or previously used identifier for the location (e.g., a borehole which later became a monitoring well). |
| LOC_METH_D | Indicates the method used to determine the location (e.g., GPS, field survey, digitized). |
| COND_D | Indicates a state of being, or readiness for use of the subject item, from lists or field inspections. |
| COORD_X | The x component of individual coordinate point. |
| COORD_Y | The y component of individual coordinate point. |
| COORD_Z | The z component of individual coordinate point. |

4.2.1.2 Groundwater Contour

The “Groundwater Contour” table contains information about connecting points on a hydrologic subsurface of the Earth of equal vertical elevation representing some fixed elevation interval (e.g., coordinate points, type or kind of bathymetric contour, depth of water, etc.).

| Entity Type | Object Type | Entity Class | Entity Set | Table Name |
|--------------------------|-------------|--------------------------|-----------------------|------------|
| groundwater_contour_line | Line | env_haz_characterization | environmental_hazards | ehchagwc |

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| Minimum Attributes | Attribute Description |
|--------------------|---|
| GRCNTOR_ID | Primary Key. A unique, user defined identifier |
| MEDIA_ID | Foreign Key linked to table COMMON_MEDIA. |
| INSTLN_ID | Foreign Key. Used to link the record to the applicable INSTALLATION record. |
| WATER_DEP | The indicated depth of water. |
| DEPTH_U_D | The unit of measure for the water depth. |

4.2.1.3 Groundwater Quality Monitoring Station

The “Groundwater Quality Monitoring Station” table contains information about equipment installed at a predetermined location for the automatic or manual, periodic collection of environmental groundwater samples.

| Entity Type | Object Type | Entity Class | Entity Set | Table Name |
|--|-------------|--------------------------|-----------------------|------------|
| groundwater_quality_monitoring_station_point | Point | env_haz_characterization | environmental_hazards | ehchagwm |

| Minimum Attributes | Attribute Description |
|--------------------|--|
| CHAGWM_ID | Primary Key. The unique identification number of a groundwater quality monitoring station. |
| MEDIA_ID | Foreign Key linked to table COMMON_MEDIA. |
| COORD_ID | Foreign Key linked to table POSTIONAL_LOCATION. |
| HAZSITE_ID | Foreign Key linked to table ENVIRONMENTAL_SITE. |
| SAM_PT_ID | Foreign Key linked to feature class ENV_FIELD_SAMPLE_LOC_POINT. |
| INSTLN_ID | Foreign Key. Used to link the record to the applicable INSTALLATION record. |
| NARRATIVE | A description or other unique information concerning the subject item |
| COORD_X | The x component of individual coordinate point. |
| COORD_Y | The y component of individual coordinate point. |
| COORD_Z | The z component of individual coordinate point. |

4.2.1.4 Surface Water Quality Monitoring Station

The “Surface Water Quality Monitoring Station” table contains information about equipment installed at a predetermined location for the automatic or manual, periodic collection of samples for monitoring the environmental quality of surface water.

| Entity Type | Object Type | Entity Class | Entity Set | Table Name |
|--|-------------|--------------------------|-----------------------|------------|
| surface_water_quality_monitoring_station_point | Point | env_haz_characterization | environmental_hazards | ehchaswm |

| Minimum Attributes | Attribute Description |
|--------------------|--|
| CHASWM_ID | Primary Key. The unique identification number of a surface water quality monitoring station. |
| MEDIA_ID | Foreign Key linked to table COMMON_MEDIA. |
| COORD_ID | Foreign Key linked to table POSTIONAL_LOCATION. |
| HAZSITE_ID | Foreign Key linked to table ENVIRONMENTAL_SITE. |
| SAM_PT_ID | Foreign Key linked to feature class ENV_FIELD_SAMPLE_LOC_POINT. |
| INSTLN_ID | Foreign Key. Used to link the record to the applicable INSTALLATION record. |

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|-----------|---|
| NARRATIVE | A description or other unique information concerning the subject item |
| COORD_X | The x component of individual coordinate point. |
| COORD_Y | The y component of individual coordinate point. |
| COORD_Z | The z component of individual coordinate point. |
| SMP_TYP_D | Type of sample collected. |
| SMP_MET_D | Sampling method used to collect the data. |

4.2.2 Environmental Hazards Environmental Manage SI

The “Environmental Manage SI” data include site investigation (SI)-related information necessary for the management of environmental restoration and compliance activities.

4.2.2.1 Site

The “Site” table is a parent table containing basic information about an environmental hazards site [e.g., date when first designated an environmental hazards site, date when last inspected, U.S. Environmental Protection Agency (EPA) region where located, etc.].

| Entity Type | Table Name | Entity Class | Entity Set |
|--------------------|------------|---------------------------------|-----------------------|
| ENVIRONMENTAL_SITE | ehenmsit | env_haz_environmental_manage_si | environmental_hazards |

| Minimum Attributes | Attribute Description |
|--------------------|---|
| HAZSITE_ID | Primary Key. The unique identification number of an Environmental Hazards Site. |
| INSTLN_ID | Foreign Key. Used to link the record to the applicable INSTALLATION record. |
| DATE_DESIG | The date on which the subject item was originally designated as an environmental hazards site. Format for date is YYYYMMDD. |
| DISPOSTN_D | The status of the subject item, from lists or entered from field inspections. |
| EPA_REGN_D | The code that indicates the Environmental Protection Agency region the environmental hazards site is located in. |
| NARRATIVE | A description or other unique information concerning the subject item |
| MEDIA_ID | Foreign Key linked to table COMMON_MEDIA. |
| ENVSITEID | Alternate Key. The identifier that represents a DISA Environmental Site |

4.2.3 Environmental Hazards Field Measurements SI

The “Environmental Hazards Field Measurements SI” data include information necessary for the management of environmental sampling, analysis, and monitoring activities.

4.2.3.1 Analytical Result

The “Analytical Result” table contains a summary of the chemical results of the laboratory analysis of a field-collected sample (e.g., name of analyte or parameter analyzed and reported, type of laboratory, type of sample collected, etc.).

| Entity Type | Table Name | Entity Class | Entity Set |
|--------------------------------|------------|------------------------------|-----------------------|
| ENV_FLD_SAMP_ANALYTICAL_RESULT | ehefmres | env_haz_field_measurement_si | environmental_hazards |

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| Minimum Attributes | Attribute Description |
|--------------------|--|
| CHARES_ID | Primary Key. The identification number assigned to chemical results of the laboratory analysis of an environmental hazards field sample. |
| MEDIA_ID | Foreign Key linked to table COMMON_MEDIA. |
| CHASAM_ID | Foreign Key linked to table ENV_FIELD_SAMPLE_OCCURRENCE. |
| HAZSITE_ID | Foreign Key linked to table ENVIRONMENTAL_SITE. |
| INSTLN_ID | Foreign Key. Used to link the record to the applicable INSTALLATION record. |
| LABCODE | A code identifying the analytical laboratory that performed the analysis of a sample(s). |
| PARVAL | This field represents the actual corrected analytical parameter concentration value for a compound/analyte generated after a sample has been analyzed or a test performed. |
| PVAL_U_D | The unit of measurement for the parameter value. |
| PARLABEL_D | The name of the parameter or analyte analyzed and reported. |
| S_MATRIX_D | A code identifying a sample's medium or makeup (e.g., soil, water, air). For field quality control (QC) samples, use the codes WQ, SQ, or AQ. For QC replicates and matrix spikes, use the matrix code for the actual matrix of the original sample. |
| S_TYPE_D | A code indicating the type of sample collected (e.g., QC, quality assurance [QA], normal). |
| SAM_PT_ID | Foreign Key linked to feature class ENV_FIELD_SAMPLE_LOC_POINT. |
| S_DATE | Date on which the sample was collected. Format for date is YYYYMMDD. |
| VALIDATE_D | Indicates whether the sample analysis result has been validated (Yes/No). |
| CAS_NUM_D | Chemical Abstracts Service (CAS) number of chemical pollutant. |
| USER_FLAG | An operator defined work area. This attribute can be used by the operator for user defined system processes. It does not affect the subject item's data integrity and should not be used to store the subject item's data. The full chemical name can be entered here. |
| PARUN | A value which measures the uncertainty of the analytical test. Conditional or radiological results can be entered here. |
| PARVQ_D | Coded value qualifying the analytical results (parval or analyte) field. |
| PRCCODE_D | Coded value identifying a class or group that a parameter (analyte) is associated with. |
| QA_FLAGS_D | Codes for quality assurance purposes assigned to analytical results during laboratory or validation review. Should be addresses in the Quality Assurance Project Plan. Chemistry data validation flags can be entered here. |
| EFMTES_ID | Foreign Key linked to table ANALYTICAL_TEST_PROCEDURE. |

4.2.3.2 Analytical Test Procedure

The "Analytical Test Procedure" table contains information on analytical test preparation and procedures for an environmental sample [e.g., leachate method used, analytical results (wet vs. dry), type of remediation technology, date the extraction was prepared, etc.].

| Entity Type | Table Name | Entity Class | Entity Set |
|---------------------------|------------|------------------------------|-----------------------|
| ANALYTICAL_TEST_PROCEDURE | ehefntes | env_haz_field_measurement_si | environmental_hazards |

| Minimum Attributes | Attribute Description |
|--------------------|---|
| EFMTES_ID | Primary Key. A locally assigned identifier for the record. |
| MEDIA_ID | Foreign Key linked to table COMMON_MEDIA. |
| INSTLN_ID | Foreign Key. Used to link the record to the applicable INSTALLATION record. |
| LCHMETH_D | Coded value identifying the leachate method. |
| BASIS_D | A coded value representing the basis (e.g., wet or dry) the analytical results are reported in. |

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| ANMCODE_D | Coded value representing the method of analysis of a given parameter (analyte). |
| CHASAM_ID | Foreign Key linked to table ENV_FIELD_SAMPLE_OCCURRENCE. |

4.2.3.3 Field Sample Occurrence

The "Field Sample" table contains all relevant information about a field sample collection occurrence [e.g., type of location undergoing sampling (borehole vs. well), coordinate values, date when sample location was completed, date of last inspection, etc.].

| Entity Type | Table Name | Entity Class | Entity Set |
|----------------------------|------------|------------------------------|-----------------------|
| ENV_FIELD_SAMPLE_OCCURENCE | ehfmsam | env_haz_field_measurement_si | environmental_hazards |

| Minimum Attributes | Attribute Description |
|--------------------|--|
| CHASAM_ID | Primary Key. The unique identification number of a collected field sample. |
| MEDIA_ID | Foreign Key linked to table COMMON_MEDIA. |
| HAZSITE_ID | Foreign Key linked to table ENVIRONMENTAL_SITE. |
| INSTLN_ID | Foreign Key. Used to link the record to the applicable INSTALLATION record. |
| SAM_PT_ID | Foreign Key linked to feature class ENV_FIELD_SAMPLE_LOC_POINT. |
| S_DATE | Date on which the sample was collected. Format for date is YYYYMMDD. |
| S_TIME | Time of day (24-hour clock) at which the sample was collected. Format for time is HHMMSS. |
| DATUM_ELEV | The elevation of the datum, or reference point used for measuring sample collection depth measurements. Typically, this elevation is measured from the top of notched casings for monitoring wells. |
| ELEV_U_D | The unit of measure for elevation data. |
| DATUM_DESC | Descriptive information concerning the datum, or elevation reference point. |
| S_DEPTH | The depth below (enter as negative number), or height above (enter as positive number), the datum where sample collection starts. |
| E_DEPTH | The depth below (enter as negative number), or height above (enter as positive number), the datum where sample collection ends. |
| DEPTH_U_D | The unit of measure for depth data. Must be same as used for datum elevation. |
| S_MATRIX_D | A code identifying a sample's medium or makeup (e.g., soil, water, air). For field QC samples, use the codes WQ, SQ, or AQ. For QC replicates and matrix spikes, use the matrix code for the actual matrix of the original sample. |
| S_TYPE_D | The type of sample collected (e.g., QC, QA, normal). |
| SAMEQP_D | Code representing the equipment used in collecting the environmental sample. |
| SAMMET_D | Code representing the method by which the environmental sample is collected. |
| NARRATIVE | A description or other unique information concerning the subject item |
| LGCONTR_ID | Foreign Key linked to table CONTRACTOR_INFORMATION. |
| LTCCODE_D | Code describing the type of location which is undergoing sampling (e.g., bh = borehole, wl = well). |

4.2.4 Environmental Hazards General Pollution

Environmental hazards general pollution data include information about activities involving the evaluation, investigation, and study of natural and manmade substances, materials, and conditions affecting more than one matrix, which are, or have the potential to be, detrimental to life and ecosystems on the Earth.

4.2.4.1 Polluted Area of Concern

The “Polluted Area of Concern” table contains information about the ‘defined area’ of polluted areas of concern (AOCs) located within environmental hazards sites.

| Entity Type | Object Type | Entity Class | Entity Set | Table Name |
|--------------------------------------|-------------|---------------------------|-----------------------|------------|
| polluted_area_of_concern_area | Polygon | env_haz_general_pollution | environmental_hazards | ehpolaac |

| Minimum Attributes | Attribute Description |
|--------------------|---|
| EHAOC_ID | Primary Key. The unique identification number of an environmental hazards polluted area of concern. |
| MEDIA_ID | Foreign Key linked to table COMMON_MEDIA. |
| INSTLN_ID | Foreign Key. Used to link the record to the applicable INSTALLATION record. |
| AOC_NAME | The name of the environmental hazards site polluted area of concern. |
| AREA_SIZE | The size of the area, zone, or polygon in square units. |
| AREA_U_D | The unit of measure for area. |
| PERIM | The distance around the boundary of the area, zone, or subject item in linear units. |
| PERIM_U_D | The unit of measure for length. |
| HAZSITE_ID | Foreign Key linked to table ENVIRONMENTAL_SITE. |
| NARRATIVE | A description or other unique information concerning the subject item |

4.2.5 Environmental Hazards Groundwater Pollution

Environmental hazards groundwater pollution data include information about activities involving the evaluation, investigation, and study of natural and manmade substances, materials, and conditions in the groundwater, which are, or have the potential to be, detrimental to life and ecosystems on the Earth.

4.2.5.1 Groundwater Pollution Isoline

A groundwater pollution isoline is a line on either a two- or three-dimensional plane in the groundwater, which represents a constant, measured or modeled pollution chemical constituent value (e.g., concentration). Such information is contained in the “Groundwater Pollution Isoline” table.

| Entity Type | Object Type | Entity Class | Entity Set | Table Name |
|---|-------------|-------------------------------|-----------------------|------------|
| groundwater_pollution_isoline_area | Polygon | env_haz_groundwater_pollution | environmental_hazards | ehgwtiso |

| Minimum Attributes | Attribute Description |
|--------------------|-----------------------|
|--------------------|-----------------------|

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|------------|--|
| GWTISO_ID | Primary Key. The unique identification number of a groundwater pollution isoline. |
| MEDIA_ID | Foreign Key linked to table COMMON_MEDIA. |
| HAZSITE_ID | Foreign Key linked to table ENVIRONMENTAL_SITE. |
| INSTLN_ID | Foreign Key. Used to link the record to the applicable INSTALLATION record. |
| PARVAL | This field represents the actual corrected analytical parameter concentration value for a compound/analyte generated after a sample has been analyzed or a test performed. |
| PVAL_U_D | The unit of measurement for the parameter value. |
| PARLABEL_D | The name of the parameter or analyte analyzed and reported. |
| CAS_NUM_D | Chemical Abstracts Service (CAS) number of chemical pollutant. |

4.2.6 Environmental Hazards Pollution Remediation

Environmental hazards pollution remediation data include information about activities involving the treatment, reduction, or removal of environmental hazards.

4.2.6.1 Environmental Remediation Excavation Area

An environmental remediation excavation area is the area where contaminated soil, buried drums, buried tanks, etc., are to be, or have been, excavated and removed. The "Environmental Remediation Excavation Area" table contains such information.

| Entity Type | Object Type | Entity Class | Entity Set | Table Name |
|---------------------------------|-------------|-------------------------------|-----------------------|------------|
| env_remediation_excavation_area | Polygon | env_haz_pollution_remediation | environmental_hazards | ehremexa |

| Minimum Attributes | Attribute Description |
|--------------------|--|
| REMEXA_ID | Primary Key. The unique identification number of an excavation area. |
| MEDIA_ID | Foreign Key linked to table COMMON_MEDIA. |
| HAZSITE_ID | Foreign Key linked to table ENVIRONMENTAL_SITE. |
| INSTLN_ID | Foreign Key. Used to link the record to the applicable INSTALLATION record. |
| NARRATIVE | A description or other unique information concerning the subject item. |
| AREA_SIZE | The size of the area, zone, or polygon in square units. |
| AREA_U_D | The unit of measure for area. |
| PERIM | The distance around the boundary of the area, zone, or subject item in linear units. |
| PERIM_U_D | The unit of measure for length. |

4.2.6.2 Environmental Remediation Operable Unit

An operable unit (OU) area is one or more areas possessing environmental contamination characteristics, which are amenable to the same type of remediation, treatment, or management procedure. The "Operable Unit Area" table contains such information.

| Entity Type | Object Type | Entity Class | Entity Set | Table Name |
|--------------------|-------------|-------------------------------|-----------------------|------------|
| operable_unit_area | Polygon | env_haz_pollution_remediation | environmental_hazards | ehremopu |

| Minimum Attributes | Attribute Description |
|--------------------|-----------------------|
|--------------------|-----------------------|

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|------------|--|
| REMOPU_ID | Primary Key. The unique identification number of an operable unit. |
| MEDIA_ID | Foreign Key linked to table COMMON_MEDIA. |
| HAZSITE_ID | Foreign Key linked to table ENVIRONMENTAL_SITE. |
| INSTLN_ID | Foreign Key. Used to link the record to the applicable INSTALLATION record. |
| NARRATIVE | A description or other unique information concerning the subject item |
| AREA_SIZE | The size of the area, zone, or polygon in square units. |
| AREA_U_D | The unit of measure for area. |
| PERIM | The distance around the boundary of the area, zone, or subject item in linear units. |
| PERIM_U_D | The unit of measure for length. |
| OUNAME | Name of an OU. |

4.2.7 Environmental Hazards Sites

Environmental hazards sites data include site-management information concerning a site where environmental hazards are, or may be, located.

4.2.7.1 Environmental Restoration Site

An environmental restoration site is a geographic area where an active environmental study or project is underway to remediate pollutants located in the soil, sediment, surface water, or groundwater. Such information is contained in the "Environmental Restoration Site" table.

| Entity Type | Object Type | Entity Class | Entity Set | Table Name |
|--------------------------------|-------------|---------------|-----------------------|------------|
| environmental_restoration_site | Polygon | env_haz_sites | environmental_hazards | ehsitirp |

| Minimum Attributes | Attribute Description |
|--------------------|--|
| SITIRP_ID | Primary Key. The unique identification number of an environmental restoration site. |
| MEDIA_ID | Foreign Key linked to table COMMON_MEDIA. |
| HAZSITE_ID | Foreign Key linked to table ENVIRONMENTAL_SITE. |
| INSTLN_ID | Foreign Key. Used to link the record to the applicable INSTALLATION record. |
| SITE_NAME | Any commonly used name for the Environmental Restoration site. |
| AREA_SIZE | The size of the area, zone, or polygon in square units. |
| AREA_U_D | The unit of measure for area. |
| SITE_DESC | The text describing an Environmental Restoration Site. |
| PERIM | The distance around the boundary of the area, zone, or subject item in linear units. |
| PERIM_U_D | The unit of measure for length. |
| DEPTH_WAT | The depth in feet to the groundwater under the site. |
| NARRATIVE | A description or other unique information concerning the subject item |
| ERSCAT_D | Discriminator. The general category of an Environmental Restoration site. |
| SITAOC_ID | Foreign Key linked to feature class POLLUTED_AREA_OF_CONCERN_AREA. |
| REL_TYP_D | A descriptor for the type of release experienced. |
| CAUSE_D | A descriptor for the cause of the pollution. |
| REM_REQ_D | Indicates whether or not further action or remediation is necessary (Yes/No). |

4.2.8 Environmental Hazards Soil Pollution

Environmental hazards soil pollution data include information on activities involving the evaluation, investigation, and study of natural and manmade substances, materials, and

conditions in the soil, which are, or have the potential to be, detrimental to life and ecosystems on the Earth.

4.2.8.1 Soil Pollution Isoline

A soil pollution isoline line is a line on either a two- or three-dimensional plane in the soil, which represents a constant, measured or modeled pollution chemical constituent value (e.g. concentration). Such information is contained in the "Soil Pollution Isoline Line" table.

| Entity Type | Object Type | Entity Class | Entity Set | Table Name |
|-----------------------------|-------------|------------------------|-----------------------|------------|
| soil_pollution_isoline_line | Line | env_haz_soil_pollution | environmental_hazards | ehsoiiso |

| Minimum Attributes | Attribute Description |
|--------------------|--|
| SOIISO_ID | Primary Key. The unique identification number of a soil pollution isoline. |
| MEDIA_ID | Foreign Key linked to table COMMON_MEDIA. |
| HAZSITE_ID | Foreign Key linked to table ENVIRONMENTAL_SITE. |
| INSTLN_ID | Foreign Key. Used to link the record to the applicable INSTALLATION record. |
| PARVAL | This field represents the actual corrected analytical parameter concentration value for a compound/analyte generated after a sample has been analyzed or a test performed. |
| PVAL_U_D | The unit of measurement for the parameter value. |
| PARLABEL_D | The name of the parameter or analyte analyzed and reported. |
| CAS_NUM_D | Chemical Abstracts Service (CAS) number of chemical pollutant. |

4.3 GEOLOGY

Geology data contain information about the geologic features and processes occurring in a given region on the Earth.

4.3.1 Geology Subsurface

The geology subsurface includes the geologic formations or activities that exist below the surface of the Earth.

4.3.1.1 Borehole

A borehole point is a shaft drilled, driven, or dug into the Earth for the purpose of installing a well or for subsurface exploration. Such information is contained in the "Borehole Point" table.

| Entity Type | Object Type | Entity Class | Entity Set | Table Name |
|----------------|-------------|--------------------|------------|------------|
| borehole_point | Point | geology_subsurface | geology | gesubbhl |

| Minimum Attributes | Attribute Description |
|--------------------|---|
| SUBBHL_ID | Primary Key. The unique identification number of a borehole. |
| MEDIA_ID | Foreign Key linked to table COMMON_MEDIA. |
| INSTLN_ID | Foreign Key. Used to link the record to the applicable INSTALLATION record. |
| COMP_DATE | The date drilling or construction of the borehole, or boring, was completed. Format for date is YYYYMMDD. |

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|------------|---|
| DATUM_ELEV | The elevation of the datum, or reference point used for measuring sample collection depth measurements. Typically, this elevation is measured from the top of the well. |
| DATUM_DESC | Descriptive information concerning the datum, or elevation reference point. |
| ELV_U_D | The unit of measure for elevation data, usually feet (ft) or meters (m). |
| GSURF_ELEV | The ground surface elevation at the top of the borehole or boring. |
| TOTDEPTH | The total depth of the borehole or boring, measured from the ground surface to the bottom of the borehole or boring. Report in feet or meters. Must be in the same units as the elevation data. |
| DEPTH_U_D | The unit of measure for all length and depth measurements. Must be in the same units as the elevation data. |
| BHDIAM | The inside diameter of the borehole or boring. Report in inches or centimeters. |
| DIAM_U_D | The unit of measure for the casing diameter above, inches (in.) or centimeters (cm). |
| BHL_DISP_D | The disposition or status of the borehole, excavation, or boring. |
| HAZSITE_ID | Foreign Key linked to table ENVIRONMENTAL_SITE. |
| SAM_PT_ID | Foreign Key linked to feature class ENV_FIELD_SAMPLE_LOC_POINT. |
| BOR_TYP_D | The material into which the borehole is bored. ROCK or SOIL |
| COORD_ID | Foreign Key linked to table POSTIONAL_LOCATION. |
| FEAT_DESC | A description of the boring. |
| BOR_METH_D | Type of drilling or excavation method used for construction of the borehole, boring, excavation, etc. |
| COORD_X | The x component of individual coordinate point. |
| COORD_Y | The y component of individual coordinate point. |
| COORD_Z | The z component of individual coordinate point. |

4.4 HYDROGRAPHY

Hydrography data include information about the physical conditions, boundaries, flow, and related characteristics of the Earth's waters.

4.4.1 Hydrography Subsurface

The hydrography subsurface is the scientific description and analysis of the physical conditions, boundaries, flow, and related characteristics of the Earth's subsurface fresh waters.

4.4.1.1 Piezometer Location

The "Piezometer Point" table contains information about each piezometer point (location of a pipe placed in the ground or a structure, which is used to measure subsurface water elevation).

| Entity Type | Object Type | Entity Class | Entity Set | Table Name |
|------------------|-------------|------------------------|-------------|------------|
| piezometer_point | Point | hydrography_subsurface | hydrography | hysubpiz |

| Minimum Attributes | Attribute Description |
|--------------------|--|
| PIEZOM_ID | Primary Key. A unique, user defined identifier for each record or instance of an entity. |
| MEDIA_ID | Foreign Key linked to table COMMON_MEDIA. |
| COORD_ID | Foreign Key linked to table POSTIONAL_LOCATION. |
| INSTLN_ID | Foreign Key. Used to link the record to the applicable INSTALLATION record. |
| FEAT_NAME | Any name or designation associated with the tube. |
| DATE_INST | The installation date of the piezometer tube. Format for date is YYYYMMDD. |
| TOP_ELEV | The elevation at the top of the tube. |

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|-----------|---|
| TIP_ELEV | The elevation at the tip of the tube. |
| ELEV_U_D | The unit of measure for the elevations above. |
| REMARKS | Any narrative remarks concerning the piezometer. |
| COORD_X | The x component of individual coordinate point. |
| COORD_Y | The y component of individual coordinate point. |
| COORD_Z | The z component of individual coordinate point. |
| DATUM | The datum from which the elevations and readings are based (e.g., Mean Low Gulf [MLG]). |
| GRND_ELEV | Ground elevation at the piezometer location |

4.4.2 Hydrography Subsurface SI

Hydrography subsurface SI data include information necessary for the management of the scientific description and analysis of the physical conditions, boundaries, flow, and related characteristics of the Earth's subsurface fresh waters.

4.4.2.1 Piezometer

The "Piezometer" table contains information regarding piezometer readings.

| Entity Type | Table Name | Entity Class | Entity Set |
|-------------|------------|---------------------------|-------------|
| PIEZOMETER | hysuiprd | hydrography_subsurface_si | hydrography |

| Minimum Attributes | Attribute Description |
|--------------------|---|
| PIZRD_ID | Primary Key. |
| MEDIA_ID | Foreign Key linked to table COMMON_MEDIA. |
| SURF_ELEV | The water surface elevation in the piezometer tube in feet National Geodetic Vertical Datum (NGVD). |
| TAILWTR_EL | The elevation at the tailwater of the tube. |
| PIEZOM_ID | Foreign Key linked to table PIEZOMETER_POINT. |

4.5 IMPROVEMENT

Improvement data contain information about the miscellaneous manmade minor structures and facilities, which improve appearance, provide security, or facilitate man's activities.

4.5.1 Improvement Wells

Improvement wells are holes drilled or dug into the ground for the purpose of removing or injecting liquids or gases, or for monitoring ground conditions.

4.5.1.1 Water Well

A water well point is a shaft dug or drilled into the Earth for the purpose of extracting water from subsurface aquifers, collecting groundwater environmental samples, injecting water or other fluids into subsurface aquifers, or extracting contamination or other impurities from subsurface aquifers. The "Water Well Point" table contains information about these well points (e.g., type or use of well, status or condition of well, well protective casing material type, drilled depth of well, etc.). For ANG's purposes, this feature will be used for all monitoring wells.

| Entity Type | Object Type | Entity Class | Entity Set | Table Name |
|-------------|-------------|--------------|------------|------------|
|-------------|-------------|--------------|------------|------------|

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|------------------|-------|-------------------|-------------|----------|
| water_well_point | Point | improvement_wells | improvement | imwelwel |
|------------------|-------|-------------------|-------------|----------|

| Minimum Attributes | Attribute Description |
|--------------------|--|
| WELL_ID | Primary Key. A unique operator generated identifier for a well. |
| MEDIA_ID | Foreign Key linked to table COMMON_MEDIA. |
| MNWELL_ID | Foreign Key linked to table WATER_WELL_POINT. |
| INSTLN_ID | Foreign Key. Used to link the record to the applicable INSTALLATION record. |
| WELL_CAT_D | Defining the category of the water well. |
| WELL_TYP_D | The type or use of the well. |
| WELL_STA_D | The status or condition of the well. |
| CASE_MAT_D | The well protective casing material type. |
| CONST_TY_D | The well construction type. |
| HOLE_DIA | The diameter of the well opening. |
| DIA_U_D | The units of measure for diameter. |
| TOTALDEPTH | The total drilled depth of the well, as measured from the ground surface. |
| REFER_ELEV | Elevation of the measurement reference point used for ground water depth level measurements, expressed in feet above Mean Sea Level. |
| ELEV_U_D | The units of measure for elevation. |
| DEPTH_U_D | The units of measure for depth |
| NARRATIVE | A description or other unique information concerning the subject item |
| PUBLIC_D | A Boolean indicating whether the well can be used for public purposes. |
| COORD_ID | Foreign Key linked to table POSTIONAL_LOCATION. |
| FEAT_NAME | Any commonly used name for the well. |
| COORD_X | The x component of individual coordinate point. |
| COORD_Y | The y component of individual coordinate point. |
| COORD_Z | The z component of individual coordinate point. |
| CAS_SDEPTH | The distance from the ground surface to the top of well casing. |
| CAS_EDEPTH | The distance from the ground surface to the bottom of well casing. |
| COMP_DATE | The date the well was completed (i.e., all hardware installed). Format for date is YYYYMMDD |
| GSURF_ELEV | The ground surface elevation at the top of the well. |
| DATUM_DESC | Descriptive information concerning the datum, or elevation reference point. |
| DATUM_ELEV | The elevation of the datum, or reference point used for measuring sample collection depth measurements. Typically, this elevation is measured from the top of notched casings for monitoring wells |

4.5.2 Improvement Wells SI

Improvement wells SI data include information necessary for the management of holes drilled or dug into the ground for the purpose of removing or injecting liquids or gases, or for monitoring ground conditions.

4.5.2.1 Well

The "Water Master" table is a parent table for wells.

| Entity Type | Table Name | Entity Class | Entity Set |
|--------------|------------|----------------------|-------------|
| WATER_MASTER | imwlimas | improvement_wells_si | improvement |

| Minimum Attributes | Attribute Description |
|--------------------|---|
| WELL_ID | Primary Key. A unique operator generated identifier for a well. |
| MEDIA_ID | Foreign Key linked to table COMMON_MEDIA. |
| MNWELL_ID | Foreign Key linked to table WATER_WELL_POINT. |
| INSTLN_ID | Foreign Key. Used to link the record to the applicable INSTALLATION record. |
| WELL_CAT_D | Defining the category of the water well. |
| WELL_TYP_D | The type or use of the well. |
| MNWELL_ID | Primary Key. The unique identification number of a well. |
| MEDIA_ID | Foreign Key linked to table COMMON_MEDIA. |
| SUBBHL_ID | Foreign Key linked to table BOREHOLE. |
| WELL_CAT_D | General category or type of well. |

4.5.2.2 Groundwater Level Data

The “Groundwater Level Data” table contains groundwater level(s) information representing a single groundwater level measurement.

| Entity Type | Table Name | Entity Class | Entity Set |
|------------------------|------------|----------------------|-------------|
| GROUNDWATER_LEVEL_DATA | imwlgiv | improvement_wells_si | improvement |

| Minimum Attributes | Attribute Description |
|--------------------|---|
| WLEVEL_ID | Primary Key. The unique identification number of a groundwater level measurement record taken from a well. |
| MEDIA_ID | Foreign Key linked to table COMMON_MEDIA. |
| MNWELL_ID | Foreign Key linked to table WATER_WELL_POINT. |
| INSTLN_ID | Foreign Key. Used to link the record to the applicable INSTALLATION record. |
| WL_METH_D | Coded value representing the method used to make the groundwater level measurement. |
| WL_DATE | Date that the groundwater measurement was made. Format for date is YYYYMMDD. |
| WL_TIME | Time that the groundwater measurement was made. Format for time is HHMMSS. Use the standard 24 hour clock. |
| WL_MELEV | Elevation of the datum from which the groundwater level measurements and sounding are made. The datum is the top of casing elevation for water wells. |
| WL_STATIC | Depth to the top of the groundwater level. Depths are measured relative to the distance below the measuring point datum elevation. |
| WL_SOUND | Total depth to the bottom of the well. Depths are measured relative to the distance below the measuring point datum elevation. |
| WLS_CHK_D | Indicates (yes or no) whether or not the depth to the bottom of the well, as determined by the sounding, matches the original as-constructed depth to the bottom of the well. |
| WLELEV_U_D | The unit of measure for depths and elevations. |
| NARRATIVE | A description or other unique information concerning the subject item |

4.6 LANDFORM

A landform is the distribution of features that make up the visible surface of the Earth’s crust.

4.6.1 Landform Bathymetry

Landform bathymetry is the science of measuring and charting the depth of seas, lakes, and other bodies of water and the bottom structures of those waters.

4.6.1.1 Sediment Sample

A sediment sample site is a site where bottom samples are taken for analysis. Such information is contained in the “Sediment Sample Site” table.

| Entity Type | Object Type | Entity Class | Entity Set | Table Name |
|-----------------------|-------------|---------------------|------------|------------|
| sediment_sample_point | Point | landform_bathymetry | landform | lfbthsmpt |

| Minimum Attributes | Attribute Description |
|--------------------|---|
| SEDSAMP_ID | Primary Key. A unique, user defined identifier |
| MEDIA_ID | Foreign Key linked to table COMMON_MEDIA. |
| COORD_ID | Foreign Key linked to table POSTIONAL_LOCATION. |
| INSTLN_ID | Foreign Key. Used to link the record to the applicable INSTALLATION record. |
| COORD_X | The x component of individual coordinate point. |
| COORD_Y | The y component of individual coordinate point. |
| COORD_Z | The z component of individual coordinate point. |

5. REFERENCES

- CADD/GIS Technology Center, A/E/C CADD Standard (ERDC/ITL TR-01-6), 2001.
- CADD/GIS Technology Center, Spatial Data Standards for Facilities, Infrastructure and Environment (SDSFIE), 2006. Version 2.6 available online at <http://www.sdsfie.org>.
- Federal Geographic Data Committee (FGDC) Standard 001-1998, Content Standards for Digital Geospatial Metadata (CSDGM) Version 2.
- FGDC Standard 007.3-1998, Geospatial Positioning Accuracy Standards, Part 3: National Standard for Spatial Data Accuracy.
- FGDC Standard 007.4-2002, Geospatial Positioning Accuracy Standards, Part 4: Standards for Architecture, Engineering, and Construction (A/E/C) and Facility Management.

ANG GIO Metadata Standards

Please reference specific guidelines and example valid values in the Electronic Data Deliverables Requirements Attachment.

ANG Metadata Standards for Vector Data

ANG GIO will publish and maintain the ANG GIO Metadata Standards document. The document will be based on and adhere to Headquarters Air Force CSDGM metadata profile while ensuring that it also adheres to the translation requirements of the Defense Installation

Spatial Data Infrastructure Group (DISDIG) Metadata Profile. The ANG GIO Metadata Standards document will include the minimum required elements to best serve the ANG user community and maintain compliance with DoD standards. Thus, ANG GIO Vector Metadata specifications will adhere to the standards established in the Federal Geographic Data Committee (FGDC) Content Standards for Digital Geospatial Metadata (CSDGM).

The ANG GIO Metadata Profile will also include translation and authoring tools for migration and quality assurance to the DISDI Geospatial Metadata Profile (DGMP) and the North American Profile (NAP). The ANG GIO Program Office will maintain configuration management and certification requirements for these COTs tools as related to Air Force Information Assurance.

ANG Metadata Standards for Imagery

The ANG GIO is coordinating with the DISDIG to develop metadata standards for raster data sets, including satellite imagery, orthophotography, DTM, and others. This effort is not complete at the time of this writing. Until a DoD requirement is established, ANG GIO Raster Metadata specifications will adhere to the standards established in the Federal Geographic Data Committee (FGDC) Content Standards for Digital Geospatial Metadata (CSDGM).

ANG GIO Geospatial Data Request Form

STEP #1: REQUESTING ORGANIZATION INFORMATION

| | |
|--|--|
| NAME | ADDRESS |
| COMPANY NAME | |
| TELEPHONE NUMBER (<input type="text"/>) <input type="text"/> <input type="text"/> | FAX NUMBER (<input type="text"/>) <input type="text"/> <input type="text"/> |
| REQUESTING PERSON CITIZENSHIP U.S. YES <input type="radio"/> NO <input type="radio"/> | COMPANY LOCATION U.S. YES <input type="radio"/> NO <input type="radio"/> |

STEP #2: SPONSORING GOVERNMENT PROJECT MANAGER INFORMATION

| | |
|--|--|
| NAME AND TITLE | ORGANIZATION |
| TELEPHONE NUMBER (<input type="text"/>) <input type="text"/> <input type="text"/> | FAX NUMBER (<input type="text"/>) <input type="text"/> <input type="text"/> |

EMAIL ADDRESS

INFORMATION REQUESTED

PURPOSE OF THE REQUEST

1. THE DATA REQUESTED IS FOR THE PERFORMANCE OF A GOVERNMENT CONTRACT AND WILL NOT BE USED FOR ANY OTHER PURPOSES INSIDE AND OUTSIDE OF THE COMPANY.
2. REQUESTING PERSON SHALL TAKE RESPONSIBILITY FOR CONTROL OF THE INFORMATION AND SHALL NOT RELEASE IT OUT THEIR PERSONAL CONTROL.
3. NO UNAUTHORIZED PERSONS WITHIN THE REQUESTING COMPANY SHALL VIEW OR RELEASE INFORMATION INSIDE OR OUTSIDE OF THE COMPANY.

REQUESTING PERSON CERTIFICATION

I certify that the information and certifications made by me are true, complete, and accurate to the best of my knowledge and belief and are made in good faith. I understand that a knowing and willful false statement on this form can be punished by fine or imprisonment or both (For U.S. Contractors see US Code, Title 18, section 1001).

| | |
|-----------|------|
| SIGNATURE | DATE |
|-----------|------|

STEP #3: APPROVING GOVERNMENT OFFICIAL SIGNATURE

| | |
|------------|-------|
| TYPED NAME | TITLE |
| SIGNATURE | DATE |

APPENDIX B



CERTIFICATIONS



NELAP - RECOGNIZED



CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

CERTIFICATE OF NELAP ACCREDITATION

Is hereby granted to

Eurofins Air Toxics Inc.

180 Blue Ravine Road, Suite B
Folsom, CA 95630

Scope of the Certificate is limited to the
"NELAP Fields of Accreditation"
which accompany this Certificate.

Continued accredited status depends on successful
ongoing participation in the program.

This Certificate is granted in accordance with provisions of
Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **12282CA**

Expiration Date: **6/30/2013**

Effective Date: **7/1/2012**

Richmond, California
subject to forfeiture or revocation

A handwritten signature in cursive script, reading "David Mazzera for".

David Mazzera, Ph.D., Assistant Division Chief
Division of Drinking Water and Environmental Management



CALIFORNIA DEPARTMENT OF PUBLIC HEALTH
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH
NELAP Fields of Accreditation



NELAP-RECOGNIZED

Eurofins Air Toxics Inc.

180 Blue Ravine Road, Suite B
Folsom, CA 95630
Phone: (916) 985-1000

Certificate No.: 12282CA
Renew Date: 6/30/2013

116 - Volatile Organic Chemistry of Hazardous Waste

| | | | |
|---------|-----|-----------|--------------------------------|
| 116.080 | 000 | EPA 8260B | Volatile Organic Compounds |
| 116.080 | 001 | EPA 8260B | Acetone |
| 116.080 | 004 | EPA 8260B | Acrylonitrile |
| 116.080 | 007 | EPA 8260B | Benzene |
| 116.080 | 010 | EPA 8260B | Bromochloromethane |
| 116.080 | 011 | EPA 8260B | Bromodichloromethane |
| 116.080 | 012 | EPA 8260B | Bromoform |
| 116.080 | 013 | EPA 8260B | Bromomethane |
| 116.080 | 015 | EPA 8260B | Carbon Disulfide |
| 116.080 | 016 | EPA 8260B | Carbon Tetrachloride |
| 116.080 | 018 | EPA 8260B | Chlorobenzene |
| 116.080 | 019 | EPA 8260B | Chloroethane |
| 116.080 | 021 | EPA 8260B | Chloroform |
| 116.080 | 022 | EPA 8260B | Chloromethane |
| 116.080 | 026 | EPA 8260B | Dibromochloromethane |
| 116.080 | 028 | EPA 8260B | 1,2-Dibromoethane |
| 116.080 | 030 | EPA 8260B | Dibromomethane |
| 116.080 | 031 | EPA 8260B | 1,2-Dichlorobenzene |
| 116.080 | 032 | EPA 8260B | 1,3-Dichlorobenzene |
| 116.080 | 033 | EPA 8260B | 1,4-Dichlorobenzene |
| 116.080 | 034 | EPA 8260B | cis-1,4-Dichloro-2-butene |
| 116.080 | 035 | EPA 8260B | trans-1,4-Dichloro-2-butene |
| 116.080 | 036 | EPA 8260B | Dichlorodifluoromethane |
| 116.080 | 037 | EPA 8260B | 1,1-Dichloroethane |
| 116.080 | 038 | EPA 8260B | 1,2-Dichloroethane |
| 116.080 | 039 | EPA 8260B | 1,1-Dichloroethene |
| 116.080 | 040 | EPA 8260B | trans-1,2-Dichloroethene |
| 116.080 | 041 | EPA 8260B | cis-1,2-Dichloroethene |
| 116.080 | 042 | EPA 8260B | 1,2-Dichloropropane |
| 116.080 | 043 | EPA 8260B | 1,3-Dichloropropane |
| 116.080 | 044 | EPA 8260B | 2,2-Dichloropropane |
| 116.080 | 045 | EPA 8260B | 1,1-Dichloropropene |
| 116.080 | 046 | EPA 8260B | cis-1,3-Dichloropropene |
| 116.080 | 047 | EPA 8260B | trans-1,3-Dichloropropene |
| 116.080 | 053 | EPA 8260B | Ethylbenzene |
| 116.080 | 056 | EPA 8260B | Hexachlorobutadiene |
| 116.080 | 058 | EPA 8260B | 2-Hexanone (MBK) |
| 116.080 | 059 | EPA 8260B | Iodomethane |
| 116.080 | 064 | EPA 8260B | Methyl tert-butyl Ether (MTBE) |
| 116.080 | 065 | EPA 8260B | Methylene Chloride |

Eurofins Air Toxics Inc.

Certificate No.: 12282CA
Renew Date: 06/30/2013

| | | | |
|---------|-----|-----------|-----------------------------|
| 116.080 | 068 | EPA 8260B | 4-Methyl-2-pentanone (MIBK) |
| 116.080 | 069 | EPA 8260B | Naphthalene |
| 116.080 | 081 | EPA 8260B | 1,1,1,2-Tetrachloroethane |
| 116.080 | 082 | EPA 8260B | 1,1,2,2-Tetrachloroethane |
| 116.080 | 083 | EPA 8260B | Tetrachloroethene |
| 116.080 | 084 | EPA 8260B | Toluene |
| 116.080 | 086 | EPA 8260B | 1,2,3-Trichlorobenzene |
| 116.080 | 087 | EPA 8260B | 1,2,4-Trichlorobenzene |
| 116.080 | 088 | EPA 8260B | 1,1,1-Trichloroethane |
| 116.080 | 089 | EPA 8260B | 1,1,2-Trichloroethane |
| 116.080 | 090 | EPA 8260B | Trichloroethene |
| 116.080 | 091 | EPA 8260B | Trichlorofluoromethane |
| 116.080 | 092 | EPA 8260B | 1,2,3-Trichloropropane |
| 116.080 | 093 | EPA 8260B | Vinyl Acetate |
| 116.080 | 094 | EPA 8260B | Vinyl Chloride |
| 116.080 | 095 | EPA 8260B | Xylenes, Total |
| 116.080 | 099 | EPA 8260B | Bromobenzene |
| 116.080 | 100 | EPA 8260B | n-Butylbenzene |
| 116.080 | 101 | EPA 8260B | sec-Butylbenzene |
| 116.080 | 102 | EPA 8260B | tert-Butylbenzene |
| 116.080 | 103 | EPA 8260B | 2-Chlorotoluene |
| 116.080 | 104 | EPA 8260B | 4-Chlorotoluene |
| 116.080 | 105 | EPA 8260B | Isopropylbenzene |
| 116.080 | 106 | EPA 8260B | N-propylbenzene |
| 116.080 | 107 | EPA 8260B | Styrene |
| 116.080 | 108 | EPA 8260B | 1,2,4-Trimethylbenzene |
| 116.080 | 109 | EPA 8260B | 1,3,5-Trimethylbenzene |
| 116.901 | 001 | EPA 8260B | 1,2-Dibromo-3-chloropropane |



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

TESTAMERICA DENVER
4955 Yarrow Street
Arvada, CO 80002
Karen Kuoppala Phone: 303-736-1203
www.testamericainc.com

ENVIRONMENTAL

Valid To: October 31, 2013

Certificate Number: 2907.01

In recognition of the successful completion of the A2LA evaluation process, (including an assessment of the laboratory's compliance with ISO IEC 17025:2005, the 2003 NELAC Chapter 5 Standard, the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the current DoD Quality Systems Manual for Environmental Laboratories), and for the test methods applicable to the Wyoming Storage Tank Remediation Laboratory Accreditation Program, accreditation is granted to this laboratory to perform recognized EPA methods using the following testing technologies and in the analyte categories identified below:

Testing Technologies

Atomic Absorption/ICP-AES Spectrometry, ICP/MS, Gas Chromatography, Gas Chromatography/Mass Spectrometry, Gravimetry, High Performance Liquid Chromatography, Ion Chromatography, Misc.- Electronic Probes (pH, O₂), Oxygen Demand, Hazardous Waste Characteristics Tests, Spectrophotometry (Visible), Spectrophotometry (Automated), Titrimetry, Total Organic Carbon, Total Organic Halide

| <u>Parameter/Analyte</u> | <u>WY Storage Tank Program</u> | <u>Non-Potable Water</u> | <u>Solid Hazardous Waste (Water)</u> | <u>Solid Hazardous Waste (Solid)</u> |
|--------------------------|--------------------------------|--------------------------|--------------------------------------|--------------------------------------|
| <u>Metals</u> | | | | |
| Aluminum | ----- | ----- | EPA 6010B / 6010C | EPA 6010B / 6010C |
| Antimony | ----- | ----- | EPA 6010B / 6010C / 6020 / 6020A | EPA 6010B / 6010C / 6020 / 6020A |
| Arsenic | ----- | ----- | EPA 6010B / 6010C / 6020 / 6020A | EPA 6010B / 6010C / 6020 / 6020A |
| Barium | ----- | ----- | EPA 6010B / 6010C / 6020 / 6020A | EPA 6010B / 6010C / 6020 / 6020A |
| Beryllium | ----- | ----- | EPA 6010B / 6010C / 6020 / 6020A | EPA 6010B / 6010C / 6020 / 6020A |
| Boron | ----- | ----- | EPA 6010B / 6010C | EPA 6010B / 6010C |

| <u>Parameter/Analyte</u> | <u>WY Storage Tank Program</u> | <u>Non-Potable Water</u> | <u>Solid Hazardous Waste (Water)</u> | <u>Solid Hazardous Waste (Solid)</u> |
|--------------------------|--------------------------------|--------------------------|--------------------------------------|--------------------------------------|
| Cadmium | EPA 6010C | ----- | EPA 6010B / 6010C / 6020 / 6020A | EPA 6010B / 6010C / 6020 / 6020A |
| Calcium | ----- | ----- | EPA 6010B / 6010C | EPA 6010B / 6010C |
| Chromium | EPA 6010C | ----- | EPA 6010B / 6010C / 6020 / 6020A | EPA 6010B / 6010C / 6020 / 6020A |
| Cobalt | ----- | ----- | EPA 6010B / 6010C / 6020 / 6020A | EPA 6010B / 6010C / 6020 / 6020A |
| Copper | ----- | ----- | EPA 6010B / 6010C / 6020 / 6020A | EPA 6010B / 6010C / 6020 / 6020A |
| Iron | ----- | ----- | EPA 6010B / 6010C | EPA 6010B / 6010C |
| Lead | EPA 6010C | ----- | EPA 6010B / 6010C / 6020 / 6020A | EPA 6010B / 6010C / 6020 / 6020A |
| Lithium | ----- | ----- | EPA 6010B / 6010C | EPA 6010B / 6010C |
| Magnesium | ----- | ----- | EPA 6010B / 6010C | EPA 6010B / 6010C |
| Manganese | ----- | ----- | EPA 6010B / 6010C / 6020 / 6020A | EPA 6010B / 6010C / 6020 / 6020A |
| Mercury | ----- | ----- | EPA 7470A | EPA 7471A / 7471B |
| Molybdenum | ----- | ----- | EPA 6010B / 6010C / 6020 / 6020A | EPA 6010B / 6010C / 6020 / 6020A |
| Nickel | ----- | ----- | EPA 6010B / 6010C / 6020 / 6020A | EPA 6010B / 6010C / 6020 / 6020A |
| Potassium | ----- | ----- | EPA 6010B / 6010C | EPA 6010B / 6010C |
| Selenium | ----- | ----- | EPA 6010B / 6010C / 6020 / 6020A | EPA 6010B / 6010C / 6020 / 6020A |
| Silica | ----- | ----- | EPA 6010B / 6010C | EPA 6010B / 6010C |
| Silicon | ----- | ----- | EPA 6010B / 6010C | EPA 6010B / 6010C |
| Silver | ----- | ----- | EPA 6010B / 6010C / 6020 / 6020A | EPA 6010B / 6010C / 6020 / 6020A |
| Sodium | ----- | ----- | EPA 6010B / 6010C | EPA 6010B / 6010C |
| Strontium | ----- | ----- | EPA 6010B / 6010C | EPA 6010B / 6010C |
| Thallium | ----- | ----- | EPA 6010B / 6010C / 6020 / 6020A | EPA 6010B / 6010C / 6020 / 6020A |

| <u>Parameter/Analyte</u> | <u>WY Storage Tank Program</u> | <u>Non-Potable Water</u> | <u>Solid Hazardous Waste (Water)</u> | <u>Solid Hazardous Waste (Solid)</u> |
|----------------------------------|--------------------------------|--------------------------|--------------------------------------|--------------------------------------|
| Tin | ----- | ----- | EPA 6010B / 6010C | EPA 6010B / 6010C |
| Titanium | ----- | ----- | EPA 6010B / 6010C | EPA 6010B / 6010C |
| Vanadium | ----- | ----- | EPA 6010B / 6010C / 6020 / 6020A | EPA 6010B / 6010C / 6020 / 6020A |
| Zinc | ----- | ----- | EPA 6010B / 6010C / 6020 / 6020A | EPA 6010B / 6010C / 6020 / 6020A |
| <u>Nutrients</u> | | | | |
| Nitrate (as N) | ----- | By calculation | By calculation / EPA 9056 / 9056A | By calculation / EPA 9056 / 9056A |
| Nitrate-nitrite (as N) | ----- | EPA 353.2 | EPA 353.2 / 9056 / 9056A | EPA 9056 / 9056A |
| Nitrite (as N) | ----- | SM 4500-NO2 B | SM 4500-NO2 B; EPA 9056 / 9056A | EPA 9056 / 9056A |
| Orthophosphate (as P) | ----- | ----- | EPA 9056 / 9056A | EPA 9056 / 9056A |
| Total phosphorus | ----- | ----- | EPA 6010B / 6010C | EPA 6010B / 6010C |
| <u>Demands</u> | | ----- | | |
| Total organic carbon | ----- | ----- | EPA 9060 / 9060A | EPA 9060 / 9060A |
| Total organic halides | ----- | ----- | EPA 9020B | ----- |
| <u>Wet Chemistry</u> | | | | ----- |
| Alkalinity | ----- | SM 2320 B | SM 2320 B | SM 2320 B |
| Ammonia | ----- | EPA 350.1 | EPA 350.1 | ----- |
| Biological Oxygen Demand | ----- | SM 5210B | SM 5210B | ----- |
| Bromide | ----- | ----- | EPA 9056 / 9056A | EPA 9056 / 9056A |
| Total organic carbon | ----- | ----- | EPA 9060/9060A | EPA 9060 / 9060A |
| Chloride | ----- | ----- | EPA 9056 / 9056A | EPA 9056 / 9056A |
| Chemical Oxygen Demand | ----- | EPA 410.4 | EPA 410.4 | |
| Conductivity | ----- | ----- | EPA 9050 / 9050A | EPA 9050 / 9050A |
| Cyanide | ----- | ----- | EPA 9010B / 9012A / 9012B | EPA 9010B / 9012A / 9012B |
| Ferrous Iron | ----- | SM 3500 Fe B, D | SM 3500 Fe B, D | |
| Fluoride | ----- | ----- | EPA 9056 / 9056A | EPA 9056 / 9056A |
| Hexavalent Chromium | EPA 7196A | ----- | EPA 7196A | EPA 7196A / 3060A |
| pH | ----- | ----- | EPA 9040B / 9045C | EPA 9040B / 9045C |
| Oil and Grease (HEM and SGT-HEM) | ----- | ----- | EPA 1664A | 9071B |
| Percent moisture | ----- | ----- | ----- | ASTM D2216 |
| Perchlorate | ----- | ----- | ----- | EPA 6860 |
| Phenols | ----- | ----- | EPA 9066 | EPA 9066 |
| Solids, Total | ----- | SM 2540 B | SM 2540 B | SM 2540 B |
| Solids, Total Suspended | ----- | SM 2540 D | SM 2540 D | SM 2540 D |
| Solids, Total Dissolved | ----- | SM 2540 C | SM 2540 C | SM 2540 C |

| <u>Parameter/Analyte</u> | <u>WY Storage Tank Program</u> | <u>Non-Potable Water</u> | <u>Solid Hazardous Waste (Water)</u> | <u>Solid Hazardous Waste (Solid)</u> |
|---------------------------------------|--------------------------------|--------------------------|--------------------------------------|--------------------------------------|
| Sulfate | ----- | ----- | EPA 9038 / 9056 / 9056A | EPA 9038 / 9056 / 9056A |
| Sulfide, Total | ----- | ----- | EPA 9034 | EPA 9034 |
| Sulfide | ----- | ----- | EPA 9030B | EPA 9030B |
| Total Kjeldahl Nitrogen | ----- | ----- | EPA 351.2 | ----- |
| <u>Purgeable Organics (volatiles)</u> | | | | ----- |
| Acetone | ----- | ----- | EPA 8260B | EPA 8260B |
| Acetonitrile | ----- | ----- | EPA 8260B | EPA 8260B |
| Acrolein | ----- | ----- | EPA 8260B | EPA 8260B |
| Acrylonitrile | ----- | ----- | EPA 8260B | EPA 8260B |
| Allyl Chloride | ----- | ----- | EPA 8260B | EPA 8260B |
| tert-Amyl Methyl Ether | EPA 8260B | | | |
| Benzene | EPA 8260B / 8021B | ----- | EPA 8260B / 8021B / AK101 | EPA 8260B / 8021B / AK101 |
| Bromobenzene | ----- | ----- | EPA 8260B | EPA 8260B |
| Bromochloromethane | ----- | ----- | EPA 8260B | EPA 8260B |
| Bromodichloromethane | ----- | ----- | EPA 8260B | EPA 8260B |
| Bromoform | ----- | ----- | EPA 8260B | EPA 8260B |
| Bromomethane | ----- | ----- | EPA 8260B | EPA 8260B |
| 2-Butanone | ----- | ----- | EPA 8260B | EPA 8260B |
| n-Butyl alcohol | ----- | ----- | EPA 8260B / 8015B / 8015C | EPA 8260B / 8015B / 8015C |
| tert-Butyl alcohol | EPA 8260B | | | |
| n-Butylbenzene | ----- | ----- | EPA 8260B | EPA 8260B |
| Sec-Butylbenzene | ----- | ----- | EPA 8260B | EPA 8260B |
| Tert-Butylbenzene | ----- | ----- | EPA 8260B | EPA 8260B |
| Carbon disulfide | ----- | ----- | EPA 8260B | EPA 8260B |
| Carbon tetrachloride | ----- | ----- | EPA 8260B | EPA 8260B |
| Chlorobenzene | ----- | ----- | EPA 8260B / 8021B | EPA 8260B / 8021B |
| 2-Chloro-1,3-butadiene | ----- | ----- | EPA 8260B | EPA 8260B |
| Chloroethane | ----- | ----- | EPA 8260B | EPA 8260B |
| 2-Chloroethyl vinyl ether | ----- | ----- | EPA 8260B | EPA 8260B |
| Chloroform | ----- | ----- | EPA 8260B | EPA 8260B |
| 1-Chlorohexane | ----- | ----- | EPA 8260B | EPA 8260B |
| Chloromethane | ----- | ----- | EPA 8260B | EPA 8260B |
| Chloroprene | ----- | ----- | EPA 8260B | EPA 8260B |
| 3-Chloroprene | ----- | ----- | EPA 8260B | EPA 8260B |
| 4-Chlorotoluene | ----- | ----- | EPA 8260B | EPA 8260B |
| 2-Chlorotoluene | ----- | ----- | EPA 8260B | EPA 8260B |
| Cyclohexane | ----- | ----- | EPA 8260B | EPA 8260B |
| Cyclohexanone | ----- | ----- | EPA 8260B | EPA 8260B |
| Dibromochloromethane | ----- | ----- | EPA 8260B | EPA 8260B |
| 1,2-Dibromo-3-chloropropane (DBCP) | ----- | EPA 504 | EPA 504 / 8260B / 8011 | EPA 8260B / 8011 |
| Dibromochloromethane | ----- | ----- | EPA 8260B | EPA 8260B |
| Dichlorodifluoromethane | ----- | ----- | EPA 8260B | EPA 8260B |
| Dibromomethane | ----- | ----- | EPA 8260B | EPA 8260B |
| 1,2 Dibromoethane (EDB) | EPA 8011 | EPA 504 | EPA 504 / 8260B / 8011 | EPA 8260B / 8011 |

| <u>Parameter/Analyte</u> | <u>WY Storage Tank Program</u> | <u>Non-Potable Water</u> | <u>Solid Hazardous Waste (Water)</u> | <u>Solid Hazardous Waste (Solid)</u> |
|--|--------------------------------|--------------------------|--------------------------------------|--------------------------------------|
| 1,2-Dichlorobenzene | ----- | ----- | EPA 8260B / 8021B | EPA 8260B / 8021B |
| 1,3-Dichlorobenzene | ----- | ----- | EPA 8260B / 8021B | EPA 8260B / 8021B |
| 1,4-Dichlorobenzene | ----- | ----- | EPA 8260B / 8021B | EPA 8260B / 8021B |
| cis-1,4-Dichloro-2-butene | ----- | ----- | EPA 8260B | EPA 8260B |
| trans-1,4-Dichloro-2-butene | ----- | ----- | EPA 8260B | EPA 8260B |
| 1,1-Dichloroethane | ----- | ----- | EPA 8260B | EPA 8260B |
| 1,2-Dichloroethane | EPA 8260B | ----- | EPA 8260B | EPA 8260B |
| 1,1-Dichloroethene | ----- | ----- | EPA 8260B | EPA 8260B |
| 1,2-Dichloroethene | ----- | ----- | EPA 8260B | EPA 8260B |
| cis-1,2-Dichloroethene | ----- | ----- | EPA 8260B | EPA 8260B |
| trans-1,2-Dichloroethene | ----- | ----- | EPA 8260B | EPA 8260B |
| Dichlorofluoromethane | ----- | ----- | EPA 8260B | EPA 8260B |
| 1,2-Dichloropropane | ----- | ----- | EPA 8260B | EPA 8260B |
| 1,3-Dichloropropane | ----- | ----- | EPA 8260B | EPA 8260B |
| 2,2-Dichloropropane | ----- | ----- | EPA 8260B | EPA 8260B |
| 1,1-Dichloropropene | ----- | ----- | EPA 8260B | EPA 8260B |
| 1,3-Dichloropropene | ----- | ----- | EPA 8260B | EPA 8260B |
| cis-1,3-Dichloropropene | ----- | ----- | EPA 8260B | EPA 8260B |
| trans-1,3-Dichloropropene | ----- | ----- | EPA 8260B | EPA 8260B |
| Diethyl ether | ----- | ----- | EPA 8260B | EPA 8260B |
| Di-isopropylether | EPA 8260B | ----- | EPA 8260B | EPA 8260B |
| 1,4-Dioxane | ----- | ----- | EPA 8260B / 8260B SIM | EPA 8260B / 8260B SIM |
| Ethanol | ----- | ----- | EPA 8260B / 8015B / 8015C | EPA 8260B / 8015B / 8015C |
| Ethyl acetate | ----- | ----- | EPA 8260B | EPA 8260B |
| Ethyl benzene | EPA 8260B/8021B | ----- | EPA 8260B / 8021B / AK101 | EPA 8260B / 8021B/ AK101 |
| Ethyl methacrylate | ----- | ----- | EPA 8260B | EPA 8260B |
| Ethyl tert-Butyl Ether | EPA 8260B | | | |
| Ethylene Glycol | ----- | ----- | EPA 8015C | EPA 8015C |
| Gas Range Organics (GRO) | EPA 8015C | ----- | EPA 8015B / 8015C / AK101 / 8015D | EPA 8015B / 8015C / AK101 / 8015D |
| Hexane | ----- | ----- | EPA 8260B | EPA 8260B |
| 2-Hexanone | ----- | ----- | EPA 8260B | EPA 8260B |
| Hexachlorobutadiene | ----- | ----- | EPA 8260B | EPA 8260B |
| Isobutyl alcohol (2-Methyl-1-propanol) | ----- | ----- | EPA 8260B / 8015B / 8015C | EPA 8260B / 8015B / 8015C |
| Isopropyl alcohol | ----- | ----- | EPA 8260B | EPA 8260B |
| Isopropylbenzene | ----- | ----- | EPA 8260B | EPA 8260B |
| 1,4-Isopropyltoluene | ----- | ----- | EPA 8260B | EPA 8260B |
| Iodomethane | ----- | ----- | EPA 8260B | EPA 8260B |
| Methacrylonitrile | ----- | ----- | EPA 8260B | EPA 8260B |
| Methanol | ----- | ----- | EPA 8015B / 8015C | EPA 8015B / 8015C |
| Methyl acetate | ----- | ----- | EPA 8260B | EPA 8260B |
| Methyl cyclohexane | ----- | ----- | EPA 8260B | EPA 8260B |
| Methylene chloride | ----- | ----- | EPA 8260B | EPA 8260B |

| <u>Parameter/Analyte</u> | <u>WY Storage Tank Program</u> | <u>Non-Potable Water</u> | <u>Solid Hazardous Waste (Water)</u> | <u>Solid Hazardous Waste (Solid)</u> |
|---------------------------------------|--------------------------------|--------------------------|--------------------------------------|--------------------------------------|
| Methyl ethyle ketone (MEK) | ----- | ----- | EPA 8260B | EPA 8260B |
| Methyl isobutyl ketone | ----- | ----- | EPA 8260B | EPA 8260B |
| Methyl methacrylate | ----- | ----- | EPA 8260B | EPA 8260B |
| Methyl tert-butyl ether (MtBE) | EPA 8260B / 8021B | ----- | EPA 8260B / 8021B | EPA 8260B / 8021B |
| 4-Methyl-2-pentanone | ----- | ----- | EPA 8260B | EPA 8260B |
| Naphthalene | EPA 8260B / 8021B | ----- | EPA 8260B | EPA 8260B |
| 2-Nitropropane | ----- | ----- | EPA 8260B | EPA 8260B |
| 2,2' Oxybisethanol | ----- | ----- | EPA 8015C | EPA 8015C |
| 2-Pentanone | ----- | ----- | EPA 8260B | EPA 8260B |
| 2-Propanol | ----- | ----- | EPA 8260B | EPA 8260B |
| Propionitrile | ----- | ----- | EPA 8260B | EPA 8260B |
| n-Propylbenzene | ----- | ----- | EPA 8260B | EPA 8260B |
| Propylene Glycol | ----- | ----- | EPA 8015C | EPA 8015C |
| Styrene | ----- | ----- | EPA 8260B | EPA 8260B |
| 1,1,1,2-Tetrachloroethane | ----- | ----- | EPA 8260B | EPA 8260B |
| 1,1,2,2-Tetrachloroethane | ----- | ----- | EPA 8260B | EPA 8260B |
| Tetrachloroethene | ----- | ----- | EPA 8260B | EPA 8260B |
| Tetrahydrofuran | ----- | ----- | EPA 8260B | EPA 8260B |
| Toluene | EPA 8260B / 8021B | ----- | EPA 8260B / 8021B / AK101 | EPA 8260B / 8021B / AK101 |
| Total Petroleum Hydrocarbons (TPH) | ----- | EPA 1664A | EPA 1664A | ----- |
| 1,2,3-Trichlorobenzene | ----- | ----- | EPA 8260B | EPA 8260B |
| 1,1,1-Trichloroethane | ----- | ----- | EPA 8260B | EPA 8260B |
| 1,1,2-Trichloroethane | ----- | ----- | EPA 8260B | EPA 8260B |
| Trichloroethene | ----- | ----- | EPA 8260B | EPA 8260B |
| Trichlorofluoromethane | ----- | ----- | EPA 8260B | EPA 8260B |
| 1,2,3-Trichlorobenzene | ----- | ----- | EPA 8260B | EPA 8260B |
| 1,2,4-Trichlorobenzene | ----- | ----- | EPA 8260B | EPA 8260B |
| 1,2,3-Trichloropropane | ----- | EPA 504.1 | EPA 504.1 / 8260B / 8011 | EPA 8260B / 8011 |
| 1,1,2-Trichloro-1,2,2-trifluoroethane | ----- | ----- | EPA 8260B | EPA 8260B |
| Triethylene Glycol | ----- | ----- | EPA 8015C | EPA 8015C |
| 1,2,3-Trimethylbenzene | ----- | ----- | EPA 8260B | EPA 8260B |
| 1,2,4-Trimethylbenzene | ----- | ----- | EPA 8260B | EPA 8260B |
| 1,3,5-Trimethylbenzene | ----- | ----- | EPA 8260B | EPA 8260B |
| Vinyl acetate | ----- | ----- | EPA 8260B | EPA 8260B |
| Vinyl chloride | ----- | ----- | EPA 8260B | EPA 8260B |
| Xylenes, total | EPA 8260B / 8021B | ----- | EPA 8260B / 8021B / AK101 | EPA 8260B / 8021B / AK101 |
| 1,2-Xylene | EPA 8260B / 8021B | ----- | EPA 8260B / 8021B / AK101 | EPA 8260B / 8021B / AK101 |
| M+P-Xylene | EPA 8260B / 8021B | ----- | EPA 8260B / 8021B / AK101 | EPA 8260B / 8021B / AK101 |
| Methane | ----- | ----- | RSK-175 | ----- |
| Ethane | ----- | ----- | RSK-175 | ----- |
| Ethylene (Ethene) | ----- | ----- | RSK-175 | ----- |
| Acetylene | ----- | ----- | RSK-175 | ----- |

| <u>Parameter/Analyte</u> | <u>WY Storage Tank Program</u> | <u>Non-Potable Water</u> | <u>Solid Hazardous Waste (Water)</u> | <u>Solid Hazardous Waste (Solid)</u> |
|---|--------------------------------|--------------------------|--------------------------------------|--------------------------------------|
| Acetylene Ethane | ----- | ----- | RSK-175 | ----- |
| <u>Extractable Organics (semivolatiles)</u> | | | | |
| Acenaphthene | ----- | ----- | EPA 8270C / 8270D / 8270SIM | EPA 8270C / 8270D / 8270SIM |
| Acenaphthylene | ----- | ----- | EPA 8270C / 8270D / 8270SIM | EPA 8270C / 8270D / 8270SIM |
| Acetophenone | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 2-Acetylaminofluorene | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Alachlor | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 4-Aminobiphenyl | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Aniline | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Anthracene | ----- | ----- | EPA 8270C / 8270D / 8270SIM | EPA 8270C / 8270D / 8270SIM |
| Aramite | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Atrazine | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Azobenzene | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Benzaldehyde | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Benzidine | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Benzoic acid | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Benzo (a) anthracene | ----- | ----- | EPA 8270C / 8270D / 8270SIM | EPA 8270C / 8270D / 8270SIM |
| Benzo (b) fluoranthene | ----- | ----- | EPA 8270C / 8270D / 8270SIM | EPA 8270C / 8270D / 8270SIM |
| Benzo (k) fluoranthene | ----- | ----- | EPA 8270C / 8270D / 8270SIM | EPA 8270C / 8270D / 8270SIM |
| Benzo (ghi) perylene | ----- | ----- | EPA 8270C / 8270D / 8270SIM | EPA 8270C / 8270D / 8270SIM |
| Benzo (a) pyrene | ----- | ----- | EPA 8270C / 8270D / 8270SIM | EPA 8270C / 8270D / 8270SIM |
| Benzyl alcohol | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Bis (2-chloroethoxy) methane | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Bis (2-chloroethyl) ether | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Bis (2-chloroisopropyl) ether (2,2'Oxybis(1-chloropropane)) | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |

| <u>Parameter/Analyte</u> | <u>WY Storage Tank Program</u> | <u>Non-Potable Water</u> | <u>Solid Hazardous Waste (Water)</u> | <u>Solid Hazardous Waste (Solid)</u> |
|-------------------------------|--------------------------------|--------------------------|--------------------------------------|--------------------------------------|
| Bis (2-ethylhexyl) phthalate | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 4-Bromophenyl phenyl ether | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Butyl benzyl phthalate | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 2-sec-Butyl-4,6-dinitrophenol | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Carbazole | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 4-Chloroaniline | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Chlorobenzilate | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 4-Chloro-3-methylphenol | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 1-Chloronaphthalene | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 2-Chloronaphthalene | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 2-Chlorophenol | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 4-Chlorophenyl phenyl ether | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Chrysene | ----- | ----- | EPA 8270C / 8270D / 8270SIM | EPA 8270C / 8270D / 8270SIM |
| Cresols | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Diallate | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Dibenzo (a,h) anthracene | ----- | ----- | EPA 8270C / 8270D / 8270SIM | EPA 8270C / 8270D / 8270SIM |
| Dibenzofuran | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 1,2-Dichlorobenzene | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 1,3-Dichlorobenzene | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 1,4-Dichlorobenzene | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 3,3'-Dichlorobenzidine | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 2,4-Dichlorophenol | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 2,6-Dichlorophenol | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Diethyl phthalate | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Dimethoate | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 3,3-Dimethylbenzidine | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |

| <u>Parameter/Analyte</u> | <u>WY Storage Tank Program</u> | <u>Non-Potable Water</u> | <u>Solid Hazardous Waste (Water)</u> | <u>Solid Hazardous Waste (Solid)</u> |
|-------------------------------------|--------------------------------|--------------------------|---|---|
| p-Dimethylaminoazobenzene | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 7,12-Dimethylbenz(a)anthracene | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Alpha-,alpha-Dimethylphenethylamine | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 2,4-Dimethylphenol | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Dimethyl phthalate | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Di-n-butyl phthalate | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Di-n-octyl phthalate | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 1,3-Dinitrobenzene | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 1,4-Dinitrobenzene | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 2,4-Dinitrophenol | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 2,4-Dinitrotoluene | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 2,6-Dinitrotoluene | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 1,4-Dioxane | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Diphenylamine | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 1,2-Diphenylhydrazine | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Disulfoton | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Diesel Range Organics (DRO) | EPA 8015C | ----- | EPA 8015B / 8015C, AK102, TX 1005 / 8015D | EPA 8015B / 8015C, AK102, TX 1005 / 8015D |
| Ethyl methanesulfonate | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Famphur | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Fluoroanthene | ----- | ----- | EPA 8270C / 8270D / 8270SIM | EPA 8270C / 8270D / 8270SIM |
| Fluorene | ----- | ----- | EPA 8270C / 8270D / 8270SIM | EPA 8270C / 8270D / 8270SIM |
| Gasoline Range Organics | ----- | ----- | TX 1005 | TX 1005 |
| Hexachlorobenzene | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Hexachlorobutadiene | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Hexachlorocyclopentadiene | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Hexachloroethane | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |

| <u>Parameter/Analyte</u> | <u>WY Storage Tank Program</u> | <u>Non-Potable Water</u> | <u>Solid Hazardous Waste (Water)</u> | <u>Solid Hazardous Waste (Solid)</u> |
|----------------------------|--------------------------------|--------------------------|--------------------------------------|--------------------------------------|
| Hexachloropropene | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Indeno (1,2,3-cd) pyrene | ----- | ----- | EPA 8270C / 8270D / 8270SIM | EPA 8270C / 8270D / 8270SIM |
| Isodrin | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Isophorone | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Isosafrole | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Methapyrilene | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 3-Methylcholanthrene | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 2-Methyl-4,6-Dinitrophenol | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Methyl methane sulfonate | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 2-Methylcholanthrene | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 1-Methylnaphthalene | ----- | ----- | EPA 8270C / 8270D / 8270SIM | EPA 8270C / 8270D / 8270SIM |
| 2-Methylnaphthalene | ----- | ----- | EPA 8270C / 8270D / 8270SIM | EPA 8270C / 8270D / 8270SIM |
| 2-Methylphenol | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 3+4-Methylphenol | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Naphthalene | ----- | ----- | EPA 8270C / 8270D / 8270SIM | EPA 8270C / 8270D / 8270SIM |
| 1,4-Naphthoquinone | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 1-Naphthylamine | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 2-Naphthylamine | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 2-Nitroaniline | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 3-Nitroaniline | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 4-Nitroaniline | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Nitrobenzene | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 2-Nitrophenol | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 4-Nitrophenol | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Nitroquinoline-1-oxide | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| N-Nitrosodiethylamine | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |

| <u>Parameter/Analyte</u> | <u>WY Storage Tank Program</u> | <u>Non-Potable Water</u> | <u>Solid Hazardous Waste (Water)</u> | <u>Solid Hazardous Waste (Solid)</u> |
|-----------------------------|--------------------------------|--------------------------|--------------------------------------|--------------------------------------|
| N-Nitrosodimethylamine | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| N-Nitrosodi-n-butylamine | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| N-Nitrosodi-n-propylamine | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| N-Nitrosodiphenylamine | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| N-Nitrosomethylethylamine | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| N-Nitrosomorpholine | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| N-Nitrosopiperidine | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| N-Nitrosopyrrolidine | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 5-Nitro-o-toluidine | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 2,2-oxybis(1-chloropropane) | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Parathion, methyl | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Parathion, ethyl | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Pentachlorobenzene | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Pentachloroethane | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Pentachloronitobenzene | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Pentachlorophenol | ----- | ----- | EPA 8270C / 8270D / 8321A / 8321B | EPA 8270C / 8270D / 8321A / 8321B |
| Phenacetin | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Phenanthrene | ----- | ----- | EPA 8270C / 8270D / 8270SIM | EPA 8270C / 8270D / 8270SIM |
| Phenol | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 1,4-Phenylenediamine | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Phorate | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 2-Picoline | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Pronamide | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Pyrene | ----- | ----- | EPA 8270C / 8270D / 8270SIM | EPA 8270C / 8270D / 8270SIM |
| Pyridine | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |

| <u>Parameter/Analyte</u> | <u>WY Storage Tank Program</u> | <u>Non-Potable Water</u> | <u>Solid Hazardous Waste (Water)</u> | <u>Solid Hazardous Waste (Solid)</u> |
|-------------------------------------|--------------------------------|--------------------------|--------------------------------------|--------------------------------------|
| Safrole | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Sulfotepp | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 1,2,4,5-Tetrachlorobenzene | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 2,3,4,6-Tetrachlorophenol | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Thionazin | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| o-Toluidine | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 1,2,4-Trichlorobenzene | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 2,4,5-Trichlorophenol | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 2,4,6-Trichlorophenol | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| o,o,o-Triethyl phosphorothioate | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| 1,3,5-Trinitrobenzene | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Tris(2,3-Dibromopropyl) phosphate | ----- | ----- | EPA 8270C / 8270D | EPA 8270C / 8270D |
| Motor Oil (Residual Range Organics) | ----- | ----- | EPA 8015B / 8015C, AK103 | EPA 8015B / 8015C, AK103 |
| <u>Pesticides/Herbicides/PCBs</u> | | | | |
| Aldrin | ----- | ----- | EPA 8081A / 8081B | EPA 8081A / 8081B |
| Atrazine | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| Azinophos ethyl | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| Azinophos methyl | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| alpha-BHC | ----- | ----- | EPA 8081A / 8081B | EPA 8081A / 8081B |
| Beta-BHC | ----- | ----- | EPA 8081A / 8081B | EPA 8081A / 8081B |
| delta-BHC | ----- | ----- | EPA 8081A / 8081B | EPA 8081A / 8081B |
| Gamma-BHC | ----- | ----- | EPA 8081A / 8081B | EPA 8081A / 8081B |
| Bolstar | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| Alpha-Chlordane | ----- | ----- | EPA 8081A / 8081B | EPA 8081A / 8081B |
| Gamma-Chlordane | ----- | ----- | EPA 8081A / 8081B | EPA 8081A / 8081B |
| Chlordane (technical) | ----- | ----- | EPA 8081A / 8081B | EPA 8081A / 8081B |

| <u>Parameter/Analyte</u> | <u>WY Storage Tank Program</u> | <u>Non-Potable Water</u> | <u>Solid Hazardous Waste (Water)</u> | <u>Solid Hazardous Waste (Solid)</u> |
|--------------------------|--------------------------------|--------------------------|---|---|
| Chloropyrifos | ----- | ----- | EPA 8081A / 8081B / 8141A / 8141B | EPA 8081A / 8081B / 8141A / 8141B |
| Coumaphos | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| 2,4-D | ----- | ----- | EPA 8151A / 8321A | EPA 8151A /8321A |
| Dalapon | ----- | ----- | EPA 8151A / 8321A | EPA 8151A / 8321A |
| 2,4-DB | ----- | ----- | EPA 8151A / 8321A | EPA 8151A / 8321A |
| 4,4'-DDD | ----- | ----- | EPA 8081A / 8081B | EPA 8081A / 8081B |
| 4,4'-DDE | ----- | ----- | EPA 8081A / 8081B | EPA 8081A / 8081B |
| 4,4',-DDT | ----- | ----- | EPA 8081A / 8081B | EPA 8081A / 8081B |
| Demeton-O | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| Demeton-S | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| Demeton, total | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| Diazinon | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| Dicamba | ----- | ----- | EPA 8151A / 8321A | EPA 8151A / 8321A |
| Dichlorovos | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| Dichloroprop | ----- | ----- | EPA 8151A / 8321A | EPA 8151A / 8321A |
| Dicofol | ----- | ----- | EPA 8081A / 8081B | EPA 8081A / 8081B |
| Dieldrin | ----- | ----- | EPA 8081A / 8081B | EPA 8081A / 8081B |
| Dimethoate | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| Dinoseb | ----- | ----- | EPA 8151A / 8321A | EPA 8151A / 8321A |
| Disulfoton | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| Endosulfan I | ----- | ----- | EPA 8081A / 8081B | EPA 8081A / 8081B |
| Endosulfan II | ----- | ----- | EPA 8081A / 8081B | EPA 8081A / 8081B |
| Endonsulfan sulfate | ----- | ----- | EPA 8081A / 8081B | EPA 8081A / 8081B |
| Endrin | ----- | ----- | EPA 8081A / 8081B | EPA 8081A / 8081B |
| Endrin aldehyde | ----- | ----- | EPA 8081A / 8081B | EPA 8081A / 8081B |

| <u>Parameter/Analyte</u> | <u>WY Storage Tank Program</u> | <u>Non-Potable Water</u> | <u>Solid Hazardous Waste (Water)</u> | <u>Solid Hazardous Waste (Solid)</u> |
|--------------------------|--------------------------------|--------------------------|--------------------------------------|--------------------------------------|
| Endrin ketone | ----- | ----- | EPA 8081A / 8081B | EPA 8081A / 8081B |
| EPN | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| Ethoprop | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| Ethyl parathion | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| Famphur | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| Fensulfothion | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| Fenthion | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| Heptachlor | ----- | ----- | EPA 8081A / 8081B | EPA 8081A / 8081B |
| Heptachlor epoxide | ----- | ----- | EPA 8081A / 8081B | EPA 8081A / 8081B |
| Hexachlorobenzene | ----- | ----- | EPA 8081A / 8081B | EPA 8081A / 8081B |
| Malathion | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| MCPA | ----- | ----- | EPA 8151A / 8321A | EPA 8151A / 8321A |
| MCPP | ----- | ----- | EPA 8151A / 8321A | EPA 8151A / 8321A |
| Merphos | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| Methoxychlor | ----- | ----- | EPA 8081A / 8081B | EPA 8081A / 8081B |
| Methyl parathion | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| Mevinphos | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| Naled | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| PCB-1016 (Arochlor) | ----- | ----- | EPA 8082 / 8082A | EPA 8082 / 8082A |
| PCB-1221 | ----- | ----- | EPA 8082 / 8082A | EPA 8082 / 8082A |
| PCB-1232 | ----- | ----- | EPA 8082 / 8082A | EPA 8082 / 8082A |
| PCB-1242 | ----- | ----- | EPA 8082 / 8082A | EPA 8082 / 8082A |
| PCB-1248 | ----- | ----- | EPA 8082 / 8082A | EPA 8082 / 8082A |
| PCB-1254 | ----- | ----- | EPA 8082 / 8082A | EPA 8082 / 8082A |
| PCB-1260 | ----- | ----- | EPA 8082 / 8082A | EPA 8082 / 8082A |
| PCB-1262 | ----- | ----- | EPA 8082 / 8082A | EPA 8082 / 8082A |
| PCB-1268 | ----- | ----- | EPA 8082 / 8082A | EPA 8082 / 8082A |
| Phorate | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| Phosmet | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| Propazine | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |

| <u>Parameter/Analyte</u> | <u>WY Storage Tank Program</u> | <u>Non-Potable Water</u> | <u>Solid Hazardous Waste (Water)</u> | <u>Solid Hazardous Waste (Solid)</u> |
|--------------------------------|--------------------------------|--------------------------|--------------------------------------|--------------------------------------|
| Ronnel | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| Simazine | ----- | ----- | EPA 8081A / 8081B / 8141A / 8141B | EPA 8081A / 8081B / 8141A / 8141B |
| Stirophos | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| Sulfotepp | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| 2,4,5-T | ----- | ----- | EPA 8151A / 8321A | EPA 8151A / 8321A |
| Thionazin | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| Tokuthion | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| 2,4,5-TP | ----- | ----- | EPA 8151A / 8321A | EPA 8151A / 8321A |
| Toxaphene | ----- | ----- | EPA 8081A / 8081B | EPA 8081A / 8081B |
| Trichloronate | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| o,o,o-triethylphosphorothioate | ----- | ----- | EPA 8141A / 8141B | EPA 8141A / 8141B |
| <u>Explosives</u> | | | | |
| 1,3,5-Trinitrobenzene | ----- | ----- | EPA 8330A / 8330B / 8321A / 8321B | EPA 8330A / 8330B / 8321A / 8321B |
| 1,3-Dinitrobenzene | ----- | ----- | EPA 8330A / 8330B / 8321A / 8321B | EPA 8330A / 8330B / 8321A / 8321B |
| 2,4,6-Trinitrotoluene | ----- | ----- | EPA 8330A / 8330B / 8321A / 8321B | EPA 8330A / 8330B / 8321A / 8321B |
| 3,5-Dinitroaniline | ----- | ----- | EPA 8330B | EPA 8330B |
| 2,4-Dinitrotoluene | ----- | ----- | EPA 8330A / 8330B / 8321A / 8321B | EPA 8330A / 8330B / 8321A / 8321B |
| 2,6-Dinitrotoluene | ----- | ----- | EPA 8330A / 8330B / 8321A / 8321B | EPA 8330A / 8330B / 8321A / 8321B |
| 2-Amino-4,6-dinitrotoluene | ----- | ----- | EPA 8330A / 8330B / 8321A / 8321B | EPA 8330A / 8330B / 8321A / 8321B |
| 2-Nitrotoluene | ----- | ----- | EPA 8330A / 8330B / 8321A / 8321B | EPA 8330A / 8330B / 8321A / 8321B |
| 3-Nitrotoluene | ----- | ----- | EPA 8330A / 8330B / 8321A / 8321B | EPA 8330A / 8330B / 8321A / 8321B |
| 4-Amino-2,6-dinitrotoluene | ----- | ----- | EPA 8330A / 8330B / 8321A / 8321B | EPA 8330A / 8330B / 8321A / 8321B |

| <u>Parameter/Analyte</u> | <u>WY Storage Tank Program</u> | <u>Non-Potable Water</u> | <u>Solid Hazardous Waste (Water)</u> | <u>Solid Hazardous Waste (Solid)</u> |
|--|--------------------------------|--------------------------|---|---|
| 4-Nitrotoluene | ----- | ----- | EPA 8330A / 8330B / 8321A / 8321B | EPA 8330A / 8330B / 8321A / 8321B |
| Nitrobenzene | ----- | ----- | EPA 8330A / 8330B / 8321A / 8321B | EPA 8330A / 8330B / 8321A / 8321B |
| Nitroglycerin | ----- | ----- | EPA 8330A / 8330B / 8321A / 8321B | EPA 8330A / 8330B / 8321A / 8321B |
| Octahydro-1,3,5,7-tetrabito- 1,3,5,7-tetrazocine (HMX) | ----- | ----- | EPA 8330A / 8330B / 8321A / 8321B | EPA 8330A / 8330B / 8321A / 8321B |
| Pentaerythritoltetranitrate (PETN) | ----- | ----- | EPA 8330A / 8330B / 8321A / 8321B | EPA 8330A / 8330B / 8321A / 8321B |
| Picric acid | ----- | ----- | EPA 8330A / 8330B / 8321A / 8321B | EPA 8330A / 8330B / 8321A / 8321B |
| RDX (hexahydro-1,3,5- trinitro-1,3,5-triazine) | ----- | ----- | EPA 8330A / 8330B / 8321A / 8321B | EPA 8330A / 8330B / 8321A / 8321B |
| Tetryl (methyl2,4,6- trinitrophenylnitramine) | ----- | ----- | EPA 8330A / 8330B / 8321A / 8321B | EPA 8330A / 8330B / 8321A / 8321B |
| <u>Hydrazines</u> | | | | |
| Hydrazine | ----- | SOP DV WC- 0077 | SOP DV WC-0077 | SOP DV WC-0077 |
| Monomethyl hydrazine | ----- | SOP DV WC- 0077 | SOP DV WC-0077 | SOP DV WC-0077 |
| 1,1-Dimethylhydrazine | ----- | SOP DV WC- 0077 | SOP DV WC-0077 | SOP DV WC-0077 |
| <u>Perfluorinated Hydrocarbons (PFCs) and Perfluorinated Sulfonates (PFSs)</u> | | | | |
| Perfluorobutanoic acid | ----- | SOP DV-LC-0012 | SOP DV-LC-0012 | SOP DV-LC-0012 |
| Perfluoropentanoic acid | ----- | SOP DV-LC-0012 | SOP DV-LC-0012 | SOP DV-LC-0012 |
| Perfluorohexanoic acid | ----- | SOP DV-LC-0012 | SOP DV-LC-0012 | SOP DV-LC-0012 |
| Perfluoroheptanoic acid | ----- | SOP DV-LC-0012 | SOP DV-LC-0012 | SOP DV-LC-0012 |
| Perfluorooctanoic acid | ----- | SOP DV-LC-0012 | SOP DV-LC-0012 | SOP DV-LC-0012 |
| Perfluorononanoic acid | ----- | SOP DV-LC-0012 | SOP DV-LC-0012 | SOP DV-LC-0012 |
| Perfluorodecanoic acid | ----- | SOP DV-LC-0012 | SOP DV-LC-0012 | SOP DV-LC-0012 |
| Perfluoroundecanoic acid | ----- | SOP DV-LC-0012 | SOP DV-LC-0012 | SOP DV-LC-0012 |
| Perfluorododecanoic acid | ----- | SOP DV-LC-0012 | SOP DV-LC-0012 | SOP DV-LC-0012 |
| Perfluorotridecanoic acid | ----- | SOP DV-LC-0012 | SOP DV-LC-0012 | SOP DV-LC-0012 |
| Perfluorotetradecanoic acid | ----- | SOP DV-LC-0012 | SOP DV-LC-0012 | SOP DV-LC-0012 |
| Perfluorobutane Sulfonate | ----- | SOP DV-LC-0012 | SOP DV-LC-0012 | SOP DV-LC-0012 |
| Perfluorohexane Sulfonate | ----- | SOP DV-LC-0012 | SOP DV-LC-0012 | SOP DV-LC-0012 |
| Perfluorooctane Sulfonate | ----- | SOP DV-LC-0012 | SOP DV-LC-0012 | SOP DV-LC-0012 |
| Perfluorodecane Sulfonate | ----- | SOP DV-LC-0012 | SOP DV-LC-0012 | SOP DV-LC-0012 |
| Perfluorooctane Sulfonamide | ----- | SOP DV-LC-0012 | SOP DV-LC-0012 | SOP DV-LC-0012 |

| <u>Parameter/Analyte</u> | <u>WY Storage Tank Program</u> | <u>Non-Potable Water</u> | <u>Solid Hazardous Waste (Water)</u> | <u>Solid Hazardous Waste (Solid)</u> |
|--|--------------------------------|--------------------------|--------------------------------------|--------------------------------------|
| N-Nitrosodimethylamine (NDMA) | ----- | SOP DV-LC-0019 | SOP DV-LC-0019 | SOP DV-LC-0019 |
| <u>Hazardous Waste Characteristics</u> | | | | |
| Conductivity | ----- | ----- | EPA 9050A | EPA 9050A |
| Corrosivity | ----- | ----- | EPA 9040B | 9045C |
| Ignitibility | ----- | EPA 1010/EPA 1010A | EPA 1010 / 1010A | EPA 1010 / 1010A |
| Paint Filter Liquids Test | ----- | ----- | EPA 9095A | EPA 9095A |
| Synthetic Precipitation Leaching Procedure (SPLP) | ----- | ----- | EPA 1312 | EPA 1312 |
| Toxicity Characteristic Leaching Procedure | ----- | ----- | EPA 1311 | EPA 1311 |
| <u>Organic Prep Methods</u> | | | | |
| Separatory Funnel Liquid-Liquid Extraction | ----- | ----- | EPA 3510C | ----- ----- |
| Continuous Liquid-Liquid Extraction | ----- | ----- | EPA 3520C | ----- ----- |
| Soxhlet Extraction | ----- | ----- | ----- ----- | EPA 3540C |
| Microwave Extraction | ----- | ----- | ----- ----- | EPA 3546 |
| Ultrasonic Extraction | ----- | ----- | ----- ----- | EPA 3550B |
| Ultrasonic Extraction | ----- | ----- | ----- ----- | EPA 3550C |
| Waste Dilution | ----- | ----- | EPA 3580A | EPA 3580A |
| Solid Phase Extraction Volatiles Purge and trap Volatiles purge and trap for soils | ----- | ----- | EPA 3535A EPA 5030B | EPA 5030B EPA 5035 |
| <u>Organic Cleanup Procedures</u> | | | | |
| Florisil Cleanup | ----- | ----- | EPA 3620B | EPA 3620B |
| Florisil Cleanup | ----- | ----- | EPA 3620C | EPA 3620C |
| Sulfur Cleanup | ----- | ----- | EPA 3660B | EPA 3660B |
| Sulfuric Acid/Permanganate Cleanup | ----- | ----- | EPA 3665A | EPA 3665A |
| <u>Metals Digestion</u> | | | | |
| Acid Digestion Total Recoverable or Dissolved Metals | ----- | ----- | EPA 3005A | ----- |
| Acid Digestion for Total Metals | ----- | ----- | EPA 3010A | ----- |
| Acid Digestion for Total Metals | ----- | ----- | EPA 3020A | ----- |
| Acid Digestion of Sediments, Sludges and Soils | ----- | ----- | ----- | EPA 3050B |



The American Association for Laboratory Accreditation

Accredited DoD ELAP Laboratory

A2LA has accredited

TESTAMERICA DENVER

Arvada, CO

for technical competence in the field of

Environmental Testing

In recognition of the successful completion of the A2LA evaluation process that includes an assessment of the laboratory's compliance with ISO/IEC 17025:2005, the 2003 NELAC Chapter 5 Standard, and the requirements of the Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the current DoD Quality Systems Manual for Environmental Laboratories (QSM); accreditation is granted to this laboratory to perform recognized EPA methods as defined on the associated A2LA Environmental Scope of Accreditation. This accreditation demonstrates technical competence for this defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).

Presented this 5th day of October 2011.



A handwritten signature in black ink, reading "Peter Mlynar", is written over a horizontal line.

President & CEO
For the Accreditation Council
Certificate Number 2907.01
Valid to October 31, 2013

For the tests or types of tests to which this accreditation applies, please refer to the laboratory's Environmental Scope of Accreditation.



CERTIFICATE OF ACCREDITATION

ANSI-ASQ National Accreditation Board/AClass
500 Montgomery Street, Suite 625, Alexandria, VA 22314, 877-344-3044

This is to certify that

Eurofins Air Toxics, Inc.
180 Blue Ravine Road, Ste. B
Folsom, CA 95630

has been assessed by AClass
and meets the requirements of

ISO/IEC 17025:2005 and DoD-ELAP

while demonstrating technical competence in the field(s) of

TESTING

Refer to the accompanying Scope(s) of Accreditation for information regarding the types of tests to which this accreditation applies.

ADE-1451

Certificate Number

AClass Approval



Certificate Valid: 03/27/2012-04/27/2014
Version No. 002 Issued: 03/27/2012



This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated January 2009).



ANSI-ASQ National Accreditation Board

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005 & DoD-ELAP

Eurofins Air Toxics, Inc.

180 Blue Ravine Rd. Suite B, Folsom, CA 95630
Bahar Amiri Phone: 916-985-1000

TESTING

Valid to: April 27, 2014

Certificate Number: ADE- 1451

I. Environmental

| MATRIX | SPECIFIC TEST or GROUP of ANALYTES | SPECIFICATION OR STANDARD METHOD (all EPA unless specified) | * KEY EQUIPMENT OR TECHNOLOGY USED |
|-------------------|---|--|---|
| Air and Emissions | BTEX / TPH | Modified TO-3 | GC/PID/FID |
| Air and Emissions | VOCs | Modified TO-15 | GC/MS (Full scan) GC/MS SIM |
| Air and Emissions | SVOCs and VOCs | Modified TO-17 | GC/MS |
| Air and Emissions | Natural Gases and NMOC | Modified ASTM D-1945 Modified ASTM D-1946 | GC/FID/dual TCD |
| Air and Emissions | APH | MADEP APH | GC/MS |

Notes:

1. * = As Applicable
2. ** = Refer to Accredited Analyte Listing for specific analytes in which the laboratory is accredited.
3. This scope is part of and must be included with the Certificate of Accreditation No. ADE- - 1451

Vice President



Accredited Analytes/Methods (by matrix)

Eurofins Air Toxics, Inc.

Folsom, CA

| NELAC Code | Analyte | Matrix | | | | | |
|------------|--------------------------------|--------|-------|------------|------|--|--|
| | | Air | | | | | |
| 4375 | Benzene | TO-15 | TO-17 | MA DEP APH | TO-3 | | |
| 4395 | Bromodichloromethane | TO-15 | | | | | |
| 4400 | Bromoform | TO-15 | | | | | |
| 4410 | 2-Butanone (MEK) | TO-15 | TO-17 | | | | |
| 4455 | Carbon tetrachloride | TO-15 | TO-17 | | | | |
| 4475 | Chlorobenzene | TO-15 | TO-17 | | | | |
| 4485 | Chloroethane | TO-15 | TO-17 | | | | |
| 4505 | Chloroform | TO-15 | TO-17 | | | | |
| 4555 | Cyclohexane | TO-15 | TO-17 | | | | |
| 4575 | Chlorodibromomethane | TO-15 | | | | | |
| 4585 | 1,2-Dibromoethane (EDB) | TO-15 | | | | | |
| 4610 | 1,2-Dichlorobenzene | TO-15 | TO-17 | | | | |
| 4620 | 1,4-Dichlorobenzene | TO-15 | TO-17 | | | | |
| 4625 | Dichlorodifluoromethane | TO-15 | | | | | |
| 4630 | 1,1-Dichloroethane | TO-15 | TO-17 | | | | |
| 4635 | 1,2-Dichloroethane | TO-15 | TO-17 | | | | |
| 4640 | 1,1-Dichloroethene | TO-15 | TO-17 | | | | |
| 4645 | cis-1,2-Dichloroethene | TO-15 | TO-17 | | | | |
| 4655 | 1,2-Dichloropropane | TO-15 | TO-17 | | | | |
| 4680 | cis-1,3-Dichloropropene | TO-15 | | | | | |
| 4685 | trans-1,3-Dichloropropene | TO-15 | | | | | |
| 4695 | 1,2-Dichlorotetrafluoroethane | TO-15 | TO-17 | | | | |
| 4765 | Ethylbenzene | TO-15 | TO-17 | | TO-3 | | |
| 4768 | p-Ethyltoluene | TO-15 | TO-17 | | | | |
| 4825 | n-Heptane | TO-15 | TO-17 | | | | |
| 4855 | n-Hexane | TO-15 | TO-17 | | | | |
| 4860 | 2-Hexanone | TO-15 | TO-17 | | | | |
| 4950 | Bromomethane | TO-15 | | | | | |
| 4960 | Chloromethane | TO-15 | | | | | |
| 4995 | 4-Methyl-2-pentanone (MIBK) | TO-15 | TO-17 | | | | |
| 5000 | tert-Butyl methyl ether (MTBE) | TO-15 | TO-17 | MA DEP APH | TO-3 | | |
| 5067 | Propylene | TO-15 | | | | | |
| 5110 | 1,1,2,2-Tetrachloroethane | TO-15 | TO-17 | | | | |
| 5115 | Tetrachloroethylene | TO-15 | TO-17 | | | | |
| 5140 | Toluene | TO-15 | TO-17 | | | | |
| 5160 | 1,1,1-Trichloroethane | TO-15 | TO-17 | | | | |
| 5165 | 1,1,2-Trichloroethane | TO-15 | TO-17 | | | | |
| 5175 | Trichlorofluoromethane | TO-15 | TO-17 | | | | |
| 5195 | Trichlorotrifluoroethane | TO-15 | TO-17 | | | | |
| 5210 | 1,2,4-Trimethylbenzene | TO-15 | TO-17 | | | | |
| 5215 | 1,3,5-Trimethylbenzene | TO-15 | TO-17 | | | | |
| 5235 | Vinyl chloride | TO-15 | TO-17 | | | | |
| 5260 | Xylenes, total | TO-15 | TO-17 | | TO-3 | | |
| | 1,3-Butadiene | TO-15 | TO-17 | MA DEP APH | | | |
| | Ethanol | TO-15 | | | | | |
| | Acetone | TO-15 | | | | | |
| | 2-Propanol | TO-15 | TO-17 | | | | |
| | Carbon disulfide | TO-15 | TO-17 | | | | |
| | 3-Chloropropene | TO-15 | | | | | |
| | Methylene Chloride | TO-15 | TO-17 | | | | |
| | trans-1,2-Dichloroethene | TO-15 | TO-17 | | | | |
| | Tetrahydrofuran | TO-15 | | | | | |
| | 2,2,4-Trimethylpentane | TO-15 | TO-17 | | | | |
| | Trichloroethene | TO-15 | TO-17 | | | | |
| | 1,4-Dioxane | TO-15 | TO-17 | | | | |
| | Styrene | TO-15 | TO-17 | | | | |

| Accredited Analytes/Methods (by matrix) | | | | | | | |
|---|-------------------------------|--------|-------|------------|------|------------|------------|
| Eurofins Air Toxics, Inc. | | | | | | | |
| Folsom, CA | | | | | | | |
| NELAC Code | Analyte | Matrix | | | | | |
| | | Air | | | | | |
| | Cumene | TO-15 | TO-17 | | | | |
| | Propylbenzene | TO-15 | TO-17 | | | | |
| | 1,3-Dichlorobenzene | TO-15 | TO-17 | | | | |
| | alpha-chlorotoluene | TO-15 | | | | | |
| | 1,2,4-Trichlorobenzene | TO-15 | TO-17 | | | | |
| | Hexachlorobutadiene | TO-15 | TO-17 | | | | |
| | m,p-Xylene | TO-15 | TO-17 | MA DEP APH | TO-3 | | |
| | o-Xylene | TO-15 | TO-17 | MA DEP APH | TO-3 | | |
| | C5-C8 Aliphatic Hydrocarbons | | TO-17 | MA DEP APH | | | |
| | C9-C12 Aliphatic Hydrocarbons | | TO-17 | MA DEP APH | | | |
| | C9-C10 Aromatic Hydrocarbons | | TO-17 | MA DEP APH | | | |
| | Naphthalene | TO-15 | TO-17 | MA DEP APH | | | |
| | 2-Methylnaphthalene | | TO-17 | | | | |
| | 1-Methylnaphthalene | | TO-17 | | | | |
| | Acenaphthylene | | TO-17 | | | | |
| | Acenaphthene | | TO-17 | | | | |
| | Fluorene | | TO-17 | | | | |
| | Phenanthrene | | TO-17 | | | | |
| | Anthracene | | TO-17 | | | | |
| | Fluoranthene | | TO-17 | | | | |
| | Pyrene | | TO-17 | | | | |
| | TPH(GRO) | | TO-17 | | TO-3 | | |
| | Methane | | | | | ASTM D1945 | ASTM D1946 |
| | Ethane | | | | | ASTM D1945 | ASTM D1946 |
| | Ethylene | | | | | ASTM D1945 | ASTM D1946 |
| | Oxygen | | | | | ASTM D1945 | ASTM D1946 |
| | Nitrogen | | | | | ASTM D1945 | ASTM D1946 |
| | Carbon Monoxide | | | | | ASTM D1945 | ASTM D1946 |
| | Carbon Dioxide | | | | | ASTM D1945 | ASTM D1946 |
| | Helium | | | | | ASTM D1945 | ASTM D1946 |
| | Hydrogen | | | | | ASTM D1945 | ASTM D1946 |
| | NMOC | | | | | ASTM D1945 | ASTM D1946 |
| | Acetylene | | | | | ASTM D1945 | |
| | Isobutane | | | | | ASTM D1945 | |
| | Isopentane | | | | | ASTM D1945 | |
| | n-Butane | | | | | ASTM D1945 | |
| | Neopentane | | | | | ASTM D1945 | |
| | n-Pentane | | | | | ASTM D1945 | |
| | Propane | | | | | ASTM D1945 | |

APPENDIX C



FIELD STANDARD OPERATING PROCEDURES



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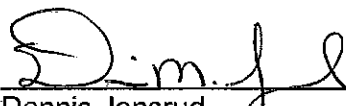
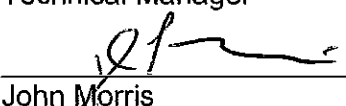

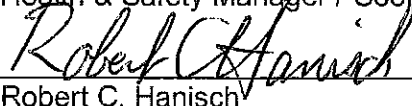
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**Title: Gasoline Range Organics (GRO) by GC/FID
[SW846 Method 8015 and others]**

| Approvals (Signature/Date): | |
|---|--------------------|
|  Dennis Jonsrud Technical Manager | 7-14-11 Date |
|  John Morris Quality Assurance Manager | 7/25/11 Date |
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1.0 Scope and Application

GRO components correspond to an alkane range from n-hexane (C₆) to n-decane (C₁₀), with boiling points between approximately 60 °C and 170 °C. The method is sensitive to a variety of aromatic and aliphatic hydrocarbons that can be present in a wide range of petroleum distillates and petroleum products (e.g., automotive gasoline, jet fuels, lighter fluid, and some paint strippers).

1.1 Analytes, Matrix(s), and Reporting Limits

1.1.1 This method is used to determine the concentration of gasoline range organic (GRO) materials in water and soil. This procedure is based on EPA Method 8015B, 8015C, 8015D, and associated methods 8000B and 8000C. Also represented are Alaska Method AK101, Washington method NWTPH-Gx and Oklahoma Methods 8020/8015 (modified Gasoline Range Organics).

1.1.2 The standard laboratory reporting limit (RL) for this method is 1.2 mg/kg for soils and 25 µg/L for water for all methods, both soil and water except for the Oklahoma methods in water where the standard RL is 10 µg/L. The method RL indicated by NWTPH-Gx is 5 mg/kg for soil and 250 µg/L for water, Alaska AK101 20 mg/kg soil and 100 µg/L water and in each case the standard RL is lower than the method specific RL. For Oklahoma the method RL is stated as 0.1 mg/kg for soil and 20 µg/L water. The higher laboratory soil RL for the Oklahoma method is due to the fact that the laboratory MDL does not support this method's lower soil RL.

1.1.3 Unless otherwise noted the most stringent or common criteria is reported and adhered to for the methods listed. Consistent with SW-846, method references will not reference a specific version unless it is necessary to state criteria for that version.

1.1.4 On occasion clients may request modifications to this SOP. These modifications are handled following the procedures outlined in Section 19 in the Quality Assurance Manual.

2.0 Summary of Method

2.1 Water samples are analyzed directly for gasoline range organics using the SW-846 Method 5030 purge-and-trap extraction and Method 8015 GC analysis. An inert gas is bubbled through a portion of the aqueous sample at ambient temperature, and the volatile components are efficiently transferred from the aqueous phase to the vapor phase. The vapor is swept through a sorbent column where the volatile components are adsorbed. After purging is completed, the sorbent column is heated and backflushed with inert gas to desorb the components onto the gas chromatograph column for analysis.

2.2 Solid samples are preserved in and extracted with methanol by the SW-846 Method 5035 high-level option. An aliquot of the methanol extract is added to organic-free reagent water, which is then analyzed using the SW-846 Method 5030 purge-and-trap extraction and Method 8015 GC analysis. The Alaska AK101 method requires

dispersion of soil and waste samples in methanol that contains the method surrogates at the time of sampling in the field to dissolve and preserve the volatile organic constituents.

- 2.3** Method 8015 is a gas chromatography (GC) method. Detection is achieved by a flame ionization detector (FID), which can be used with a photoionization detector (PID) in series to characterize individual aromatic components by method 8021B (see SOP DV-GC-0023 for details). The GRO retention time range is characterized by running n-alkane standards. Quantitation of GRO organics is based on the FID detector response to an external gasoline standard relative to an internal standard.

3.0 Definitions

- 3.1** Gasoline Range Organics (GRO): All chromatographic peaks eluting between 2-methylpentane and 1,2,4-trimethylbenzene are attributed to GRO. Quantitation is based on a direct comparison of the area within this range to the total area of the calibration standard within this range.
- 3.2** Alaska Method AK101 defines GRO as all chromatographic peaks, both resolved and unresolved, eluting between the peak start time for C₆ (n-hexane) and the peak start time for C₁₀ (n-decane). Quantitation is based on a direct comparison of the baseline-to-baseline integrated area within this range to the total area of the calibration standard over the same (C₆ – C₁₀) range, using FID response.
- 3.3** Oklahoma Methods 8020/8015 (modified) defines GRO as all chromatographic peaks, both resolved and unresolved, eluting 0.1 minutes before the peak start time for MTBE and 0.1 minutes after the peak start time for naphthalene.
- 3.4** Method NWTPH-Gx requires the retention time range (window) for gasoline integration to include, at a minimum, toluene through naphthalene.
- 3.4.1** Surrogate peak areas must be determined by valley-to-valley integration.
- 3.4.2** Other volatile petroleum products may be analyzed by method NWTPH-Gx provided that they elute within the gasoline range and the window is adjusted to encompass the expected range of the product and co-eluting surrogate areas are subtracted.

4.0 Interferences

- 4.1** High levels of heavier petroleum products such as diesel fuel may contain some volatile components producing a response within the retention time range for GRO. Other organic compounds, including chlorinated solvents, ketones, and ethers, are also detectable by this method. As defined in the method, the GRO results will include these compounds.
- 4.2** Samples can become contaminated by diffusion of volatile organics through the sample container septum during shipment and storage. A trip blank prepared from reagent water (for water samples) or methanol (for soil and sediment samples that will be preserved with methanol in the field) and carried through sampling and subsequent storage and handling can serve as a check on such contamination.

- 4.3** Contamination by carryover can occur whenever high-level and low-level samples are sequentially analyzed. To reduce carryover, the sample syringe and purging device must be replaced or thoroughly rinsed between samples with methanol and then dried at 105°C in an oven. Whenever an unusually concentrated sample is encountered, it should be followed by analysis of an instrument blank to check for cross contamination. For volatile samples containing high concentrations of water-soluble materials, suspended solids, high boiling compounds, or organohalides, it may be necessary to wash the syringe or purging device with a detergent solution, rinse with distilled water, rinse with methanol, and then dry in a 105°C oven between analyses. The trap and other parts of the system are also subject to contamination; therefore, frequent bake-out and purging of the entire system may be required. Screening of all samples prior to analysis is recommended to protect analytical instrumentation.

5.0 Safety

Employees must abide by the policies and procedures in the Environmental Health and Safety Manual, Radiation Safety Manual and this document.

This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

5.1 Specific Safety Concerns or Requirements

- 5.1.1** Eye protection that satisfies ANSI Z87.1, laboratory coat, and nitrile gloves must be worn while handling samples, standards, solvents, and reagents. Disposable gloves that have been contaminated must be removed and discarded; non-disposable gloves must be cleaned immediately.
- 5.1.2** Purge vessels on purge-and-trap instruments can be pressurized by the time analysis is completed. Vent the pressure prior to removal of these vessels to prevent the contents from spraying out.
- 5.1.3** GC VOA instruments use an ultraviolet (UV) light source, which must be shielded from view. There should also be a warning label/sticker on each instrument that identifies it as a UV light source.
- 5.1.4** The gas chromatograph contains zones that have elevated temperatures. The analyst needs to be aware of the locations of those zones, and must cool them to room temperature prior to working on them.
- 5.1.5** There are areas of high voltage in the gas chromatograph. Depending on the type of work involved, either turn the power to the instrument off, or disconnect it from its source of power.

Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating.

NOTE: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.

A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

| Material | Hazards | Exposure Limit ⁽¹⁾ | Signs and Symptoms of Exposure |
|--|---------------------------------|-------------------------------|--|
| Acetone | Flammable | 1000 ppm (TWA) | Inhalation of vapors irritates the respiratory tract. May cause coughing, dizziness, dullness, and headache. |
| Methanol | Flammable Poison Irritant | 200 ppm (TWA) | A slight irritant to the mucous membranes. Toxic effects exerted upon nervous system, particularly the optic nerve. Symptoms of overexposure may include headache, drowsiness and dizziness. Methyl alcohol is a defatting agent and may cause skin to become dry and cracked. Skin absorption can occur; symptoms may parallel inhalation exposure. Irritant to the eyes. |
| (1) Exposure limit refers to the OSHA regulatory exposure limit. | | | |

6.0 Equipment and Supplies

6.1 Instrumentation

6.1.1 Gas chromatographic analytical system complete with gas chromatograph suitable for purge-and-trap sample introduction and all required accessories, including detectors, column supplies, recorder, gases, and syringes. A data system capable of determining peak areas is recommended.

6.1.2 Columns

- 6.1.2.1** Restek Rtx® 502.2, 105 m, 0.53 mm I.D., 0.3 micron film thickness, or equivalent.
- 6.1.2.2** For 8021B/GRO and the Oklahoma Methods 8020/8015 (modified), Restek Rtx-1 ®, 105 m, 0.53 mm I.D., 3 micron film thickness or equivalent.
- 6.1.2.3** Other capillary columns such as a 30 m, 0.53 mm ID, DB-5 may be used, but the column must be able to resolve 2-methylpentane from the methanol solvent front in a 30 µg/L LCS standard and should resolve ethylbenzene from m/p-xylene.

- 6.1.3 Detectors: Flame ionization detector (FID) in series with a photoionization detector (PID). The FID is used for the measurement of all hydrocarbons. The optional PID is to be used only for the measurement of volatile aromatics for 8021B/GRO and the Oklahoma Methods 8020/8015 (modified).
- 6.1.4 Purge-and-Trap Device: Tekmar LSC 2000 with optional ALS 2016 autosampler or equivalent for Method 5030 preparation.
- 6.1.5 An analytical balance capable of accurately weighing 0.0001 g is used for preparing standards. A top-loading balance capable of weighing to the nearest 0.01 g is used for weighing samples. The accuracy of each balance is checked each day of use (see SOP DV-QA-0014 for details).

6.2 Supplies

- 6.2.1 Syringes: 5 mL Luerlock glass hypodermic and a 5 mL gas-tight syringe with shutoff valve.
- 6.2.2 Volumetric Flasks: 10 mL, 50 mL, 100 mL, 500 mL, and 1,000 mL with a ground-glass stopper.
- 6.2.3 Microsyringes: 1 μ L, 5 μ L, 10 μ L, 25 μ L, 100 μ L, 250 μ L, 500 μ L, and 1000 μ L.
- 6.2.4 Syringe Valve: Two-way, with Luer ends (three each), if applicable to the purging device.
- 6.2.5 Glass Scintillation Vials: 20 mL, with screw-caps/crimp caps and Teflon liners or glass culture tubes with a screw-cap and Teflon liner, or equivalent.
- 6.2.6 Stainless steel spatula.
- 6.2.7 Wooden tongue depressors.
- 6.2.8 Disposable Pasteur pipettes

6.3 Computer Software and Hardware

Please refer to the master list of documents and software located on G:\QA\Read\Master List of Documents\Master List of Documents, Software and Hardware.xls for the current software and hardware to be used for data processing.

7.0 Reagents and Standards

7.1 Reagents

- 7.1.1 Reagent Water: De-ionized reagent water that is boiled and purged with helium.
- 7.1.2 Methanol: Purge and trap grade or equivalent. Store away from other solvents. See SOP CA-Q-S-001 for the description of the program for testing solvents prior to use.
- 7.1.3 Methanol: HPLC grade, used for cleaning labware.

- 7.1.4** Sand: Reagent grade Ottawa Sand or equivalent, dried in an oven at 105 °C for 8 hours before using.

7.2 Gasoline Calibration Standards

NOTE: Specifics for preparing diluted standard solutions depend on the concentration of the original stock standard. The source of the stock or parent neat gasoline standard depends on the specific client or project requirements and can change from project to project. The details presented in this section are intended to provide guidance only. Specific dilutions may change depending on the source of the gasoline standard required for the project.

7.2.1 Gasoline Standards Sources

Authentic gasoline fuel standards are used for calibrations and spiking. Depending on project/client requirements, the gasoline standard may be any of the following:

- 7.2.1.1** A neat (100%) gasoline obtained from a gasoline station, either locally or from the sampling region, as directed by client requirements. NWTPH-Gx calls for the use of unleaded regular gasoline.
- 7.2.1.2** When analyzing for both Method 8015B GRO and Method 8021B BTEX, a certified mix of gasoline and aromatic hydrocarbons (BTEX) is used. See Table 1.
- 7.2.1.3** For Alaska Method AK101, an equal-weight mixture of regular, plus, and premium grades of commercial, non-oxygenate gasoline is used. This standard may be obtained as a neat gasoline or as a concentrated stock standard solution in methanol from a commercial source. See Table 2.

7.2.2 Preparing GRO Standards from Neat Gasoline

- 7.2.2.1** To prepare a stock standard from neat gasoline, first determine the density of the neat standard by weighing 2 µL of the standard in a tared 10 µL syringe. The density is calculated as follows:

$$\rho = \frac{m}{v} \quad \text{Equation 1}$$

Where:

| | | |
|--------|---|-----------------|
| ρ | = | Density in g/µL |
| m | = | Mass in grams |
| v | = | Volume in µL |

7.2.2.2 Preparation of GRO Stock Standard, 10,025 µg/mL

To prepare a stock standard from neat gasoline, dilute a volume of the neat gasoline, as determined based on its density, to 5 mL with

methanol to achieve a final concentration of 10,025 µg/mL. The volume of the neat gasoline needed is determined as follows:

$$\text{Volume of Neat Gasoline } (\mu\text{L}) = \frac{10025(\mu\text{g} / \text{mL}) \times 5(\text{mL})}{\rho(\text{g} / \mu\text{L}) \times 1000(\mu\text{g} / \text{g})} \quad \text{Equation 2}$$

This calculation will generally yield a result somewhat greater than 50 µL.

7.2.3 Commercial Calibration Stock Standard, 10,025 µg/mL

As described in Section 7.2.2.2, a GRO stock standard may be prepared using a neat gasoline standard. Alternatively, a stock GRO or combined GRO and aromatic solvent (BTEX) stock standard may be purchased from a commercial vendor with a GRO concentration of 10,025 µg/mL in methanol. See Tables 1 - 3.

7.2.4 Calibration Intermediate Standard, 200.5 µg/mL

Dilute 36 µL of the stock standard (Section 7.2.2.2 or 7.2.3) with 1.8 mL of methanol to achieve a final GRO concentration of 200.5 µg/mL. See Table 1. (Other stock standard concentrations will require different aliquots to prepare the intermediate standard.)

7.2.5 Working Level Calibration Standards

7.2.5.1 Method 8015 GRO/AK101 Analysis

The initial calibration is performed at 6 concentration levels for the Method 8015 GRO/AK101 analyses as shown in the table below and in Table 4. Each calibration level standard is prepared at the instrument just prior to analysis and is analyzed in the same manner as an aqueous sample (see Section 10.7). Use the following table to inject the appropriate amount of the calibration intermediate standard solution (Section 7.2.4) and the surrogate working solution (Section 7.3.2) into the 5 mL Luerlock syringe containing 5 mL of reagent water. Other calibration standards can be made up based on concentrations of the intermediate stock standards and components required by the program or client.

Preparation of Working Level Calibration Standards for GRO Analyses

| Level | Vol. of Intermediate & Surrogate Working Standards (µL) | Final Vol (mL) | Final GRO Concentration (µg/L) | Final Surrogate Concentration (µg/L) |
|-------|---|----------------|--------------------------------|--------------------------------------|
| 1 | 0.5 | 5.0 | 20 | 3 |
| 2 | 1.25 | 5.0 | 50 | 7.5 |
| 3 | 2.5 | 5.0 | 100 | 15 |
| 4 | 5 | 5.0 | 200 | 30 |
| 5 | 12.5 | 5.0 | 500 | 75 |
| 6 | 25 | 5.0 | 1,000 | 150 |

7.2.5.2 For soil samples the same curve is used and the concentrations are

recalculated based on the default sample size used.

7.2.6 Second-Source Initial Calibration Verification (ICV) and Spike Standard

NOTE: When analyzing aqueous samples, the second-source ICV working standard solution is used to prepare the laboratory control sample (LCS), which then serves the dual purpose of LCS and ICV. When analyzing soil samples, the LCS is prepared by spiking reagent sand with the ICV stock solution and extracting into methanol.

Obtain a neat gasoline standard or commercially available gasoline mix standard from a source different than the source that supplied the primary standard (Section 7.2.5) and prepare according to section 7.2.2.7 and 7.2.2.8.

7.2.6.1 ICV/Spike Stock Standard Solution, 5500 µg/mL

If using a neat gasoline, prepare an ICV/spike stock standard solution at a concentration of 5500 µg/mL. Determine the density of the neat standard as described in Section 7.2.2. Calculate the volume of the neat standard needed to prepare 5 mL of stock standard using the following equation:

$$\text{Volume of Neat Gasoline } (\mu\text{L}) = \frac{5500(\mu\text{g} / \text{mL}) \times 5(\text{mL})}{\rho(\text{g} / \mu\text{L}) \times 1000(\mu\text{g} / \text{g})} \quad \text{Equation 3}$$

Dilute the calculated volume of neat standard with methanol to a final volume of 5 mL.

Alternatively, obtain a stock GRO standard solution in methanol from a commercial source and dilute as necessary with methanol to achieve a final concentration of 5500 µg/mL. See Table 8.

7.2.6.2 ICV/Spike Working Standard Solution, 100.8 µg/mL

Prepare an ICV/spike working standard solution at a concentration of 100.8 µg/mL by diluting 33 µL of the ICV/spike stock standard (Section 7.2.6.1) with methanol to a final volume of 1.8 mL. See Table 8.

7.2.7 Continuing Calibration Verification (CCV) Standard, 200 µg/L

7.2.7.1 The CCV for Method 8015 GRO/AK101 analyses is prepared in the same manner as the Level 4 working level calibration standard (Section 7.2.5), which has a concentration of 200 µg/L, as the CCV standard.

7.2.7.2 The CCV for Method 8021B/GRO is prepared in the same manner as the Level 5 working level calibration standard (Section 7.2.5) which has a concentration of 240 µg/L, as the CCV standard.

7.2.7.3 The CCV for the Oklahoma Methods 8020/8015 (modified) is prepared in the same manner as the Level 5 working level calibration

standard (Section 7.2.5) which has a concentration of 500 µg/L, as the CCV standard.

7.3 Surrogate Standards

7.3.1 Surrogate Stock Standard, 2,000 µg/mL

- 7.3.1.1 The surrogate used for this method is α,α,α -trifluorotoluene. A stock solution is obtained from a commercial vendor at a concentration of 2,000 µg/mL in methanol.
- 7.3.1.2 For AFCEE projects or as specified, chlorobenzene can be used in place of α,α,α -trifluorotoluene, using the same concentrations. A stock solution of chlorobenzene is obtained from a commercial vendor at a concentration of 2,000 µg/mL in methanol.
- 7.3.1.3 For aqueous samples, both α,α,α -trifluorotoluene and chlorobenzene are used as surrogates.
- 7.3.1.4 When soil samples are preserved in the field with surrogated methanol (as recommended in Alaska Method AK101), a sample of the surrogated methanol (a field blank) must be submitted to the lab with the samples so that the surrogate concentration may be verified. In these cases, the lab may opt to add a second, different surrogate at the time of analysis to assess the analytical recovery.
- 7.3.1.5 The Alaska method specifies using α,α,α -trifluorotoluene and/or bromofluorobenzene as a surrogate. If soil samples are submitted for the Alaska method and contain the bromofluorobenzene, then the laboratory will perform an initial calibration using that surrogate, which will be prepared at the same concentration levels as the routine surrogates.

7.3.2 Surrogate Working Standard, 30 µg/mL

- 7.3.2.1 A working surrogate solution is prepared for each surrogate by diluting 300 µL of the stock standard solution (Section 7.3.1) to 20.0 mL with methanol to achieve a final concentration of 30 µg/mL. For aqueous samples, the internal standard and both surrogates are combined in a single solution as described in Section 7.4.3.
- 7.3.2.2 Alaska Method AK101 requires the addition of a methanol solution containing the surrogate at a concentration 2.4 µg/mL to the soil samples in the field. This is referred to as "surrogated methanol." A client submitting soil samples preserved in the field in this way must also provide a field blank containing the surrogated methanol so that the surrogate concentration may be verified at the time of analysis.

7.4 Internal Standard

7.4.1 Internal Standard (IS) Stock Solution

The internal standard used for this method is 1-chloro-4-fluorobenzene. The internal standard stock solution is obtained from a commercial source at a concentration of 2500 µg/mL in methanol.

7.4.2 IS Working Spike Solution for Soil Samples, 30 µg/mL

The internal standard working spike solution for soil samples is prepared by diluting 240 µL of the stock standard with methanol to a final volume of 20 mL to achieve a concentration of 30 µg/mL.

7.4.3 IS/Surrogate Working Spike Solution for Aqueous Samples, 30 µg/mL

The IS/surrogate working spike solution for aqueous samples is prepared by diluting 300 µL of the α,α,α -trifluorotoluene stock standard (Section 7.3.1), 300 µL of the chlorobenzene stock standard (Section 7.3.1), and 240 µL of the IS stock standard (Section 7.4.1) in a final volume of 20 mL of methanol to achieve a concentration of 30 µg/mL for each component.

NOTE: The Oklahoma Methods 8020/8015 (modified) and 8021B/GRO do not include chlorobenzene as a surrogate.

7.5 Retention Time (RT) Reference Standards

RT reference standards are used to establish retention time windows for the analytes of interest.

NOTE: The Oklahoma Methods 8020/8015 (modified) and Method 8021B/GRO do not use a separate RT reference standard. The retention time windows are updated using the first CCV of the run.

7.5.1 RT Stock Standard

The RT stock standard is purchased commercially as a pre-prepared mixture of eleven alkane and aromatic hydrocarbon compounds at the concentrations shown for the 8015 GRO method and the alkanes, C₅, C₆, C₈, C₁₀, C₁₂ and C₁₃ at the concentrations shown for the Method 8021B/GRO in Table 9.

7.5.2 Working RT Standard

Dilute 36 µL of the RT stock standard (Section 7.5.1) with methanol to a final volume of 1.8 mL to achieve the concentrations shown in Table 9.

7.5.3 RT Marker Standard

The internal standard, 1-chloro-4-fluorobenzene, is also used as the daily RT marker standard for making daily adjustments to the established RT windows. Since the internal standard is added to all standards, samples, and QC samples, retention time can be monitored continuously throughout the analytical sequence.

7.6 LCS and MS Spike Solutions

7.6.1 Spike Solution for Aqueous Samples, 100 µg/mL

For aqueous sample batches, the LCS is prepared by injecting 5 µL of the 100 µg/mL ICV/spike working standard solution (Section 7.2.6.2) into reagent water for a final volume of 5.0 mL. The MS and MSD are prepared similarly by injecting 5 µL of the 100 µg/mL ICV/spike working standard solution into an aliquot of the selected aqueous sample for a final volume of 5.0 mL. This results in a sample GRO concentration of 100 µg/L in the LCS, and a “spike added” GRO concentration of 100 µg/L in the MS and MSD.

7.6.2 Spike Solution for Soil Samples, 5500 µg/mL

7.6.2.1 For soil sample batches, the LCS is prepared by adding 10 µL of the 5500 µg/mL ICV/spike stock standard solution to 10 g of reagent sand before extracting into methanol. The MS and MSD are prepared similarly by adding 10 µL of the 5500 µg/mL ICV/spike stock standard solution to 10 g of the selected sample. This results in a sample GRO concentration of 5.5 mg/kg in the LCS, and a “spike added” GRO concentration of 5.5 mg/kg in the MS and MSD. When samples collected in EnCore™ samplers are analyzed, use one-half the spike volume.

7.6.2.2 The stock and intermediate level standards are stored in Teflon-sealed screw-cap/crimp cap bottles with no headspace, and kept at –10 °C to –20 °C protected from light.

7.6.2.3 The shelf life is 6 months for the stock standards, 6 months for intermediate level standards, and one month for the working level standards, which are prepared fresh monthly or more frequently as results indicate.

8.0 Sample Collection, Preservation, Shipment and Storage

8.1 Water Samples

8.1.1 Aqueous samples should be collected in triplicate without agitation and without headspace in contaminant-free glass 40 mL vials with Teflon-lined septa in the caps. The Teflon layer must contact the sample (zero headspace).

8.1.2 Samples are preserved with 200 µL of 50% HCl. Alaska Method AK101 specifies 200 µL of 50% HCl as preservation for volatile analytes. Oklahoma and NWTPH-Gx specify preservation with HCL to a pH<2.

8.1.3 Samples must be stored at ≤ 6°C (without freezing) and analyzed within 14 days of collection. NWTPH-Gx requires analysis within 7 days.

8.1.4 Alaska Method AK101 specifies a trip blank consisting of a contaminant-free amber glass 40 mL vial with Teflon-lined septum filled to zero headspace with purged, organic-free water preserved with the same acid as the samples.

8.2 Soil Samples

- 8.2.1** This procedure is designed to work with soil samples preserved and extracted in methanol. To minimize the loss of volatiles during handling in the field and in transit to the laboratory,
- 8.2.1.1** Method 5035, Oklahoma and NWTPH-Gx preserve high level samples in the field by adding 5.0 ± 0.5 g of soil to a pre-weighed 40 mL vial containing 10 mL of methanol.
 - 8.2.1.2** Alaska Method AK101 requires preservation of soil samples in the field by submerging the sample in methanol to which the surrogate has been added. See Appendix A for detailed instructions for Method AK101.
- 8.2.2** If the methanol preservation cannot be done in the field, the lab must be supplied with an intact portion of sample in an EnCore™ sampler or in a volatile organic vial. In which case, the laboratory will perform the preservation step. The maximum holding time between collection and preservation at the laboratory is 48 hours. Per Method AK101, data from lab preserved samples must be reported as “greater than or equal to” the calculated concentration of GRO as gasoline.
- 8.2.2.1** The lab must also be provided with a 2-ounce glass jar containing a portion of the sample to use for screening and for moisture determination.
 - 8.2.2.2** Samples must be stored at ≤ 6 °C and, once preserved in methanol, analyzed within 14 days of collection. Method NWTPH-Gx requires analysis within 1 week of preservation in methanol.
- 8.2.3** Alternatively, soil samples may be collected in 4-ounce jars packed with minimum head space and extracted with methanol at the lab and analyzed within 14 days per Method 5035 high concentration soil method.

9.0 Quality Control

- 9.1** The minimum quality controls (QC), acceptance criteria, and corrective actions are described in this section. When processing samples in the laboratory, use the LIMS special instructions to determine specific QC requirements that apply.
- 9.1.1** The laboratory’s standard QC requirements, the process of establishing control limits, and the use of control charts are described more completely in TestAmerica Denver policy DV-QA-003P, *Quality Assurance Program*.
 - 9.1.2** Specific QC requirements for Federal programs, e.g., Department of Defense (DoD), Department of Energy (DOE), AFCEE, etc., are described in TestAmerica Denver policy DV-QA-024P, *Requirements for Federal Programs*.
 - 9.1.3** Project-specific requirements can override the requirements presented in this section when there is a written agreement between the laboratory and the client, and the source of those requirements should be described in the project documents. Project-specific requirements are communicated to the analyst via

special instructions in the LIMS and in the Quality Assurance Summaries (QAS) available in the public folders.

- 9.1.4** Any QC result that fails to meet control criteria must be documented in a Nonconformance Memo (NCM). The NCM is approved by the supervisor and then automatically sent to the laboratory Project Manager by e-mail so that the client can be notified as appropriate. The NCM process is described in more detail in SOP DV-QA-0031. This is in addition to the corrective actions described in the following sections.

9.2 Initial Performance Studies

Before analyzing samples, the laboratory must establish a method detection limit (MDL). In addition, an initial demonstration of capability (IDOC) must be performed by each analyst on the instrument he/she will be using. On-going proficiency must be demonstrated by each analyst on an annual basis. See Section 12 for more details on detection limit studies, initial demonstrations of capability, and analyst training and qualification.

9.3 Preparation Batch

- 9.3.1** A preparation batch is a group of up to 20 samples that are of the same matrix and are processed together using the same procedures and reagents. The preparation batch must contain a method blank, a laboratory control sample (LCS), a matrix spike (MS), and a matrix spike duplicate (MSD).
- 9.3.2** As discussed in the following sections, special program or project requirements can include additional requirements. Always refer to special project instructions for details before proceeding with the analysis.
- 9.3.3** The Oklahoma methods require an initial MB prior to analysis and one MB and MS/MSD per 10 samples.

9.4 Method Blank (MB)

At least one method blank must be processed with each preparation batch. The method blank for water batches consists of 5 mL of reagent water, and for solids batches, 10 g of reagent sand.

Acceptance Criteria: The result for the method blank must be less than one-half the reporting limit or less than 10% of the GRO concentration found in the associated samples, whichever is higher. Note that some programs (e.g., AFCEE, Navy, and USACE) require that the maximum blank concentration must be less than one-half of the reporting or less than 10% of the lowest sample concentration.

Corrective Action: All samples associated with an unacceptable method blank must be re-prepared and reanalyzed. If GRO was not detected in the samples, then the data may be reported with qualifiers (check project requirements to be sure this is allowed) and it must be addressed in the project narrative.

9.5 Laboratory Control Sample (LCS), 100 µg/L or 5.5 mg/kg

At least one LCS must be processed with each preparation batch. For aqueous sample batches, the LCS consists of 5 mL of reagent water to which 5 µL of the ICV/spike working standard (Section 7.2.6.2) is added. The LCS for aqueous sample batches also functions as the ICV (second-source calibration verification). For soil sample batches, the LCS consists of 10 g of reagent sand to which 10 µL of the ICV/spike stock standard (Section 7.2.6.1) is added. The LCS is carried through the entire analytical procedure. See Section 10.8.1.2 for the addition of surrogates and internal standards.

Acceptance Criteria: The recovery results for the LCS must fall within the established control limits. For aqueous sample batches where the LCS also functions as the ICV, the control limits are 85 to 115%. For soil batches, the control limits are set at ± 3 standard deviations around the historical mean and must be no wider than the limits specified in the reference methods. Alaska Method AK101 limits are summarized in Table 12. Oklahoma requires a recovery of $\pm 20\%$ for waters and $\pm 40\%$ for soils.

Corrective Action: If LCS recoveries are outside of the established control limits, the system is out of control and corrective action must occur. If recoveries are above the upper control limit and GRO is not detected in samples, the data may be reported with qualifiers (check project requirements to be sure this is allowed) and it must be addressed in the project narrative. In other circumstances, the entire batch must be re-prepared and reanalyzed.

9.6 Matrix Spike/Matrix Spike Duplicate (MS/MSD), 100 µg/L or 5.5 mg/kg

One MS/MSD pair must be processed with each preparation batch. A matrix spike (MS) is a field sample to which known concentrations of target analytes have been added. It is prepared in a manner similar to the LCS, but uses a real sample matrix in place of the blank matrix. (See Section 9.5 for spike amounts.) A matrix spike duplicate (MSD) is a second aliquot of the same sample (spiked exactly as the MS) that is prepared and analyzed along with the sample and matrix spike. Some programs will allow spikes to be reported for project-related samples only. Samples identified as field blanks cannot be used for the MS/MSD analysis.

Acceptance Criteria: The recovery results for the MS and MSD must fall within the established control limits, which are set at ± 3 standard deviations around the historical mean. The RPD between the MS and MSD must be less than the established RPD limit, which is set at 3 standard deviations above the historical mean.

Alaska Method AK101 limits are summarized in Table 12. Oklahoma requires a recovery of $\pm 20\%$ for waters and $\pm 40\%$ for soils.

Corrective Action: If analyte recovery or RPD falls outside the acceptance range, the associated LCS must be in control for the data to be reported. If there is no evidence of analytical problems and all other QC criteria are met, then qualified results may be reported and the situation must be described in the final report case narrative. In other circumstances, the batch must be re-prepared and reanalyzed.

If the native analyte concentration in the MS/MSD sample exceeds 4 times the spike level for that analyte, the recovery data are reported as NC (i.e., not calculated).

9.7 Surrogate Spikes

9.7.1 The α,α,α -trifluorotoluene (TFT) surrogate standard (Section 7.3) is added to all field and QC samples prior to extraction or analysis, as appropriate. For aqueous samples, 5 μ L of the IS/surrogate working spike solution (Section 7.4.3) is added to 5mL of the aqueous sample just prior to injection. For soil samples, 7.5 μ L of the surrogate stock standard (Section 7.3.1) is added to 5 g of the soil sample prior to extraction with methanol.

9.7.2 For EnCore™ or Alaska Method AK101 samples, the same surrogate spike levels are used.

9.7.3 For AFCEE projects under the 3.1 and earlier QAPPs, chlorobenzene is used as the surrogate in place of TFT.

9.7.4 No surrogate is specified for the Oklahoma method so it is recommended that the analyst follow the procedure for method 8015.

NOTE: When soil samples are preserved in the field with surrogated methanol (as recommended in Alaska Method AK101), a sample of the surrogated methanol (a field blank) must be submitted to the lab with the samples so that the surrogate concentration may be verified. In these cases, the lab may opt to add a second, different surrogate at the time of analysis to assess the analytical recovery.

Acceptance Criteria: The recovery of the surrogate must fall within established statistical limits, which are set at ± 3 standard deviations around the historical mean.

Alaska Method AK101 limits are summarized in Table 12. In addition, the RT of the surrogate must fall within the established RT window.

Corrective Action: If surrogate recoveries are outside the established limits, verify calculations, dilutions, and standard solutions. Also verify that instrument performance is acceptable. High recoveries may be due to a co-eluting matrix interference, which can be confirmed by examining the sample chromatogram. Low recoveries

may be due to adsorption by the sample matrix (i.e., clay particles, peat or organic material in the sample). Recalculate the data and/or reanalyze the extract if the checks reveal a problem.

If the surrogate recovery is outside of the established limits due to well documented matrix effects, the results must be flagged and an explanation included in the report narrative. As with matrix spike failures, some programs (e.g., USACE) may require additional analyses to confirm suspected matrix interferences. The decision to reanalyze or flag the data should be made in consultation with the client. It is only necessary to re-prepare / reanalyze a sample once to demonstrate a matrix effect is reproducible.

For Alaska Method AK101 soils that are preserved in the field with surrogated methanol, if the field-added surrogate fails acceptance criteria, it may be possible to report results with appropriate narration if the laboratory-added surrogate meets acceptance criteria.

If the surrogate peak falls outside of its established RT window, it may be necessary to re-establish the center of the RT window and reanalyze affected samples. This requires re-starting the analytical sequence. (See Section 10.6.)

9.8 RT Reference Standard:

An RT reference standard containing the predominant gasoline components (see Table 9) is tested with each initial calibration to establish the retention time window. The RT reference standard is prepared by adding 5 μ L of the working RT standard (Section 7.5.2) and 5 μ L of the IS/surrogate working spike solution (Section 7.4.3) to 5 mL of reagent water, which is then injected into the purge-and-trap apparatus.

9.9 RT Marker Standard:

At the beginning of each day's analytical sequence, an RT reference standard is analyzed. The internal standard, 1-chloro-4-fluorobenzene, is added to the RT reference standard along with the surrogate compounds. The midpoint of the RT window for the internal standard is set for the day based on these results. See Section 10.5. If the midpoint of the RT window for the internal standard in any subsequent field sample, QC sample, or CCV slips by more than the established retention time window, then the data for that sample or standard is invalid and samples are reanalyzed as necessary.

10.0 Procedure

- 10.1** One-time procedural variations are allowed only if deemed necessary in the professional judgment of supervision to accommodate variation in sample matrix, radioactivity, chemistry, sample size, or other parameters. Any variation in procedure shall be

completely documented using an NCM. The NCM is approved by the supervisor and then automatically sent to the laboratory Project Manager by e-mail so that the client can be notified as appropriate. The NCM process is described in more detail in SOP DV-QA-0031. The NCM shall be filed in the project file and addressed in the case narrative.

Any deviations from this procedure identified after the work has been completed must be documented in an NCM, with a cause and corrective action described.

- 10.2** Generally, samples are screened prior to analysis by purge-and-trap GC/FID. Sample aliquots used for the definitive analysis are based on the screening data.

10.3 Gas Chromatographic Conditions

- 10.3.1** Recommended instrument conditions are shown in Table 10. These can be adjusted prior to calibration in order to improve performance.
- 10.3.2** The routine purge volume is 5 mL.
- 10.3.3** Instrument conditions and columns must be chosen to meet the acceptance criteria presented in this section.

10.4 Retention Time (RT) Window

- 10.4.1** Before establishing retention time (RT) windows, ensure that the chromatographic system is operating reliably and that the system conditions have been optimized for the target analytes and surrogates in the sample matrix to be analyzed.
- 10.4.2** Analyze an RT Reference Standard (Section 7.5) three times throughout the course of a 72-hour period. Serial injections over less than a 72-hour period result in retention time windows that are too tight.
- 10.4.3** Calculate the mean and standard deviation of the three absolute retention times for each surrogate and the internal standard.
- 10.4.3.1** The width of the retention time window for each analyte and surrogate peak is defined as ± 3 times the standard deviation of the mean absolute retention time established during the 72-hour period.
- 10.4.3.2** In those cases where the standard deviation for a particular analyte is zero, the minimum window to use is method specific:
- 10.4.3.2.1** 8000B or 8000C: ± 0.03 minute
- 10.4.3.2.2** AK101: ± 0.05 minute
- 10.4.3.2.3** Oklahoma: ± 0.1 minute
- 10.4.4** For the GRO identification and quantization, the retention time window is specified by the method based on the range of hydrocarbons to be included as described below:
- 10.4.4.1** SW-846 Methods (8015B, 8015C and 8015D): the lower limit for the first eluting compound and the upper limit of last eluting compound.
- 10.4.4.2** AK101: start of C₆ through start of C₁₀

10.4.4.3 Oklahoma: start approximately 0.1 min before the retention time of MTBE and ending 0.1 min after the RT of naphthalene.

10.4.4.4 NWTPH-Gx: toluene through naphthalene; window for both sample and standards can be adjusted if interference observed in the sample.

10.4.5 The laboratory must calculate retention time windows for each standard on each GC column and whenever a new GC column is installed. The data must be retained by the laboratory.

10.5 Daily Retention Time Windows

10.5.1 At the beginning of each daily analytical sequence, analyze the RT marker standard (Section 7.5.3). The center of the retention time windows are adjusted based on the retention time observed for the RT marker standard and the start and endpoints for the hydrocarbon ranges.

10.5.2 A notation is made in the run sequence log to identify any standard used for the retention time verification and adjustments.

10.5.3 The Oklahoma Methods 8020/8015 (modified) and Method 8021B/GRO do not use a separate RT reference standard. The retention times are updated using the first CCV of the run.

10.6 Analytical Sequence

10.6.1 The analytical sequence starts with an RT reference standard, initial calibration (ICAL) and initial calibration verification (ICV or LCS), or with a daily continuing calibration verification (CCV). See Section 7.2.

10.6.2 For aqueous sample batches, the ICV serves as the LCS, and is followed by a method blank. For soil batches, the LCS and the method blank are analyzed following the initial calibration event or the daily CCV.

10.6.3 Samples are analyzed and are interspersed with a CCV check performed after every 12 hours or every 10 samples, whichever is more frequent.

10.6.4 If the measured concentration of any sample exceeds the highest calibration standard concentration, the sample extract must be diluted and reanalyzed. All dilutions should keep the response of the major constituents (previously saturated peaks) in the upper half of the linear range of the curve.

10.6.5 Blanks should also be run after samples suspected of being highly concentrated to prevent carryover. If the blank analysis shows contamination beyond established "column bleed", the column must be baked out and subsequent blanks analyzed until the system is shown to be free from contaminants.

10.6.6 If a sample is discovered to have a high concentration, then the sample immediately following the high concentration sample must be evaluated for detection of target analytes. If target analytes are detected at or above the RL, then reanalyze the sample to rule out carryover from the high concentration sample.

10.6.7 The analytical sequence is bracketed with a closing CCV.

10.7 Aqueous Sample Analysis

- 10.7.1 Remove the plunger from a 5 mL syringe.
- 10.7.2 Open the sample or standard bottle, which has been allowed to come to ambient temperature, and carefully pour the sample into the syringe barrel.
- 10.7.3 Replace the plunger and compress the sample.
- 10.7.4 Open the syringe valve and vent any residual air while adjusting the sample volume to 5.0 mL.
- 10.7.5 Add 5 μ L of the IS/surrogate working spike solution (Section 7.4.3) to all field and QC samples.
- 10.7.6 Add 5 μ L of the ICV/spike working standard (Section 7.2.6.2) to the LCS, MS, and MSD.
- 10.7.7 This process destroys the validity of the liquid sample for future analysis. Therefore, if there is only one 40 mL vial, then transfer sample from the 40 mL vial to a 20 mL vial so that it is completely full (no headspace). This second sample is maintained only until it has determined that the first sample has been analyzed properly. If a second analysis is needed, it must be analyzed within 24 hours. Care must be taken to prevent air from getting into the 20 mL vial.
- 10.7.8 Attach the syringe to the purging device. Open the syringe valves and inject the sample into the purging chamber.
- 10.7.9 Close both valves and purge the sample. See Table 10 for recommended purge-and-trap conditions, and refer to the instrument operation manuals for routine and non-routine maintenance.

10.8 Soil Sample Preparation

NOTE: Alaska Method AK101 requires results for soil samples to be reported on a dry-weight basis. Therefore moisture determination must accompany all soils data. The client must provide an unpreserved portion of sample for the moisture determination. The percent moisture is determined by weighing an aliquot of the sample as received and weighing it again after it has dried overnight at 105°C.

10.8.1 Preserved Soil Samples Received in Pre-Weighed Containers

NOTE: In the field, the soil sample is placed in a vial that contains surrogated methanol. The weight of the vial plus methanol is determined prior to adding the sample and is marked on the vial.

10.8.1.1 Weigh the sample container and subtract the number written on the vial from this weight to obtain the weight of the sample. Do not add any labels to the vial until this weight has been determined.

NOTE: The number marked on the vial is the weight of the vial plus the methanol.

10.8.1.2 Add 5 μL of the specific surrogate stock standard that has been specified in method or project requirements (Section 7.3.1) to each field sample, blank, LCS, MS, and MSD.

NOTE: For Alaska Method AK101 samples, the methanol used to preserve the sample in the field should already contain the appropriate surrogate, either bromofluorobenzene or α,α,α -trifluorotoluene. A second, alternate surrogate should be added in the laboratory to verify analytical accuracy and serve as check for the field-added surrogate.

10.8.1.3 Add 5 μL of the ICV/spike stock standard solution (Section 7.2.6.1) to the LCS, MS, and MSD.

10.8.1.4 Proceed to Section 10.9.1

10.8.2 Unpreserved Soil Samples Received in Pre-Weighed Containers

10.8.2.1 Weigh the sample container as received to confirm the field weights, and to determine the weight of the sample, and record the weight.

10.8.2.2 If the field weight differs by more than 0.2 gram from the laboratory-determined weight, the sample collection is considered invalid. The most common reason for disagreement in weights is extra labels added to the container after weighing in the field. However, it is possible that the weights disagree because volatile components have been lost since the time of sample collection. Contact the client before proceeding with analysis if the weights do not agree.

10.8.2.3 If the weight of the sample is ≥ 10 g, then treat the sample as “not pre-weighed” and proceed to Section 10.8.3

10.8.2.4 If the weight of the sample is less than 10 g, then add 5 mL of methanol and 3.75 μL of the specific surrogate stock standard that has been specified in method or project requirements (Section 7.3.1) to each field sample, blank, LCS, MS, and MSD.

10.8.2.5 Add 5 μL of the ICV/spike stock standard solution (Section 7.2.6.1) to the LCS, MS, and MSD.

10.8.2.6 Proceed to Section 10.9

10.8.3 Unpreserved Soils Received in Containers Not Pre-Weighed

10.8.3.1 EnCore™ Soil Samples: Obtain the tare weight of a 20 mL vial, including the cap, that contains 5 mL of methanol and 5 μL of the specific surrogate stock standard that has been specified in method or project requirements (Section 7.3.1). Extrude the sample from the EnCore™ into the vial, cap, and weigh.

10.8.3.2 Ensure that 5 μL of the specific surrogate stock standard that has been specified in method or project requirements (Section 7.3.1) is added to each field sample, blank, LCS, MS, and MSD.

10.8.3.3 Add 5 μL of the ICV/spike stock standard solution (Section 7.2.6.1) to the LCS, MS, and MSD.

10.8.3.4 If there is sufficient sample, split the sample to create a duplicate portion and extract both portions of the sample.

NOTE: To comply with Method 5035, this extraction must be done within 48 hours of collection. Some work plans may have special provisions for longer holding times for samples frozen in EnCore™ samplers, but that is not routine.

10.8.3.5 Bulk Soils: Bulk soil samples are submitted in packed, unweighed jars, vials, or core tubes. Transfer 10 ± 0.5 grams of soil into a prepared 20 mL vial that contains 10 mL of methanol, 7.5 μL of the specific surrogate stock standard and 10 μL of spike (if required) that has been specified in method or project requirements (Section 7.3.1) and cap the vial. This transfer must be performed very quickly to minimize loss of target analytes.

10.8.3.6 Ensure that 7.5 μL of the specific surrogate stock standard that has been specified in method or project requirements (Section 7.3.1) is added to each field sample, blank, LCS, MS, and MSD.

10.8.3.7 Add 10 μL of the ICV/spike stock standard solution (Section 7.2.6.1) to the LCS, MS, and MSD.

10.9 Aqueous and Soil Sample Analysis

10.9.1 After combining the sample, methanol, surrogate, and spikes (if appropriate), cap the vial and shake for 2 minutes.

10.9.2 Allow the sediment to settle.

10.9.3 If not analyzed immediately, these extracts must be stored at $\leq 6^{\circ}\text{C}$ in the dark.

10.9.4 Use Table 11 to determine the volume of methanol extract to add to 5 mL of reagent water for analysis. If a screening procedure was used, use the estimated concentration to determine the appropriate methanol volume. The maximum volume of methanol that can be added to the reagent water for analysis is 100 μL . If an extract volume of less than 100 μL is used, then a volume of reagent methanol is added to total 100 μL . All dilutions must keep the response of the major constituents (previously saturated peaks) in the upper half of the linear range of the curve.

10.9.5 Remove the plunger from a 5.0 mL Luerlock-type syringe equipped with a syringe valve, and fill until overflowing with reagent water. Replace the plunger and compress the water to vent trapped air. Adjust the volume to 4.9 mL.

10.9.6 Pull the plunger to 5.0 mL to allow volume for the addition of the sample extract and of internal standard. Add the volume of methanol extract determined from screening and a volume of methanol solvent to total 100 μL (excluding methanol in standards). Add 5 μL of the 30 $\mu\text{g/mL}$ IS working spike solution (Section 7.4.2) to the water in the syringe.

10.9.7 Attach the syringe valve assembly to the syringe valve on the purging device. Open the syringe valves and inject the sample into the purging chamber.

- 10.9.8** Analyze all reagent blanks on the same instrument as that used for the samples. The method blank should contain 100 µL of the methanol used to extract the organic-free reagent sand.

10.10 Calibration

Detailed information regarding calibration models and calculations can be found in Corporate SOP CA-Q-S-005, *Calibration Curves (General)* and in the public folder, Arizona Calibration Training.

10.10.1 Initial Calibration (ICAL)

- 10.10.1.1** A new calibration curve must be generated after major changes to the system or when continuing calibration criteria cannot be met. Major changes include installation of new columns and changing FID jets.
- 10.10.1.2** The ICAL is performed using six or seven concentration levels (see Section 7.2.5 and Tables 4-6). The lowest calibration concentration is at or below the laboratory reporting limit (RL) concentration. The highest standard defines the highest sample extract concentration that may be reported without dilution.
- 10.10.1.3** Generally, it is NOT acceptable to remove points from a calibration. If calibration acceptance criteria are not met, the normal corrective action is to examine conditions such as instrument maintenance and accuracy of calibration standards. Any problems found must be fixed and documented in the run log or maintenance log. Then the calibration standard(s) must be reanalyzed.
- 10.10.1.4** If no problems are found or there is documented evidence of a problem with a calibration point (e.g., obvious misinjection explained in the run log), then one point might be rejected, but only if all of the following conditions are met:
- 10.10.1.4.1** The rejected point is the highest or lowest on the curve, i.e., the remaining points used for calibration must be contiguous;
 - 10.10.1.4.2** The lowest remaining calibration point is still at or below the project reporting limit; and
 - 10.10.1.4.3** The highest remaining calibration point defines the upper concentration of the working range, and all samples producing results above this concentration are diluted and reanalyzed; and
 - 10.10.1.4.4** The calibration must still have the minimum number of calibration levels required by the method, i.e., five levels for calibrations modeled with average response factors or linear regressions, or six levels for second-order curve fits.
- 10.10.2** The external standardization method is used for all methods except 8021B/GRO and Oklahoma which use the internal standardization method. (See Section 10.10.4.) Tabulate the area response for each calibration level

against the concentration injected. The ratio of the response to the concentration injected, defined as the calibration factor (CF), is calculated for the standard at each concentration as follows:

$$CF_i = \frac{A_{fuel}}{C_{fuel}} \quad \text{Equation 4}$$

Where:

- CF_i = Calibration factor for the i^{th} calibration level.
- A_{fuel} = Total area of the fuel calibration standard peak.
- C_{fuel} = Concentration of fuel calibration standard, mg/mL

If the percent relative standard deviation (%RSD) for the average (mean) of the calculated calibration factors is less than 20%, the average calibration factor can be used for sample quantitation.

$$\text{AverageResponseFactor} = \overline{CF} = \frac{\sum_{i=1}^n CF_i}{n} \quad \text{Equation 5}$$

Where:

- CF_i = Calibration factor for the i^{th} calibration level.
- n = The number of calibration levels.

10.10.3 Establishing the Calibration Function

Calibrations are modeled either as average calibration factors or as calibration curves, using a systematic approach to selecting the optimum calibration function. Start with the simplest model, i.e., a straight line through the origin and progress through other options until the calibration criteria are met. Pay particular attention to the residuals noticed at the upper and lower end of the curves. This may be cause for rejection of a curve fit even if the calibration acceptance criteria are met.

10.10.3.1 Linear Calibration Using Average Calibration Factor

Tabulate the peak area response for each target analyte or hydrocarbon range in each calibration level against the concentration injected. For each analyte in each calibration standard, calculate the calibration factor (CF) as shown in Equation 4 above. The calibration factor is a measure of the slope of the calibration line, assuming that the line passes through the origin. Under ideal conditions, the factors calculated for each calibration level will not vary with the concentration of the standard. In practice, some variation can be expected. When the variation, measured as the relative standard deviation, is relatively small (e.g., $\leq 20\%$), the use of the straight line through the origin model is generally appropriate.

For each target analyte, calculate the average calibration factor as follows:

$$\text{Average Calibration Factor} = \overline{CF} = \frac{\sum_{i=1}^n CF_i}{n} \quad \text{Equation 6}$$

Where:

CF_i = Calibration factor for the i^{th} calibration level.

n = The number of calibration levels.

The relative standard deviation (RSD) is calculated as follows:

$$RSD = \frac{SD}{\overline{CF}} \times 100\% \quad \text{Equation 7}$$

Where SD is the standard deviation of the average CF, which is calculated as follows:

$$SD = \sqrt{\frac{\sum_{i=1}^n (CF_i - \overline{CF})^2}{n - 1}} \quad \text{Equation 8}$$

10.10.3.2 Evaluation of the Average Calibration Factor

The calibration relationship can be graphically represented as a line through the origin with a slope equal to the average calibration factor. Examine the residuals, i.e., the difference between the actual calibration points and the plotted line. Particular attention should be paid to the residuals for the highest points, and if the residual values are relatively large, a linear regression should be considered.

Acceptance Criteria: The % RSD must be $\leq 20\%$ (AK101 upper limit is 25%).

Corrective Action: If the % RSD exceeds the limit, linearity through the origin cannot be assumed, and a least-squares linear regression should be attempted.

10.10.3.3 Linear Calibration Using Least-Squares Regression

Calibration using least-squares linear regression produces a straight line that does not necessarily pass through the origin. The calibration relationship is constructed by performing a linear regression of the instrument response (peak area or peak height) versus the concentration of the standards. The instrument response is treated as the dependent variable (y) and the concentration as the independent variable (x). A weighted least squares regression may be used if at least three multi-point calibrations have been

performed. The weighting used is the reciprocal of the square of the standard deviation. The regression produces the slope and intercept terms for a linear equation in the following form:

$$y = ax + b \quad \text{Equation 9}$$

Where:

- y = Instrument response (peak area or height).
- x = Concentration of the target analyte in the calibration standard.
- a = Slope of the line.
- b = The y-intercept of the line.

For an external standard calibration, the above equation takes the following form:

$$A_s = aC_s + b \quad \text{Equation 10}$$

To calculate the concentration in an unknown sample extract, the regression equation is solved for concentration, resulting in the following equation, where C_s is now C_e , the concentration of the target analyte in the unknown sample extract.

$$C_e = \frac{A_e - b}{a} \quad \text{Equation 11}$$

Where:

- A_s = Area of the chromatographic peak for the target analyte in the calibration standard.
- A_e = Area of the chromatographic peak for the target analyte in the sample extract.
- a = Slope of the line as determined by the least-squares regression.
- C_s = Concentration of the target analyte in the calibration standard.
- C_e = Concentration of the target analyte in the sample extract.
- b = Intercept of the line as determined by the least-squares regression.

10.10.3.4 Linear Regression Evaluation

With an unweighted linear regression, points at the lower end of the calibration curve have less weight in determining the curve than points at the high concentration end of the curve. For this reason, inverse weighting of the linear function is recommended to optimize the accuracy at low concentrations. Note that the August 7, 1998 EPA memorandum "Clarification Regarding Use of SW-846 Methods", Attachment 2, Page 9, includes the statement "The Agency further recommends the use of a weighted regression over the use of an unweighted regression."

Acceptance Criteria: To avoid bias in low level results, the absolute value of the y-intercept must be significantly less than the reporting limit, and preferably less than the MDL.

Also examine the residuals, paying particular attention to the residuals at the low end of the curve. If the intercept or the residuals are large, a second-order regression should be considered.

The linear regression must have a correlation coefficient (r) ≥ 0.990 . Some programs (e.g., AFCEE, DoD) require a correlation coefficient ≥ 0.995 . Note that the AK102/AK103 method requires that r^2 be greater than or equal to 0.995 but method AK101 does not list a specification.

Corrective Action: If the correlation coefficient falls below the acceptance limit, linear regression cannot be used and a second-order regression should be attempted.

10.10.3.5 Non-Linear Calibration

When the instrument response does not follow a linear model over a sufficiently wide working range, or when the previously described calibration approaches fail acceptance criteria, a non-linear, second-order calibration model may be employed. The second-order calibration uses the following equation:

$$y = ax^2 + bx + c \quad \text{Equation 12}$$

Where a, b, and c are coefficients determined using a statistical regression technique; y is the instrument response; and x is the concentration of the target analyte in the calibration standard.

10.10.3.6 Non-Linear Calibration Evaluation

A minimum of six points must be used for a second-order regression fit.

Acceptance Criteria: The coefficient of determination must be ≥ 0.990 .

Corrective Action: If the coefficient of determination falls below the acceptance limit and the other calibration models are unacceptable, the source of the problem must be investigated and the instrument recalibrated. Third-order regressions are not allowed at TestAmerica-Denver.

10.10.3.6.1 Second-order regressions should be the last option. Note that some programs (e.g., South Carolina) do not allow the use of second-order regressions.

10.10.3.6.2 Before selecting a second-order regression calibration model, it is important to ensure the following:

- The absolute value of the intercept is not large relative to the lowest concentrations being reported.
- The response increases significantly with increasing standard concentration (i.e., the instrument response does not plateau at high concentrations).
- The distribution of concentrations is adequate to characterize the curvature.

Note: Method 8015C and the NWTPH method require that the calibration points be “back calculated” to the line or curve and that each point be within +/- 20% (for 8015C) and 15% (for NWTPH) of the expected concentration for that point.

10.10.4 Internal Standard Calibration

10.10.4.1 For 8021B/GRO and the Oklahoma Methods 8020/8015 (modified), internal standard calibration is used. Internal standard calibration involves the comparison of instrument responses from the target compounds in the sample to responses of specific standards added to the sample or sample extract prior to injection. For this method, the internal standard is 1-chloro-4-fluorobenzene, which is added to each standard, field sample, and QC sample at the time of injection.

10.10.4.2 The ratio of the peak area of the target compound in the sample extract to the peak area of the internal standard in the sample extract is compared to a similar ratio derived for each calibration standard. This ratio is the response factor (RF).

For each of the initial calibration standards, calculate the RF value for the GRO relative to the internal standard as follows:

$$RF = \frac{A_s \times C_{is}}{A_{is} \times C_s} \quad \text{Equation 13}$$

Where:

A_s = Peak area of the analyte or surrogate.

A_{is} = Peak area of the internal standard.

C_s = Absolute weight of analyte purged in μg .

C_{is} = Absolute weight of the internal standard purged in μg .

10.10.4.3 The response factor is a measure of the slope of the calibration relationship and the assumption is made that the curve passes

through the origin. To evaluate the linearity of the calibration, calculate the mean response factor, the standard deviation (SD), and the relative standard deviation (RSD) as follows:

$$\text{mean RF} = \overline{RF} = \frac{\sum_{i=1}^n RF_i}{n} \quad \text{Equation 14}$$

$$SD = \sqrt{\frac{\sum_{i=1}^n (RF_i - \overline{RF})^2}{n-1}} \quad \text{Equation 15}$$

$$RSD = \frac{SD}{\overline{RF}} \times 100\% \quad \text{Equation 16}$$

Where:

RF_i = Response factor for the i^{th} calibration level.
 n = Number of calibration levels

If the RSD of the response factors is $\leq 20\%$, then linearity through the origin may be assumed, and the average response factor may be used to determine sample concentrations as follows. Otherwise, a linear least-squares regression fit must be used for the calibration.

$$C_e = \frac{A_s \times C_{is}}{A_{is} \times \overline{RF}} \quad \text{Equation 17}$$

Where:

C_e = Absolute weight of the analyte or surrogate in the sample purge in μg .
 A_s = Peak area of the analyte or surrogate.
 A_{is} = Peak area of the internal standard.
 C_{is} = Absolute weight of the internal standard purged in μg .
 \overline{RF} = Average response factor from calibration.

10.10.4.4 To establish the least-squares regression calibration function, the instrument response (peak area) is treated as the dependent variable (y), and the concentration as the independent variable (x). The regression produces the slope and intercept terms for a linear equation in the following form:

$$y = mx + b \quad \text{Equation 18}$$

Where:

- y = Instrument response (peak area).
- m = Slope of the line.
- x = Concentration or amount of the calibration standard.
- b = Intercept of the line.

10.10.4.5 To calculate a sample concentration or amount, the equation is solved for concentration/amount, taking the following form:

$$x = \frac{y - b}{m} \quad \text{Equation 19}$$

For the internal standard method, the regression equation is rearranged as follows:

$$\frac{A_s C_{is}}{A_{is}} = m C_s + b \quad \text{Equation 20}$$

To calculate a sample concentration (or amount), this equation is solved for concentration (or amount) as follows:

$$C_e = \frac{\left[\frac{A_s C_{is}}{A_{is}} - b \right]}{m} \quad \text{Equation 21}$$

Where:

- C_e = Concentration or amount of the target analyte in the sample purge.
- A_s = Peak area for target analyte in sample purge.
- A_{is} = Peak area for internal standard.
- C_{is} = Concentration or amount of the internal standard.
- m = Slope of the line.

10.10.4.6 The correlation coefficient, r, of the fitted line must be ≥ 0.990 . Some programs (e.g., AFCEE and USACE) require $r \geq 0.995$, unless approval is given in the project QAPP to use 0.990.

Method NWTPH-Gx requires a linear correlation coefficient of ≥ 0.990 with none of the standards varying from their true value by more than $\pm 15\%$.

10.10.4.7 If the ICAL %RSD or correlation coefficient linearity criteria are not met, sample analysis cannot be performed. Check that the instrument is performing properly, and adjust as needed. Check

that the standards are made correctly. After correcting any problems, prepare and reanalyze a new ICAL.

10.10.5 Second-Source Initial Calibration Verification (ICV)

Analyze a 100 µg/mL second-source verification standard after each ICAL. For aqueous sample batches, the ICV is also the LCS (Section 7.2.6.2). For soil sample batches, the ICV is separate from the soil LCS.

Acceptance Criteria: The percent difference (%D) between the measured concentration for this standard and the expected concentration must be within $\pm 15\%$. When the ICV also functions as the LCS for aqueous soil batches, the percent recovery for the LCS must be within 85 to 115%. Methods 8015C and 8015D allow up to $\pm 20\%$ D.

Corrective Action: If the %D or % recovery for the second-source verification fails acceptance criteria, then sample analysis cannot be performed. Reanalyze the second-source verification standard to confirm the original result. If the second result also fails acceptance criteria, then re-prepare the verification standard, and/or re-prepare and rerun the ICAL.

The %D and % recovery are calculated as follows:

$$\%D = \frac{\text{Measured Conc} - \text{Expected Conc}}{\text{Expected Conc}} \times 100\% \quad \text{Equation 22}$$

$$\% \text{ Recovery} = \frac{\text{Conc Recovered}}{\text{Conc Added}} \times 100\% \quad \text{Equation 23}$$

10.10.6 Continuing Calibration Verification (CCV)

Analyze a mid-point calibration standard every 12 hours or after 20 sample analyses, whichever is more frequent, and upon completion of sample analyses to bracket the run. Method 8000C requires two levels for the CCV when a quadratic fit is used for the ICAL. The concentrations of the CCVs in this case are near the midpoint of the calibration curve and near the RL. (See Section 7.2.2.5) It is not necessary to run a CCV standard at the beginning of the sequence if samples are analyzed immediately after the completion of the initial calibration.

Acceptance Criteria: The result for each analyte must be within $\pm 15\%$ of the expected value. Methods 8015C, 8015D, Oklahoma, and NWTPH-Gx allow a $\pm 20\%$ drift. AK101 allows $\pm 25\%$ drift.

Corrective Action: If one or more analytes fails the acceptance criteria, check the instrument operating conditions, and if necessary, restore them to original settings or perform routine maintenance. This may include clipping the column, changing the liner, or other minor instrument adjustments. Inject another aliquot of the CCV standard.

If the response for any analyte is still not within $\pm 15\%$, then a new initial calibration must be performed. Any samples injected after the last valid CCV standard must be re-injected.

11.0 Calculations / Data Reduction

The concentration of GRO in the sample is determined by calculating the absolute weight of analyte purged, from a summation of peak response for all chromatographic peaks, resolved and unresolved, eluting between 2-methylpentane (C_6) and 1,2,4-trimethylbenzene (C_9), using the calibration curve or the response factor determined in Section 10.10 For Alaska Method AK101, the range is defined as all chromatographic peaks, resolved and unresolved, eluting between the peak start time of hexane (C_6) and the peak start time of decane (C_{10}). Second column confirmation is not normally performed for this method as confirmation of chemical identity is not part of the analysis.

11.1 Calculation of Sample GRO Concentration

GRO in the sample extract (C_e) is calculated using the calibration function as described in Section 10.10 The GRO concentration in the original sample is calculated as follows:

11.1.1 GRO Concentration in Aqueous Samples

$$C_s = \frac{C_e}{V_s} \times DF \quad \text{Equation 24}$$

Where:

- C_s = Concentration of GRO in the original sample in $\mu\text{g/L}$.
- C_e = Absolute weight of GRO in sample purged in μg .
- V_s = Volume of sample purged in liters.
- DF = Dilution factor.

11.1.2 GRO Concentration in Soil Samples

$$C_s = C_e \times \frac{V_m \times DF}{W_s \times V_p} \quad \text{Equation 25}$$

Where:

- C_s = Concentration of GRO in the original sample.
- C_e = Absolute weight of GRO in sample extract purged in μg .
- V_m = Volume of methanol extract in μL (e.g., 10 mL = 10,000 μL).
- W_s = Weight of sample extracted in kg. For Alaska Method AK101 and as specified by project requirements, the dry weight is used.
- V_p = Volume of extract actually purged in μL .
- DF = Dilution factor.

NOTE: For Alaska Method AK101, and as specified by project requirements, the percent moisture of a soil sample is calculated by subtracting the weight after drying from the original sample weight, dividing that by the original sample weight, and expressing the result as a percent.

NOTE: For work performed for the state of Alaska, the volume of methanol used for extraction must be adjusted for the moisture content of the sample by the following equation:

$$V_t = V_m + M * W_s / 100 \quad \text{Equation 26}$$

Where:

- V_t = final extract volume, corrected for moisture (mL)
- V_m = volume methanol used for extraction (mL)
- M = moisture content of the sample (%)
- W_s = aliquot of sample extracted (g)

- 11.2** Upon completion of the analytical sequence, transfer the raw chromatography data to the TARGET DB database for further processing.
- 11.2.1** Review chromatograms online and determine whether manual data manipulations are necessary.
 - 11.2.2** All manual integrations must be justified and documented. See DV-QA-011P requirements for manual integration
 - 11.2.3** Manual integrations may be processed using an automated macro, which prints the before and after chromatograms and the reason for the change, and attaches the analyst's electronic signature.
 - 11.2.4** Alternatively, the manual integration may be processed manually. In the latter case, print both the before and after chromatograms to the same scale and record the reason for the change and initial and date the after chromatogram. Before and after chromatograms must be of sufficient scale to allow an independent reviewer to evaluate the manual integration.
- 11.3** Compile the raw data for all the samples and QC samples in a batch. The analytical batch is defined as containing no more than 20 samples, which include field samples and the MS and MSD.
- 11.3.1** Perform a Level 1 data review and document the review on the data review checklist, GC Data Review Checklist/Batch Summary (See SOP DV-QA-0020.)
 - 11.3.2** Submit the data package and review checklist to the peer reviewer for the Level 2 review. All manual integrations must be evaluated by the peer reviewer and initialed on the manual integration summary report. The Level 2 review is documented on the review checklist initiated at the Level 1 review. The data review process is explained in SOP DV-QA-0020.

12.0 Method Performance

12.1 Method Detection Limit Study (MDL)

An initial method detection limit study is performed in accordance with Policy DV-QA-005P. An MDL verification is performed once a year to satisfy NELAC 2003 requirement. For DoD, AFCEE, and DOE projects, an MDL verification is performed quarterly. MDLs are stored in the LIMS.

12.2 Initial Demonstration of Capability

IDOCs must be performed initially, before samples are analyzed, and must be repeated on an annual basis. Each analyst performing this procedure must successfully analyze four LCS QC samples using current laboratory LCS control limits. The results of the IDOC study are summarized in the NELAC format, as described in SOP DV-QA-0024. IDOCs are approved by the Quality Assurance Manager and the Technical Director. IDOC records are maintained by the QA staff in the central training files.

12.2.1 Initial demonstration of ability for Oklahoma method

12.2.1.1 Analyze 7 replicates of organic free water spiked with the gasoline component standard at a concentration of 2 ug/L for each individual component with recoveries for all components within $\pm 30\%$ of the known concentration and precision of all replicates within $\pm 20\%$.

12.2.1.2 Analyze 7 replicates of GRO-free sand spiked with the gasoline component standard at the reporting limit (50 ug/kg) for each individual component with recoveries for all components within $\pm 40\%$ of the known concentration and precision of all replicates within $\pm 20\%$.

12.3 Training Qualification

The Group/Team leader has the responsibility to ensure that this procedure is performed by an associate who has been properly trained in its use and has the required experience. See requirements for demonstration of analyst proficiency in SOP DV-QA-0024.

13.0 Pollution Control

Standards and reagents are prepared in volumes consistent with laboratory use to minimize the volume of expired standards and reagents requiring disposal.

14.0 Waste Management

All waste will be disposed of in accordance with Federal, State, and local regulations. Where reasonably feasible, technological changes have been implemented to minimize the potential for pollution of the environment. Employees will abide by this procedure, the policies in section 13, "Waste Management and Pollution Prevention", of the Environmental Health and Safety Manual, and DV-HS-001P, "Waste Management Program."

The following waste streams are produced when this method is carried out:

- Methanol extract vial waste – Expired Extract Vials, Waste Stream A
- Purge-and-trap aqueous waste – Flammable Solvent Waste, Waste Stream C
- Solvent rinse waste – Flammable Solvent Waste, Waste Stream C
- Expired Chemicals/Reagents/Standards – Contact the Waste Coordinator

Radioactive and potentially radioactive waste must be segregated from non-radioactive waste as appropriate. Contact the Radioactive Waste Coordinator for proper management of radioactive or potentially radioactive waste generated by this procedure.

15.0 References / Cross-References

15.1 SW-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition and all promulgated updates, EPA Office of Solid Waste, January 2005.

15.1.1 Method 8000B, Determinative Chromatographic Separations, Revision 2, December 1996.

15.1.2 Method 8000C, Determinative Chromatographic Separations, Revision 3, March 2003.

15.1.3 Method 8015B, Nonhalogenated Organics Using GC/FID, Revision 2, December 1996.

15.1.4 Method 8015C, Nonhalogenated organics by Gas Chromatography, Revision 3, February 2007.

15.1.5 Method 8015D, Nonhalogenated organics by Gas Chromatography, Revision 4, June 2003.

15.1.6 Method 5000, Sample Preparation for Volatile Organic Compounds, Revision 0, December 1996.

15.1.7 Method 5030B, Purge-and-Trap for Aqueous Samples, Revision 2, December 1996

15.1.8 Method 5030C, Purge-and-Trap for Aqueous Samples, Revision 3, May 2003.

15.1.9 Method 5035, Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples, Revision 0, December 1996.

15.1.10 Method 5035A, Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples, Revision 1, July 2002.

15.2 American Petroleum Institute "Method for the Determination of Gasoline Range Organics," Draft Revision 4- August 18, 1992, prepared by Rocky Mountain Analytical for the American Petroleum Institute.

15.3 Alaska Method AK101, "For the Determination of Gasoline Range Organics", Version 04/08/02.

15.4 Oklahoma Methods 8020/8015 (modified) Gasoline Range Organics (GRO), Revision 4.0, 02/24/96.

15.5 NWTPH-Gx, "Volatile Petroleum Products Method for Soil and Water", Manchester Environmental Laboratory, Dept. of Ecology, State of Washington.

16.0 **Method Modifications:**

| Item | Method | Modification |
|------|------------|---|
| 1 | AK101 | The Alaska method recommends bromofluorobenzene and α, α, α -trifluorotoluene as surrogates. This method allows the use of alternate surrogates as long as they are non-polar, purgeable from water, elute prior to the start of C ₁₁ , and do not co-elute with any significant component of gasoline. This SOP uses chlorobenzene in place of bromofluorobenzene. |
| 2 | AK101 | Method AK101 suggests a retention time standard consisting of n-hexane and n-decane. This SOP uses a standard mixture that includes both alkanes and aromatic hydrocarbons over the carbon range of the method. |
| 3 | NWTPH-Gx | NWTPH-Gx suggests the use of 1,4-difluorobenzene or bromofluorobenzene but also allows for the use of other surrogates as long as these compounds are non-polar, purgeable from water and do not coelute with any significant component of gasoline. α, α, α -Trifluorotoluene is used in place of the method suggested surrogates. |
| 4 | OK Methods | Standard soil RL of 1.2 mg/kg for GRO and 0.050 mg/kg for individual components is higher than the method specified RL of 0.1 mg/kg for GRO and 0.01 mg/kg for individual components. The laboratory MDLs do not support the method RL. The Oklahoma method identifies a direct purge of soil samples unless dilution is required and then a methanol extraction is performed. The lab uses the methanol extraction for all samples. |
| 5 | OK Methods | The spike level used by the laboratory to fulfill Oklahoma's requirement for the analysis of 7 replicates for demonstration of ability to generate acceptable accuracy and precision for soil has been increased to 50 ug/kg. The method requirement is to spike at the method reporting limit of 10 ug/kg for individual components. The laboratory MDLs do not support the method RL and the spike level used is the laboratory RL for the individual components. |

17.0 **Attachments**

Table 1: Typical Commercial GRO/BTEX Calibration Standard

| | |
|-------------|--|
| Table 2: | Typical Commercial Alaska Method AK101 GRO Calibration Standard |
| Table 3: | Typical Commercial GRO/BTEX Calibration Standard for Oklahoma Methods 8020/8015 (Modified) |
| Table 4: | Method 8015 GRO/AK101 Calibration Levels |
| Table 5: | Method 8021/GRO Calibration Levels |
| Table 6: | Oklahoma Method GRO Calibration Levels |
| Table 7: | typical Commercial 8021B /GRO Calibration Standard |
| Table 8: | Typical Commercial GRO/BTEX Second-Source Standard |
| Table 9: | Typical RT Stock Standard |
| Table 10: | Recommended Instrument Conditions |
| Table 11: | Amount of Methanol Extract Needed for Analysis of Soils |
| Table 12: | Alaska Method AK101 Quality Control Acceptance Criteria |
| Appendix A: | Sample Collection Instructions for Alaska Method AK101 GRO/BTEX |
| Figure 1: | Sample Chromatogram – RT Marker Standard |
| Figure 2: | Sample Chromatogram – Gasoline Standard |

18.0 **Revision History**

- Revision 7.1, dated 18 July 2011
 - Revised Oklahoma IDOC procedure (section 12.2.1) to increase spike level for Soil IDOC to 50 ug/kg, the laboratory RL for the individual components.
 - Clarified method modification 4 and added method modification 5.
- Revision 7, dated 11 April 2011
 - Combined with SOP DV-GC-0028, Gasoline Range Organics (GRO) by GC/FID SW846 Method 8015C to provide a comprehensive SOP that covers GRO by Methods 8015B, C and D, 8021B and the state methods of Alaska, Oklahoma and Washington.
 - Removed references to CA LUFT Manual and method
 - Removed LCSD requirement except as needed based on TA-Denver policy and client request.
 - Included both internal and external standard calibration discussions
 - Updated formatting
 - Removed grand mean of %RSD for continuing calibration acceptance criteria
 - Included Oklahoma IDOC protocol
 - Expanded references section to include all methods in SOP including prep methods.
 - Updated tables to include each set initial calibration standards based on individual method requirements.
 - Added example chromatograms for RT Marker Standard and GRO standard

- Revision 6.1, dated 12 March 2010
 - Updated implementation date
 - Added section 6.3
- Revision 6, dated 19 June 2009
 - Added references and method modifications for Washington's NWTPH-Gx
 - Updated formatting
 - Added CCV criteria (section 10.9.4)
- Changes from Previous Versions
 - Revision 5, March 2008 – changed to TestAmerica format and name.
 - Incorporated Alaska Method AK101 throughout this SOP.
 - Reformatted SOP to include change in name to TestAmerica.
 - Modified Table 4 to include the AK101 RT Markers.

TABLE 1.

TYPICAL COMMERCIAL GRO/BTEX CALIBRATION STANDARD

| NOTE: The following formulation is an example of a commercially available GRO/BTEX standard. In this case, the formulation is that of AccuStandard GA-001-20X-BTEX. The components are in a methanol solution. | | |
|---|--------------------------------------|---|
| Component | Stock Standard Concentration (µg/mL) | Intermediate Standard Concentration (µg/mL) |
| Benzene | 78 | 1.56 |
| Ethylbenzene | 320.5 | 6.41 |
| Gasoline | 10,025.0 | 200.5 |
| m- & p-Xylenes | 381.2 | 7.62 |
| o-Xylene | 137.7 | 2.75 |
| Toluene | 97.0 | 1.94 |

TABLE 2.

TYPICAL COMMERCIAL ALASKA METHOD AK101 GRO CALIBRATION STANDARD

| NOTE: The following formulation is an example of a commercially available GRO standard for the Alaska method AK101. In this case, the formulation is that of AccuStandard AK-101GSC-R1. The components are in a methanol solution. | | |
|---|--------------------------------------|---|
| Component | Stock Standard Concentration (µg/mL) | Intermediate Standard Concentration (µg/mL) |
| Gasoline | 744055.2 | 200 |

TABLE 3.

**TYPICAL COMMERCIAL GRO/BTEX CALIBRATION STANDARD FOR OKLAHOMA
METHODS 8020/8015 (MODIFIED)**

| NOTE: The following formulation is an example of a commercially available GRO/BTEX standard for the Oklahoma Methods 8020/8015 (modified). In this case, the formulation is that of Ultra UST-100. The components are in a methanol solution. | | |
|--|---|--|
| Component | Stock Standard Concentration (µg/mL) | Intermediate Standard Concentration (µg/mL) |
| 1,2,4-Trimethylbenzene | 1000 | 20 |
| 1,3,5-Trimethylbenzene | 1000 | 20 |
| Benzene | 1000 | 20 |
| Ethylbenzene | 1000 | 20 |
| Gasoline | 10,000 | 200 |
| m- & p-Xylenes | 1000 | 20 |
| Methyl t-Butyl Ether (MTBE) | 1000 | 20 |
| Naphthalene | 1000 | 20 |
| o-Xylene | 1000 | 20 |
| Toluene | 1000 | 20 |

TABLE 4.
METHOD 8015 GRO/AK101

| Calibration Levels (µg/L) | | | | | | |
|--|---------|---------|---------|---------|---------|---------|
| | Level 1 | Level 2 | Level 3 | Level 4 | Level 5 | Level 6 |
| GRO C ₆ -C ₁₀ C ₅ -C ₁₂ C ₆ -C ₁₂ | 20 | 50 | 100 | 200 | 500 | 1000 |
| Chlorobenzene α,α,α-Trifluorotoluene 1-Chloro-4-fluorobenzene | 3 | 7.5 | 15 | 30 | 75 | 150 |

Table 5
METHOD 8021-GRO
CALIBRATION LEVELS
(µg/L)

| | Level 1 | Level 2 | Level 3 | Level 4 | Level 5 | Level 6 | Level 7 |
|---|---------|---------|---------|---------|---------|---------|---------|
| Benzene | 0.25 | 0.5 | 2.5 | 5 | 10 | 20 | 30 |
| Ethylbenzene | 0.25 | 0.5 | 2.5 | 5 | 10 | 20 | 30 |
| m- & p-Xylene | 1.0 | 2.0 | 10.0 | 20 | 40 | 80 | 120 |
| o-Xylene | 0.5 | 1.0 | 5.0 | 10 | 20 | 40 | 60 |
| Toluene | 0.75 | 1.5 | 7.5 | 15 | 30 | 60 | 90 |
| MTBE | 1.0 | 2.0 | 10.0 | 20 | 40 | 80 | 120 |
| 1,2,4-Trimethylbenzene | 0.5 | 1.0 | 5.0 | 10 | 20 | 40 | 60 |
| Gasoline (C ₆ -C ₁₀) | 6 | 12.0 | 60.0 | 120 | 240 | 480 | 720 |
| α,α,α-Trifluorotoluene (surrogate) | 0.75 | 1.5 | 7.5 | 15 | 30 | 60 | 90 |

TABLE 6.
OKLAHOMA GRO METHOD
CALIBRATION LEVELS

| Calibration Levels (µg/L) | | | | | | |
|-----------------------------|---------|---------|---------|---------|---------|---------|
| | Level 1 | Level 2 | Level 3 | Level 4 | Level 5 | Level 6 |
| 1,2,4-Trimethylbenzene | 0.5 | 5 | 10 | 20 | 50 | 100 |
| 1,3,5-Trimethylbenzene | 0.5 | 5 | 10 | 20 | 50 | 100 |
| Benzene | 0.5 | 5 | 10 | 20 | 50 | 100 |
| Ethylbenzene | 0.5 | 5 | 10 | 20 | 50 | 100 |
| m- & p-Xylene | 0.5 | 5 | 10 | 20 | 50 | 100 |
| Methyl t-Butyl Ether (MTBE) | 0.5 | 5 | 10 | 20 | 50 | 100 |
| Naphthalene | 0.5 | 5 | 10 | 20 | 50 | 100 |
| o-Xylene | 0.5 | 5 | 10 | 20 | 50 | 100 |
| Toluene | 0.5 | 5 | 10 | 20 | 50 | 100 |
| | | | | | | |
| Gasoline | 5.0 | 50 | 100 | 200 | 500 | 1000 |
| | | | | | | |
| Surrogate | 0.75 | 7.5 | 15 | 30 | 75 | 150 |

TABLE 7.

TYPICAL COMMERCIAL 8021B/GRO CALIBRATION STANDARD

| NOTE: The following formulation is an example of a commercially available 8021B/GRO standard). In this case, the formulation is that of Ultra CUS-1699A. The components are in a methanol solution. | | |
|--|---|--|
| Component | Stock Standard Concentration (µg/mL) | Intermediate Standard Concentration (µg/mL) |
| 1,2,4-Trimethylbenzene | 1000 | 20 |
| 2,2,4-Trimethylpentane | 1500 | 30 |
| 2-Methylpentane | 1500 | 30 |
| Benzene | 500 | 10 |
| Ethylbenzene | 500 | 10 |
| Gasoline | 12,000 | 240 |
| m- & p-Xylenes | 2000 | 40 |
| Methyl t-Butyl Ether (MTBE) | 2000 | 40 |
| n-Heptane | 500 | 10 |
| o-Xylene | 1000 | 20 |
| Toluene | 1500 | 30 |

Table 8.

TYPICAL COMMERCIAL GRO/BTEX SECOND-SOURCE STANDARD

| NOTE: The following formulation is an example of a commercially available GRO/BTEX second-source standard. In this case, the formulation is that of Restek 30237. The components are in a methanol solution. | | | |
|---|--------------------------------------|---|--|
| Component | Stock Standard Concentration (µg/mL) | 8015 GRO Working Standard Concentration (µg/mL) | 8021B/GRO Working Standard Concentration (µg/mL) |
| Benzene | 80 | 1.47 | 8 |
| Ethylbenzene | 94 | 1.72 | 9.4 |
| Isopropylbenzene | 12 | 0.22 | 1.2 |
| m- & p-Xylenes | 327 | 6.00 | 32.7 |
| Methyl t-Butyl Ether (MTBE) | 124 | 2.27 | 12.4 |
| Naphthalene | 25 | 0.46 | 2.5 |
| o-Xylene | 130 | 2.38 | 13 |
| Toluene | 399 | 7.32 | 39.9 |
| Unleaded gasoline composite (compliant with Alaska Method AK101) | 5500 | 100.8 | 550 |

TABLE 9.

TYPICAL RT STOCK STANDARDS

NOTE: The following formulations are examples of commercially available stock standards (in methanol)

Table 9A

| TYPICAL RT REFERENCE STANDARD – Method 8015 | | |
|--|---|---|
| Component | Stock Standard Concentration (µg/mL) | Working Standard Concentration (µg/mL) |
| 1,2,4-Trimethylbenzene (C ₉) | 1000 | 20 |
| 2,2,4-Trimethylpentane (C ₈) | 1500 | 30 |
| 2-Methylpentane (C ₆) | 1500 | 30 |
| Benzene (C ₆) | 500 | 10 |
| Ethylbenzene (C ₈) | 500 | 10 |
| m-Xylene (C ₈) | 1000 | 20 |
| Methyl t-Butyl Ether (MTBE) | 2000 | 40 |
| n-Heptane (C ₇) | 500 | 10 |
| o-Xylene | 1000 | 20 |
| p-Xylene | 1000 | 20 |
| Toluene (C ₇) | 1500 | 30 |

Table 9B

| Typical RT Marker Standard – AK101 | | |
|---|---|---|
| Component | Stock Standard Concentration (ug/mL) | Working Standard Concentration (µg/mL) |
| n-Pentane (C ₅) | 2000 | 50 |
| n-Hexane (C ₆) | 2000 | 50 |
| n-Octane (C ₈) | 2000 | 50 |
| n-Decane (C ₁₀) | 2000 | 50 |
| n-Dodecane (C ₁₂) | 2000 | 50 |
| n-Tridecane (C ₁₃) | 2000 | 50 |

TABLE 10:
RECOMMENDED INSTRUMENT CONDITIONS

Purge-and-Trap Apparatus

| | |
|--------------------------|--------------------|
| Purge gas | Nitrogen or Helium |
| Purge gas flow rate | 25-40 mL/min. |
| Purge temperature | 30 °C |
| Desorb temperature | 180 °C |
| Backflush inert gas flow | 180 mL/min. |
| Desorb time | 2 minutes |
| Purge time | 11 minutes |

GC Conditions

| | |
|----------------------------|--|
| Helium Column Pressure | 20 psi |
| Initial Column Temperature | 40 °C for 2 minutes |
| First Temperature Ramp | 5 °C/minute & hold at 110 °C for 8 minutes |
| Second Temperature Ramp | 8 °C/minute to 190 °C |
| Third Temperature Ramp | 10 °C/minute to 210 °C & hold for 1 minute |
| FID Temperature | 320 °C |

TABLE 11:
AMOUNT OF METHANOL EXTRACT NEEDED FOR ANALYSIS OF SOILS

| GRO Approximate Concentration ($\mu\text{g/g}$) ^a | Volume of Methanol Extract (μL) ^b |
|---|--|
| 0 – 500 | 100 |
| 500 – 2000 | 50 |
| 2000 – 5000 | 10 |
| ≥ 5000 | 100 μL of 1/50 dilution ^c |

Calculate the appropriate dilution factor for concentrations exceeding the concentrations in this table.

- ^a This value may be based on a screening result or historical knowledge.
- ^b The volume of methanol added to 5 mL of water being purged should be kept constant. Therefore, add to the 5 mL syringe whatever volume of methanol is necessary to maintain a volume of 100 μL for each blank, sample, and control.
- ^c Dilute an aliquot of the methanol extract and then take 100 μL for analysis.

TABLE 12.
Alaska Method AK101 Quality Control Acceptance Criteria

| Analyte | Spike Concentration | | Control Limits | |
|---|---------------------|--------------|----------------|---------|
| | Water (mg/L) | Soil (mg/kg) | % Recovery | RPD (%) |
| GRO in Lab-Fortified Blanks ¹ | 0.1 – 1.0 | 5 - 100 | 60 - 120 | 20 |
| Laboratory Sample ² Surrogate Recovery (α,α,α -trifluorotoluene or bromofluorobenzene) | 0.05 | 2.5 | 60 - 120 | --- |
| Field Sample Surrogate Recovery (α,α,α -trifluorotoluene or bromofluorobenzene) | 0.05 | 2.5 | 50 - 150 | --- |
| Continuing Calibration | 1.0 | --- | 75 - 125 | --- |
| Calibration Verification | 1.0 | --- | 75 - 125 | --- |

¹ This is the same as the TAL Denver laboratory control sample (LCS).

² Laboratory samples are control samples that are spiked in the laboratory, i.e., LCS, method blank, MS, and MSD.

The quality control criteria listed in this table represent the minimum acceptable levels, using highly organic soil matrices. Higher performance may be required on some projects.

APPENDIX A –
Sample Collection Instructions for Alaska Method AK101 GRO/BTEX



TestAmerica Denver
Volatile (AK101 GRO/BTEX) Sample Collection Instructions

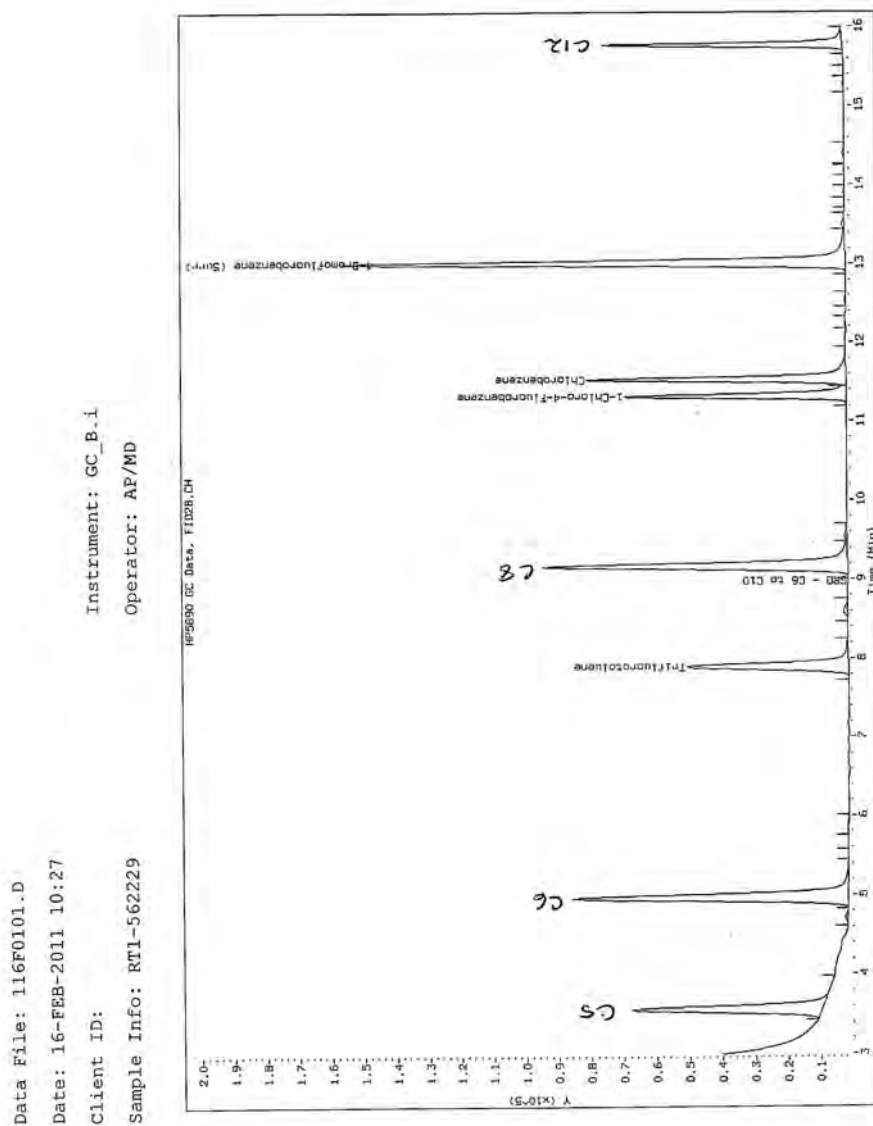
Soil Samples:

1. Soil samples should be collected in 4-oz amber jars that are pre-tared. Using a pre-tared jar ensures that the lab can very accurately determine the sample mass. TestAmerica Denver proves these containers.
2. The sample should be collected with minimum disturbance.
3. **The recommended amount of sample to collect is 25 to 50g, which is approximately 1 inch of soil inside the jar.**
4. The vial containing 25-mL of methanol/surrogate solution (also provided by TestAmerica Denver) is then carefully poured into the jar.
5. **The soil sample MUST be completely submersed in the methanol/surrogate solution.** If too much sample is collected and therefore the sample is not completely submersed in the methanol/surrogate solution, sample integrity has been compromised and the lab will issue the final report with a qualifier for the sample.
6. Samples must be refrigerated or iced to 0-6°C.
7. A trip blank (provided by the lab) must accompany each shipping container and should be stored with the field samples.
8. An additional sample of the same soil to be analyzed for GRO should be collected into a 4-oz unpreserved amber jar for percent moisture analysis in order to report results on a dry weight basis.

Aqueous Samples:

1. Aqueous samples should be collected in 40-mL HCl preserved glass VOA vials. TestAmerica Denver provides these containers. Three vials per sample are required.
2. Samples should be collected without agitation and **WITHOUT HEADSPACE.**
3. Samples must be refrigerated or iced to 0-6°C.
4. An aqueous trip blank (provided by the lab) must accompany each shipping container and should be stored with the field samples.

Figure 1
Sample Chromatogram for RT Marker Standard



Note: Actual retention times will vary by instrument and column.

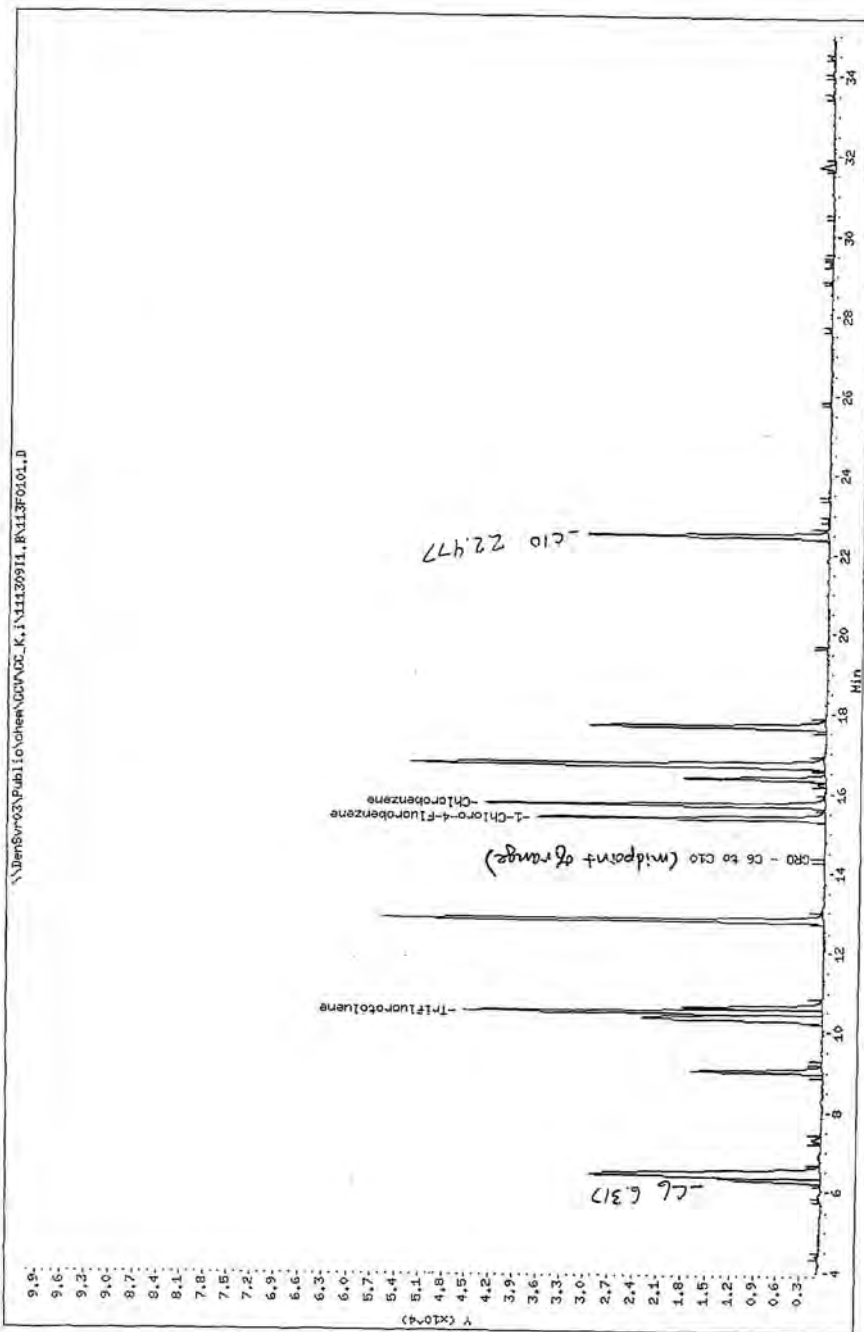
Figure 2
Sample Chromatogram for GRO Standard

Page 3

Data File: \\Densv03\Public\chem\GC\NOC_K\11130911.F\113F0101.D
Date : 13-NOV-2009 08:04
Client ID:
Sample Info: RT1 #0348-09
Column phase: DB624

Instrument: GC_K.1

Operator: BR
Column diameter: 0.32



Note: Actual retention times will vary by instrument and column.



TestAmerica Denver

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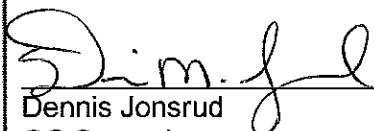
TestAmerica Laboratories, Inc.
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Phone: 303-736-0100
Fax: 303-431-7171

Title: Diesel and Residual Range Organics (DRO and RRO) and Terphenyls by GC/FID

[SW846 Method 8015 and others]

Approvals (Signature/Date):


Dennis Jonsrud
GC Supervisor

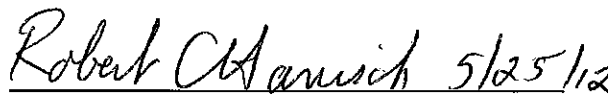
5-22-12
Date


Adam Alban
Health & Safety Manager / Coordinator

Date


John Morris
Quality Assurance Manager

5/22/12
Date


Robert C. Hanisch
Laboratory Director

Date

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1.0 Scope and Application

- 1.1** This procedure is designed to measure the concentration of terphenyls, diesel range organics (DRO), jet fuels, and motor oils in water or solid samples by EPA Methods 8015B, 8015C, 8015D, using method 8000B and 8000C criteria. Also addressed in this SOP are Alaska Methods AK102 and AK103, NWTPH (Washington) and the California LUFT method. The Oklahoma method appears in the appendix.
- 1.2** As most commonly defined, this corresponds to a carbon range of $C_{10} - C_{36}$ (boiling point range of approximately 170 °C to 430 °C). This carbon range can include kerosene, several types of jet fuel, several types of diesel fuels, and a number of types of light heating oils. Other petroleum hydrocarbon ranges, any within the $C_8 - C_{38}$ general range, may be characterized using this general method (details concerning the calibration and aliphatic reference standards need to be specified in the project work plan, and the final report must clearly indicate the range used).
- 1.3** Alaska Method AK102 for the determination of diesel range organics defines DRO as a carbon range from the beginning of C_{10} to the beginning of C_{25} (boiling point range of approximately 170 °C to 400 °C). Alaska method AK103 for the determination of residual range organics (RRO) has also been incorporated into this SOP. Alaska Method AK103 defines RRO as a carbon range from the beginning of C_{25} to the end of C_{36} (boiling point range of approximately 400 °C to 500 °C). It should be noted that this is essentially the same range as defined for motor oil.
- 1.4** Refer to Table 1 for boiling point information for the aliphatic hydrocarbons.
- 1.5** Petroleum products such as lubricating oils, waxes, and asphalt can have a significant fraction of higher molecular weight / higher boiling point components that are not detectable under the conditions of this method.

1.6 Analytes, Matrix(s), and Reporting Limits

- 1.6.1** The standard diesel reporting limit for this procedure is 0.1 mg/L for water samples and 4.0 mg/kg for soil samples. The jet fuel and motor oil reporting limits are 1 mg/L (0.5 mg/L for NWTPH) for water samples and 10 mg/kg for soil samples. Other reporting limits may apply to each of the listed methods with the level 1 initial calibration standard being the basis of the calibration for the lowest reporting limit.
- 1.6.2** The standard terphenyls reporting limit for this procedure is 0.005 mg/L for water samples and 0.167 mg/kg for soil samples.
- 1.6.3** Unless otherwise noted the most stringent criteria or common criteria will be reported and adhered to for the methods listed above.
- 1.6.4** On occasion clients may request modifications to this SOP. These modifications are handled following the procedures outlined in SOP DV-QA-0031.

2.0 Summary of Method

- 2.1** The method involves extracting hydrocarbons from aqueous or solid samples with methylene chloride. See SOPs DV-OP-0006, DV-OP-0016, DV-OP-0015, and DV-OP-0007 for water sample extraction, solid sample extraction, and extract concentration procedures, respectively. For solvent-miscible products, medium/high level options are provided.

- 2.2** The methylene chloride extract is concentrated and analyzed with a gas chromatograph equipped with a flame ionization detector (GC/FID). Quantitation is performed by comparing the total peak area within the specified carbon range, both resolved and unresolved peaks, to the response of an authentic fuel or oil calibration standard.

3.0 Definitions

- 3.1 Diesel Range Organics (DRO):** The sum of compounds producing chromatographic peaks, both resolved and unresolved, eluting from:

- the start of the n-decane peak (C_{10}) to the end of n-octacosane (C_{28}), or
- n-decane (C_{10}) to (beginning of for AK101) n-pentacosane (C_{25}), or
- n-decane (C_{10}) to n-docosane (C_{22}), or
- n-decane (C_{10}) to n-tetracosane (C_{24}), or
- n-decane (C_{10}) and n-hexatriacontane (C_{36}).

The markers used for integration for quantitation of DRO varies by method. The 8015 methods imply that the integration begins at the apex minus the RT window for the starting alkane and ends at the apex plus the RT window for the ending alkane marker. The Oklahoma method states that the integration begins 0.1 minutes before the initial alkane and ends 0.1 minutes beyond the ending alkane marker. NWTPH implies that the whole of the hydrocarbon pattern be incorporated into the range of integration (peaks at least down to 10% of the highest representative peak) and that the integration breaks where multiple hydrocarbon patterns are indicated for a single sample.

- 3.2 Diesel Calibration Standard:** A retail-purchased diesel #2 or fuel oil #2 (the two products are essentially the same crude oil distillation cut) used as the calibration stock. The Oklahoma standard uses a ten component (C_{10} - C_{28} , even homologs) blend of alkanes.

- 3.3 Motor Oil (MO):** The sum of the compounds producing chromatographic peaks, both resolved and unresolved, eluting from

- the start of the tetracosane (C_{24}) to n-hexatriacontane (C_{36}), or
- n-docosane (C_{22}) to n-hexatriacontane (C_{36}), or
- (the beginning of for AK103) n-pentacosane (C_{25}) to (the end of for AK103) n-hexatriacontane (C_{36}).

Alaska Method AK103 defines this latter range as "residual range organics."

- 3.4 Jet Propellant-4 (JP-4):** The range is determined by injecting a standard purchased from a vendor and choosing the retention times from the initial low point of the chromatographic peaks to the end of the resolved and unresolved peaks. The hydrocarbon range for this fuel is typically from C_4 to C_{12} .

- 3.5 Jet Propellant-8 (JP-8):** The range is determined by the same method as used for JP-4. The hydrocarbon range for this fuel is typically from C_6 to C_{12} .

3.6 Residual Range Organics (RRO): All compounds producing chromatographic peaks, both resolved and unresolved, eluting between the peak start of n-pentacosane (C_{25}) and the peak end of n-hexatriacontane (C_{36}). See "motor oil" above (Section 3.3).

3.7 Boeing and Oklahoma: These carbon ranges and standards are defined and explained in detail in Appendix 1.

4.0 Interferences

4.1 Although primarily designed as a petroleum hydrocarbon test procedure, other organic compounds including, but not limited to, animal and vegetable oil and grease, chlorinated hydrocarbons, phenols, phthalate esters, and biogenic terpenes are measurable under the conditions of this method. A silica gel cleanup can be used to remove these biogenic and substituted hydrocarbons. The details of the cleanup procedure are not given in this SOP and would have to be detailed in an approved project QAPP.

4.2 Heavier petroleum products such as lubricating oil and crude oil also produce a response within the retention time range for DRO. As defined in the method, the DRO results include these compounds.

4.3 Method interferences are reduced by washing all glassware in accordance with SOP DV-OP-0004. At least one method blank must be analyzed with each extraction batch to demonstrate that the samples are free from method interferences.

4.4 High-purity reagents must be used to minimize interference problems.

4.5 Contamination by carryover can occur whenever high-level and low-level samples are sequentially analyzed. Whenever an unusually concentrated sample is encountered, it should be followed by an analysis of a solvent blank to check for cross-contamination.

5.0 Safety

Employees must abide by the policies and procedures in the Environmental Health and Safety Manual (CW-E-M-001), Radiation Safety Manual and this document. This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

5.1 Specific Safety Concerns or Requirements

5.1.1 Eye protection that satisfies ANSI Z87.1, laboratory coat, and nitrile gloves must be worn while handling samples, standards, solvents, and reagents. Disposable gloves that have been contaminated must be removed and discarded; non-disposable gloves must be cleaned immediately.

5.1.2 The gas chromatograph contains zones that have elevated temperatures. The analyst needs to be aware of the locations of these zones, and must cool them to room temperature prior to working on them.

5.1.3 There are areas of high voltage in the gas chromatograph. Depending on the type of work involved, either turn the power to the instrument off, or disconnect it from its source of power.

5.2 Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating.

NOTE: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.

A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

| Material ⁽¹⁾ | Hazards | Exposure Limit ⁽²⁾ | Signs and Symptoms of Exposure |
|---|----------------------------------|--------------------------------|---|
| Methylene Chloride | Carcinogen Irritant Poison | 25 ppm – TWA 125 ppm – STEL | Causes irritation to respiratory tract. Has a strong narcotic effect with symptoms of mental confusion, light-headedness, fatigue, nausea, vomiting, and headache. Causes irritation, redness, and pain to the skin and eyes. Prolonged contact can cause burns. Liquid degreases the skin. May be absorbed through skin. |
| Acetone | Flammable | 1000 ppm – TWA | Inhalation of vapors irritates the respiratory tract. May cause coughing, dizziness, dullness, and headache. |
| (1) Always add acid to water to prevent violent reactions. (2) Exposure limit refers to the OSHA regulatory exposure limit.. | | | |

6.0 Equipment and Supplies

6.1 Instrumentation

Gas Chromatograph: Analytical system including appropriate gas supply and all required accessories, including a Flame Ionization Detector (FID), column supplies, gases, and syringes. A data system capable of determining peak areas using a forced baseline and baseline projection is required. A data system capable of storing and reintegrating chromatographic data is recommended.

6.2 Supplies

6.2.1 Restek Corporation Rtx®-1 (fused silica), 30 m, 0.32 mm ID, 0.25 µm film thickness.

6.2.1.1 Other columns that meet the performance criteria stipulated in Section 10.0 may be used. Capillary columns are required to achieve the necessary resolution.

6.2.2 2-mL glass vials with Teflon-lined cap (autosampler vials).

6.2.3 40-mL VOA vials with Teflon-lined screw caps.

- 6.2.4 Y-splitter, septa, guard columns, ferrules, Siltek injection port liners, Siltek glass wool. Use Agilent liner 5183-4647 for instrument U2.
- 6.2.5 Microsyringes (μL): 1, 5, 10, 25, 100, 250, 500, 1000, and 5000 μL .
- 6.2.6 Volumetric flasks: 10.0, 50.0, and 100 mL, Class A glass.
- 6.2.7 An analytical balance capable of accurately weighing 0.0001 g must be used for preparing standards. A top-loading balance capable of weighing to the nearest 0.01 g must be used for sample preparation.

6.3 Computer Software and Hardware

- 6.3.1 Please refer to the master list of documents and software located on G:\QA\Read\Master List of Documents\Master List of Documents, Software and Hardware.xls for the current software and hardware to be used for data processing.

7.0 Reagents and Standards

7.1 Reagents

- 7.1.1 Methylene chloride, pesticide grade or equivalent. Each lot must be approved for use in accordance with CA-Q-S--001.
- 7.1.2 Acetone, pesticide grade or equivalent. Each lot must be approved for use in accordance with CA-Q-S-001.
- 7.1.3 Ottawa sand (reagent sand) for solid matrix method blanks and lab control samples.

7.2 Standards

- 7.2.1 RT Reference Standard: DRO Mixture (Tennessee/Mississippi) and Calibration/Window Defining Hydrocarbon Standard. Current source Accu Std DRH-004S-R1-5x and Ultra Sci UST-210 both at 1000 $\mu\text{g}/\text{mL}$.
- 7.2.2 Stock Diesel Fuel Standard – Vendor purchased Diesel fuel oil #2 at a concentration of 50,000 $\mu\text{g}/\text{mL}$ in methylene chloride. Current source Restek 31259.
- 7.2.3 Stock Motor Oil / Residual Range Organics (RRO) Standard – Equal weights of 30-weight and 40-weight motor oils are composited and used to make this standard. Alternatively, the Alaska method standard may be purchased from a commercial source as a stock solution in methylene chloride at a concentration of 50,000 $\mu\text{g}/\text{mL}$. Current source is Ultra Sci RGO-724.
- 7.2.4 Stock Jet Fuel Standards, JP8 and JP4 - Purchased from a vendor at concentrations of 10,000 $\mu\text{g}/\text{mL}$ in methylene chloride.

7.2.5 Stock Surrogate Solution – Purchased as a custom mix from a vendor, consisting of ortho-terphenyl and n-octacosane, at a concentration of 5,000 µg/mL each in methylene chloride. Accu Std S-8087-2.5x.

NOTE: Alaska Method AK103 (RRO) requires the use of n-triacontane-d62 as a surrogate. However, the Alaska Certification Office has granted approval to use n-octacosane (C28) as the surrogate.

7.2.6 Surrogate Spike Solution – Dilute 1.0 mL of Stock Surrogate Solution to a final volume of 250 mL using 90:10 acetone : methylene chloride for a final concentration of each surrogate compound at 20 µg/mL.

7.2.7 Spike Solution – Spike solutions may be prepared as single or multi-component solutions in acetone as follows:

| Standard Solution | Vol of Standard Solution (mL) | Final Vol (mL) | Conc (µg/mL) |
|-----------------------------------|-------------------------------|----------------|--------------|
| Stock Diesel Fuel Standard | 8.0 | 200.0 | 2,000 |
| Stock Jet Fuel Standard (JP8) | 1.0 | 10.0 | 1,000 |
| Stock Jet Fuel Standard (JP4) | 1.0 | 10.0 | 1,000 |
| Stock RRO (or Motor Oil) Standard | 1.0 | 10.0 | 5,000 |

7.2.8 Diesel Fuel Calibration Standards – Diesel fuel calibration standards are prepared in methylene chloride at 7 concentration levels using either the Stock Diesel Fuel Standard (Section 7.2.2) or a higher level calibration standard as summarized in the following table:

| Level | Fuel Standard Solution Used | Volume Used (mL) | Final Volume (mL) | Final Diesel Conc (µg/mL) | Surrogate Conc (µg/mL) |
|-------|-----------------------------|------------------|-------------------|---------------------------|------------------------|
| 7 | Stock | 0.6 | 1.0 | 30,000 | NA |
| 6 | Stock + Stock Surrogate | 1.5 and 0.075 | 5.0 | 15,000 | 75.0 |
| 5 | Level 6 | 0.5 | 1.0 | 7500 | 37.5 |
| 4* | Stock + Stock Surrogate | 1 and 0.05 | 10 | 5000 | 25.0 |
| 3 | Level 4 | 0.2 | 1.0 | 1000 | 5.0 |
| 2 | Level 4 | 0.05 | 1.0 | 250 | 1.25 |
| 1 | Level 4 | 0.02 | 1.0 | 100 | 0.5 |

NOTE: The Level 4 (*) calibration standard is also used as the continuing calibration verification (CCV) standard.

Only the diesel fuel calibration standards contain the surrogates.

- 7.2.9** Jet Fuel Calibration Standards – Jet Fuel (JF) Calibration standards are prepared in methylene chloride at 6 concentration levels using either the Stock Jet Fuel Standards (Section 7.2.4) or a higher level calibration standard as summarized in the following table:

| Level | Fuel Standard Solution Used | Volume Used (mL) | Final Volume (mL) | Final Conc (µg/mL) |
|-------|-----------------------------|------------------|-------------------|--------------------|
| 6 JF | Stock | NA | NA | 10,000 |
| 5 JF | Stock | 0.125 | 0.250 | 5000 |
| 4 JF | Stock | 0.0625 | 0.250 | 2500 |
| 3 JF* | Stock | 1.0 | 10.0 | 1000 |
| 2 JF | Level 3 JF | 0.125 | 0.250 | 500 |
| 1 JF | Level 3 JF | 0.025 | 0.250 | 100 |

NOTE: The Level 3 JF (*) jet fuel calibration standard is used as the CCV standard.

- 7.2.10** Motor Oil / RRO Calibration Standards: Motor Oil (MO) (or Alaska Method RRO) calibration standards are prepared in methylene chloride at 7 concentration levels using either the Stock Motor Oil / RRO Standard (Section 7.2.3) or a higher level calibration standard as summarized in the following table:

| Level | Fuel Standard Solution Used | Volume Used (mL) | Final Volume (mL) | Final Conc (µg/mL) |
|--------|-----------------------------|------------------|-------------------|--------------------|
| 7RRO | Stock | 0.6 | 1.0 | 30,000 |
| 6RRO | 7RRO | 0.5 | 1.0 | 15,000 |
| 5 RRO | 7RRO | 0.250 | 1.0 | 7500 |
| 4 RRO* | Stock | 0.5 | 5.0 | 5000 |
| 3 RRO | Level 4 RRO | 0.2 | 1.0 | 1000 |
| 2 RRO | Level 4 RRO | 0.05 | 1.0 | 250 |
| 1 RRO | Level 4 RRO | 0.02 | 1.0 | 100 |

NOTE: The Level 4 MO (*) calibration standard is used as the CCV standard.

- 7.2.11** Diesel Fuel Continuing Calibration Verification Standard (CCV): The Level 4 Diesel Fuel Calibration Standard (Section 7.2.8) is used as the CCV standard.
- 7.2.12** Jet Fuel CCV Standard: The Level 3 JF jet fuel calibration standard (Section 7.2.9) is used as the jet fuel CCV standard.
- 7.2.13** Motor Oil / RRO CCV Standard: The Level 4 MO motor oil / RRO calibration standard (Section 7.2.10) is used as the motor oil / RRO CCV standard.
- 7.2.14** Second-Source Calibration Verification Standards: A standard containing diesel fuel or motor oil/RRO in methylene chloride at a concentration of 1,000-µg/mL and jet fuel at a concentration of 2,500 µg/mL is used to verify each initial

calibration. This standard uses diesel fuel, jet fuel and motor oil obtained from a source different than the source for the primary standard.

- 7.2.15** Terphenyls Calibration Standards: Make a primary standard by weighing out 100 mg each of the three terphenyl stocks: o-Terphenyl (ChemService Catalog #F1054), p-Terphenyl (ChemService Catalog #F1064), and m-Terphenyl (ChemService Catalog #F105). Bring this mixture up to 10mL final volume with Methylene Chloride to yield a 10,000 ug/mL standard. Make the level 6 calibration standard by mixing 200 ul of the primary standard and 200 ul of the n-Octacosane surrogate (Restek Catalog # 31672) up to a final volume of 10 mL with Methylene Chloride. This yields a 200 ug/mL standard which is used to make the following calibration levels:

| Level | Terphenyl Standard Solution Used | Volume Used (uL) | Methylene Chloride (uL) | Final Conc (ug/mL) |
|-------|----------------------------------|------------------|-------------------------|--------------------|
| 5 | Calibration Level 6 | 225 | 25 | 150 |
| 4 | Calibration Level 6 | 150 | 150 | 100 |
| 3/CCV | Calibration Level 6 | 250 | 750 | 50 |
| 2 | Calibration Level 6 | 100 | 900 | 20 |
| 1 | Calibration Level 6 | 25 | 975 | 5 |

- 7.2.16** Second-Source Calibration Verification Standards: Make a primary standard by weighing out 50 mg each of the three terphenyl stocks: o-Terphenyl (AccuStandard Catalog #T-001N), p-Terphenyl (AccuStandard Catalog #T-003N), and m-Terphenyl (AccuStandard Catalog #T-002N). Bring this mixture up to 10mL final volume with Methylene Chloride to yield a 5,000 ug/mL standard. Make a 200 ug/mL intermediate by mixing 400 ul of the stock with 200 ul of the n-Octacosane surrogate to a final volume of 10 mL with Methylene Chloride. Make a 100 ug/mL ICV standard by using 5 mL of the 200 ug/mL intermediate to a final volume of 10 mL with methylene chloride.

- 7.2.17** The standards listed above may also be prepared from certified commercial sources, in which case, the starting stock standards may be at lower concentrations. One-time deviations from the directions shown above must be recorded in the standards dilution log.

7.3 Standards Verification

All standards are subject to verification using a second-source standard before they are used for sample analysis. This process is described in SOP DV-QA-0015.

7.4 Storage of Stock Standards

Stock standard solutions are stored per vendor recommendations, generally at room temperature. Working level standard solutions are kept refrigerated. Standard solutions must be replaced every six months or sooner as specified by the vendor. Standard

solutions must be replaced more frequently if comparison with check standards indicates a problem.

7.5 Non-Routine Compounds

Other, non-routine compounds not listed in this section may be requested by a client and may be added to this procedure.

- 7.5.1** In these cases, all stock solutions will be obtained from commercial sources and will be verified with a second-source standard as described in Section 7.3 above.
- 7.5.2** Non-routine standards will be stored and treated as described in Section 7.4 above or as specified by the manufacturer.
- 7.5.3** Subsequent dilutions of specially requested compounds will be determined in a manner consistent with the client's recommendations for number of calibration points, inclusion of reporting limit, and concentration range adequate to represent the linearity of the instrument.
- 7.5.4** These specially requested, non-routine compounds either may be added to the dilution scheme used for routine compounds or may be prepared as a separate calibration.
- 7.5.5** All standards preparation for non-routine compounds shall be documented using the same method that is used for routine compounds.

8.0 Sample Collection, Preservation, Shipment and Storage

- 8.1** Water samples are collected in duplicate, in 1-liter amber glass containers with Teflon-lined screw caps. Alaska Method AK102 requires that the water sample be acidified to a pH of 2 using hydrochloric acid.
- 8.2** Soils are collected in a core tube, or 4- or 8-ounce glass jar with Teflon-lined lid. The samples are stored at $\leq 6^{\circ}\text{C}$ from the time of collection until extraction.
- 8.3** Extraction must be performed on water samples within 7 days, and soil samples within 14 days. Methods AK102, AK103, and NWTPH allow a 14 day holding time for water extraction when preserved. All analyses must take place within 40 days from extraction.

9.0 Quality Control

- 9.1** The minimum quality controls (QC), acceptance criteria, and corrective actions are described in this section. When processing samples in the laboratory, use the LIMS QC program code and special instructions to determine specific QC requirements that apply.

- 9.1.1 The laboratory's standard QC requirements, the process of establishing control limits, and the use of control charts are described more completely in TestAmerica Denver policy DV-QA-003P, Quality Control Program.
- 9.1.2 Specific QC requirements for Federal programs, e.g., Department of Defense (DoD), Department of Energy (DOE), AFCEE, etc., are described in TestAmerica Denver policy DV-QA-024P, Requirements for Federal Programs.
- 9.1.3 Project-specific requirements can override the requirements presented in this section when there is a written agreement between the laboratory and the client, and the source of those requirements should be described in the project documents. Project-specific requirements are communicated to the analyst via special instructions in the LIMS.
- 9.1.4 Any QC result that fails to meet control criteria must be documented in a Nonconformance Memo (NCM). The NCM is approved by the supervisor and then automatically sent to the laboratory Project Manager by e-mail so that the client can be notified as appropriate. The NCM process is described in more detail in SOP DV-QA-0031. This is in addition to the corrective actions described in the following sections.

9.2 **Initial Demonstration of Capability**

- 9.2.1 Before analyzing samples, the analyst must demonstrate the ability to operate the instrumentation and generate data that meets method criteria (IDOC). The analyst must also establish a method detection limit (MDL) for each instrument used for a particular method of analysis. The initial demonstration and method detection limit (MDL) studies (see Policy DV-QA-005P) must be acceptable before analysis of samples may begin. An MDL verification standard prepared at approximately two times the MDL is analyzed quarterly to demonstrate the qualitative reliability of the calculated MDL value. MDLs are verified annually or when major changes are made to the analytical processes. Likewise ongoing proficiency must be demonstrated by each analyst on an annual basis. MDLs are stored in the LIMS. See Section 13 for more details on detection limit studies, initial demonstrations of capability, and analyst training and qualification.

9.3 **Sample QC**

The following quality control samples are prepared with each batch of samples.

9.3.1 **Quality Control Batch**

The batch is a set of up to 20 samples of the same matrix processed together using the same reagents and standards. Each quality control batch must contain a method blank (MB), a laboratory control sample (LCS), and matrix spike - matrix spike duplicate (MS/MSD) pair. If there is not enough sample volume for an MS/MSD then a different duplicate LCS may be used to determine precision. For more details see Policy DV-QA-003P.

NOTE: The AK-102 and AK-103 Methods require duplicate LCSs (i.e., LCS and LCSD) for each batch. The NWTPH and Oklahoma methods specify that duplicates be supplied every 10 samples.

9.3.2 Method Blank (MB)

One method blank is analyzed with every preparation batch or every 20 samples, whichever is more frequent. The method blank consists of either 1 liter of organic-free water (for batches of aqueous samples) or 30 grams of Ottawa sand (for batches of soil samples). Method AK102 and 103 specifies a 25 gram sample size for soils. Oklahoma and NWTPH methods specify a 20 gram soil sample size. The method blank is processed exactly as samples in the batch, and is used to assess whether the laboratory processes have contaminated the samples in the batch.

Acceptance Criteria: Results for the method blank must be less than or equal to one-half the reporting limit concentration or less than 10% of the lowest concentration found in the associated samples.

Corrective Action: If the method blank acceptance criteria are not met, identify and correct the source of contamination, and re-prepare and reanalyze the associated samples. If the analyte that was present in the MB was not detected in the affected samples, then the data may be reported with qualifiers (check the project's requirements to be sure that this is allowed) and it must be addressed in the projects narrative.

9.3.3 Laboratory Control Sample (LCS)

9.3.3.1 With the exception of sample batches analyzed by Methods AK-102 or AK-103, one LCS is analyzed with every preparation batch or every 20 samples, whichever is more frequent. The LCS consists of either 1 liter of organic-free water (for batches of aqueous samples) or 30 grams of Ottawa sand (or method designated sample size as noted in Section 9.3.2 for batches of soil samples), to which the analytes of interest are added at a known concentration.

9.3.3.2 Methods AK-102 and AK-103 require the analysis of an LCS and a duplicate LCS (LCSD) with each preparation batch or every 20 samples, whichever is more frequent. The LCS and LCSD consists of either 1 liter of organic-free water (for batches of aqueous samples) or 30 grams (25 grams for AK102 and Ak103) of Ottawa sand (for batches of soil samples), to which the analytes of interest are added at a known concentration.

9.3.3.3 See Table III for spike levels and section 7.2.7 for preparation of the spiking solution. The LCS is processed exactly as samples in the batch and is used to assess the accuracy of the analytical system.

Acceptance Criteria: The percent recovery of the analytes of interest must fall within the established

control limits. For Alaska Methods AK102 and AK103, the acceptance limits are listed in Table V. Oklahoma method specifies a recovery of $\pm 20\%$ (80-120%) for waters and $\pm 40\%$ (60-140%) for soils. For all other methods, the control limits are set at ± 3 standard deviations around the calculated mean of the historical LCS recovery data, unless project-specific control limits apply. Current control limits are stored in the laboratory LIMS. See Policy DV-QA-003P for further details.

Corrective Action: If no MS was prepared for the batch or if the MS and MSD is analyzed and is out of control (per section 9.3.4 below) then the LCS must be assessed and must meet acceptance criteria. If LCS acceptance limits are not met, check the analytical system for proper function and calibration control, make any corrections, then the LCS should be reanalyzed once to confirm that the original analysis is reliable. If the results are still outside control limits, the extraction process must be examined and corrected where problems are identified. The associated samples must then be re-extracted following the corrected procedure and reanalyzed. If the LCS recovery is above the upper control limit, and the associated samples are all below reportable concentrations, the deviation may be described in an NCM, if this is acceptable to the client or allowed by the specific program or project.

9.3.4 Matrix Spike and Matrix Spike Duplicate (MS/MSD)

One matrix spike (MS) and one matrix spike duplicate (MSD) are prepared for each preparation batch. A matrix spike (MS) is a field sample to which known concentrations of target analytes have been added. It is prepared in a manner similar to the LCS, but uses real sample matrix in place of the blank matrix. Field blanks and equipment rinses may not be used to prepare the MS and MSD. The MS and MSD are processed exactly as samples in the batch, and are used to assess the effects of sample matrix on the accuracy and precision of the analytical system. See Table III for spike levels and see section 7.2.7 for preparation of the spiking solution.

Acceptance Criteria: The percent recovery of the analytes of interest must fall within the established control limits. The control limits are set at ± 3 standard deviations around the calculated mean of the historical MS recovery data, unless project-specific control limits apply. Current control limits are

stored in the laboratory LIMS. See Policy DV-QA-003P for further details.

The relative percent difference (RPD) between the MS and MSD must be less than the established control limit, which is based on 3 standard deviations of the mean of the historical data. RPD control limits are maintained in the laboratory LIMS.

Corrective Action: If the analyte recovery in the MS and/or the RPD between the MS and MSD fails acceptance criteria, but all other QC criteria are met, the MS/MSD failure may be attributed to matrix effects and the associated sample results may be reported as qualified. However, some programs (e.g., USACE) require reanalysis to confirm that presumed matrix effects are reproducible. The probable cause of the out of control event must be documented (significant concentration in parent sample, other matrix effects, non homogenous sample, etc.) in an NCM. Where no apparent cause is indicated then the batch should be evaluated for reextraction.

9.3.5 Surrogate Spikes

The calibration standards, field samples, and QC samples are spiked with ortho-terphenyl and n-octacosane surrogates. These surrogates have chemistry similar to the analytes of interest, but are not expected to be found in environmental samples. See Table III for spike levels and Sections 7.2.5 and 7.2.6 for surrogate spike preparation. Surrogate results are used to assess the performance of the analytical system for each field and QC sample.

Acceptance Criteria: The percent recovery of the surrogates must fall within the established control limits. For Alaska Methods AK102 and AK103, the acceptance limits are listed in Table V. For all other methods, the control limits are set at ± 3 standard deviations around the calculated mean of the historical surrogate recovery data, unless project-specific control limits apply. Current control limits are stored in the laboratory LIMS. See Policy DV-QA-003P for further details.

Corrective Action: If surrogate recoveries in the method blank are outside the established limits, verify calculations, standard solutions, and acceptable instrument performance. High surrogate recoveries in the blank might be acceptable if the surrogate recoveries for the field samples and other QC samples in the batch are in control. Low surrogate recoveries in the blank require re-preparation and re-analysis of the samples, unless the sample surrogate recoveries are in control and the targeted compounds are not found in the affected samples.

If the sample surrogate recoveries are outside the established limits, verify calculations, dilutions, standard solutions, and acceptable instrument performance. High recoveries may be due to a co-eluting matrix interference and the chromatogram should be examined for evidence of this. Low recoveries may be due to adsorption by the sample matrix (e.g., clay particles, peat, or organic material in the sample). Recalculate the results and/or reanalyze the extract if the checks reveal a problem.

If the surrogate recovery is outside the established limits due to well-documented matrix effects, the results must be flagged and an explanation included in the report narrative. As with matrix spike failures, some programs (e.g., USACE) may require additional analyses to confirm suspected matrix interferences. The decision to reanalyze or flag the data should be made in consultation with the client. If matrix interference is not obvious, it is only necessary to re-prepare / reanalyze a sample once to demonstrate that a matrix effect is reproducible. The decision to re-prepare samples for out of control surrogate outside of the holding time should be made when consultation with the client indicates that this corrective action will be satisfactory.

9.3.6 RT Reference Standard

A combination of two n-alkane mixtures is analyzed to establish the retention time (RT) window for each initial calibration. The Tennessee / Mississippi DRO mixture is composed of all n-alkanes from C₁₀ – C₂₅ and the Calibration / Window Defining Hydrocarbon Standard is composed of all even-numbered n-alkanes from C₈ – C₄₀. The instrument conditions should be chosen so that each alkane component is completely resolved from the next alkane component (this is necessary in order to define each range as different from another specified range).

10.0 Calibration and Standardization

10.1 Instrumentation.

- 10.1.1** TestAmerica Denver gas chromatograph instrument systems are computer controlled to automatically inject samples and process the resulting data.
- 10.1.2** Instrument conditions are shown in Table IV.
- 10.1.3** The routine injection volume is 1 µL.
- 10.1.4** GC run conditions and columns must be chosen to meet the acceptance criteria for the RT Reference Standard listed in Section 9.3.6 and the calibration criteria in Section 10.
- 10.1.5** Detailed information regarding calibration models and calculations can be found in Corporate SOP CA-Q-S-005, *Calibration Curves (General)* and under the public folder Arizona Calibration Training.

- 10.1.6** Unprocessed calibration data are transferred to the TARGET DB database for processing. After processing the calibration data, print the calibration report and review it using the calibration review checklist, GC and HPLC ICAL TALS Review Checklist. (See SOP DV-QA-0020.) Submit the calibration report to a qualified peer or the group leader for final review. The completed calibration reports are scanned and stored as Adobe Acrobat files on the Public Drive.
- 10.1.7** A new calibration curve must be generated initially, after major changes to the system, or when continuing calibration criteria cannot be met. Major changes include installation of new columns and changing FID jets.

10.2 Calibration

- 10.2.1** The ICAL is performed using the concentration levels described in Sections 7.2.8 for diesel fuel, 7.2.9 for the jet fuels, and 7.2.10 for motor oil. Calibration levels are also presented in Table II. Although some methods allow as few as three calibration levels, the minimum number of calibration levels will be maintained as five levels for the purpose of this SOP.
- 10.2.1.1** Several separate initial calibration curves (ICALs) are required to calibrate for all the mixtures. An ICAL must always be maintained for the diesel fuel as these standards contain the surrogate compounds. ICALs for the other mixtures are analyzed as needed, depending upon the requested parameters. Samples may be calculated as one or more mixtures, dependent upon the project requirements.
- 10.2.1.2** The lowest calibration concentration is equal to the laboratory reporting limit (RL) concentration. The highest standard defines the highest sample extract concentration that may be reported without dilution.
- 10.2.1.3** It is not acceptable to remove points from a calibration curve for the purpose of meeting criteria, however, the lowest point or the highest point may be removed and the RL or maximum concentration adjusted accordingly (as long as the minimum number of calibration points is sufficient for the curve used). Transfer calibration standard solutions into autosampler vials and load onto the GC autosampler. Use the Chem Station software to set up the analytical sequence.
- 10.2.2** The external standardization method is used. Tabulate the area response for each calibration level against the concentration injected. The ratio of the response to the concentration injected, defined as the calibration factor (CF), is calculated for the standard at each concentration as follows:

$$CF_i = \frac{A_{fuel}}{C_{fuel}}$$

Where:

- CF_i = Calibration factor for the i^{th} calibration level.
 A_{fuel} = Total area of the fuel calibration standard peak.
 C_{fuel} = Concentration of fuel calibration standard, mg/mL

10.3 Establishing the Calibration Function

Calibrations are modeled either as average calibration factors or as calibration curves, using a systematic approach to selecting the optimum calibration function. Start with the simplest model, i.e., a straight line through the origin and progress through other options until the calibration criteria are met. Pay particular attention to the residuals noticed at the upper and lower end of the curves. This may be cause for rejection of a curve fit even if the calibration acceptance criteria are met.

10.3.1 Linear Calibration Using Average Calibration Factor

Tabulate the peak area response for each target analyte or hydrocarbon range in each calibration level against the concentration injected. For each analyte in each calibration standard, calculate the calibration factor (CF) as shown in section 10.2.2 above. The calibration factor is a measure of the slope of the calibration line, assuming that the line passes through the origin. Under ideal conditions, the factors calculated for each calibration level will not vary with the concentration of the standard. In practice, some variation can be expected. When the variation, measured as the relative standard deviation, is relatively small (e.g., $\leq 20\%$), the use of the straight line through the origin model is generally appropriate.

For each target analyte, calculate the average calibration factor as follows:

$$\text{Average Calibration Factor} = \overline{CF} = \frac{\sum_{i=1}^n CF_i}{n} \quad \text{Equation 4}$$

Where:

- CF_i = Calibration factor for the i^{th} calibration level.
 n = The number of calibration levels.

The relative standard deviation (RSD) is calculated as follows:

$$RSD = \frac{SD}{\overline{CF}} \times 100\% \quad \text{Equation 5}$$

Where SD is the standard deviation of the average CF, which is calculated as follows:

$$SD = \sqrt{\frac{\sum_{i=1}^n (CF_i - \overline{CF})^2}{n-1}}$$

Equation 6

10.3.2 If the percent relative standard deviation (%RSD) for the average (mean) of the calculated calibration factors is less than 20%, the average calibration factor can be used for sample quantitation. Methods AK102 and AK103 require the % RSD to be <25%.

10.3.3 Evaluation of the Average Calibration Factor

The calibration relationship can be graphically represented as a line through the origin with a slope equal to the average calibration factor. Examine the residuals, i.e., the difference between the actual calibration points and the plotted line. Particular attention should be paid to the residuals for the highest points, and if the residual values are relatively large, a linear regression should be considered. SW-846 Method 8000B allows evaluation of the grand average RSD across all analytes, but TestAmerica-Denver evaluates each analyte individually.

Acceptance Criteria: The RSD must be $\leq 20\%$ (AK102/AK103 upper limit is 25%).

Corrective Action: If the RSD exceeds the limit, linearity through the origin cannot be assumed, and a least-squares linear regression should be attempted.

10.3.4 Linear Calibration Using Least-Squares Regression

Calibration using least-squares linear regression produces a straight line that does not necessarily pass through the origin. The calibration relationship is constructed by performing a linear regression of the instrument response (peak area or peak height) versus the concentration of the standards. The instrument response is treated as the dependent variable (y) and the concentration as the independent variable (x). The regression produces the slope and intercept terms for a linear equation in the following form:

$$y = ax + b$$

Equation 7

Where:

- y = Instrument response (peak area or height).
- x = Concentration of the target analyte in the calibration standard.
- a = Slope of the line.
- b = The y-intercept of the line.

For an external standard calibration, the above equation takes the following form:

$$A_s = aC_s + b \quad \text{Equation 8}$$

To calculate the concentration in an unknown sample extract, the regression equation is solved for concentration, resulting in the following equation, where C_s is now C_e , the concentration of the target analyte in the unknown sample extract.

$$C_e = \frac{A_e - b}{a} \quad \text{Equation 9}$$

Where:

- A_s = Area of the chromatographic peak for the target analyte in the calibration standard.
- A_e = Area of the chromatographic peak for the target analyte in the sample extract.
- a = Slope of the line as determined by the least-squares regression.
- C_s = Concentration of the target analyte in the calibration standard.
- C_e = Concentration of the target analyte in the sample extract.
- b = Intercept of the line as determined by the least-squares regression.

10.3.5 Linear Regression Evaluation

With an unweighted linear regression, points at the lower end of the calibration curve have less weight in determining the curve than points at the high concentration end of the curve. For this reason, inverse weighting of the linear function is recommended to optimize the accuracy at low concentrations. Note that the August 7, 1998 EPA memorandum "Clarification Regarding Use of SW-846 Methods", Attachment 2, Page 9, includes the statement "The Agency further recommends the use of a weighted regression over the use of an unweighted regression."

Acceptance Criteria: To avoid bias in low level results, the absolute value of the y-intercept must be significantly less than the reporting limit, and preferably less than the MDL.

Also examine the residuals, paying particular attention to the residuals at the low end of the curve. If the intercept or the residuals are large, a second-order regression should be considered.

The linear regression must have a correlation coefficient (r) ≥ 0.990 . Some programs (e.g., AFCEE, DoD) require a correlation coefficient ≥ 0.995 . Note that the AK102/AK103 method requires that r^2 be greater than or equal to 0.995.

Corrective Action: If the correlation coefficient falls below the acceptance limit, linear regression cannot be used and a second-order regression should be attempted.

10.3.6 Non-Linear Calibration

When the instrument response does not follow a linear model over a sufficiently wide working range, or when the previously described calibration approaches fail acceptance criteria, a non-linear, second-order calibration model may be employed. The second-order calibration uses the following equation:

$$y = ax^2 + bx + c \quad \text{Equation 10}$$

Where a , b , and c are coefficients determined using a statistical regression technique; y is the instrument response; and x is the concentration of the target analyte in the calibration standard.

10.3.7 Non-Linear Calibration Evaluation

A minimum of six points must be used for a second-order regression fit.

Second-order regressions should be the last option. Note that some programs (e.g., South Carolina) do not allow the use of second-order regressions.

Before selecting a second-order regression calibration model, it is important to ensure the following:

- The absolute value of the intercept is not large relative to the lowest concentrations being reported.
- The response increases significantly with increasing standard concentration (i.e., the instrument response does not plateau at high concentrations).
- The distribution of concentrations is adequate to characterize the curvature.

Acceptance Criteria: The coefficient of determination must be ≥ 0.990 .

Corrective Action: If the coefficient of determination falls below the acceptance limit and the other calibration models are unacceptable, the source of the problem must be investigated and the instrument recalibrated. Third-order regressions are not allowed at TestAmerica Denver.

Note: Method 8015C and the NWTPH method require that the calibration points be "back calculated" to the line or curve and that each point be within $\pm 20\%$ (for 8015C) and 15% (for NWTPH) of the expected concentration for that point. See the specific method for how to apply

any exceptions (involves a narrowing of the concentration range to within the area that is within control).

10.3.8 Second-Source Initial Calibration Verification (ICV)

10.3.8.1 A second-source initial calibration verification (ICV) standard is prepared as described in section 7.2.14 and analyzed immediately after each ICAL. This standard can also be used as the continuing calibration verification (CCV) standard. The response for this standard must be within $\pm 20\%$ of the response predicted from the ICAL (AK102/AK103 method requires the standard response to be within $\pm 25\%$ and 8000B requires $\pm 15\%$).

10.3.8.2 The percent difference between the measured ICV calibration factor (or the measured concentration of the ICV standard) and the ICAL calibration factor (or the known concentration of the ICV standard) is calculated as follows:

$$\text{Percent Difference} = \frac{R_1 - R_2}{R_1} \times 100\%$$

Where:

R_1 = Average calibration factor from the calibration curve or the ICV known value.

R_2 = Calculated calibration factor for the ICV analysis or the measured ICV value.

10.3.8.3 If the percent difference for the second-source verification falls outside of $\pm 20\%$ (25% for AK102/AK103, $\pm 15\%$ for 8000B), then sample analysis cannot be performed. Reanalyze the second-source verification standard to confirm the original result. If the second result fails, then re-prepare the verification standard, and/or re-prepare and rerun the ICAL. The ICV must be analyzed under the same conditions that were used for the ICAL.

10.3.9 Continuing Calibration Verification (CCV)

10.3.9.1 A CCV standard (see Sections 7.2.11 through 7.2.13 for CCV standard concentrations) is analyzed at the beginning of the analytical sequence, every 12 hours of operation, or every 20 samples (whichever is more frequent), and at the end of the analytical sequence. A CCV must be included in each bracket for each fuel type that is requested and quantified for the samples and QC in the bracket.

10.3.9.2 The 8000 series methods (and some state specific methods-Arizona) indicate the need for two levels for the CCV where non-linear calibrations are used and all other methods indicate a single mid-point CCV. The response for this standard must be within $\pm 20\%$ (25% for AK102/AK103) of the response predicted from the ICAL (see previous equation).

Note: it is not necessary to run a CCV standard at the beginning of the sequence if samples are analyzed immediately after the completion of the initial calibration.

10.3.9.3 If the percent difference between the measured CCV value and the expected CCV value falls outside of the method criteria, first check the accuracy of the CCV standard. Method criteria for %D for the CCV are:

- $\pm 20\%$ for Method 8015C or 8015D (Method 8000C)
- $\pm 25\%$ for AK102/AK103
- $\pm 15\%$ for Method 8015B (8000B) and NWTPH

If the standard is accurate and the results fail acceptance criteria then the instrument must be recalibrated and all samples analyzed since the last successful CCV must be reanalyzed.

10.3.9.4 In some cases the nature of the samples being analyzed may be the cause of the failing %D. If such matrix effects are suspected then those samples must be reanalyzed (at a dilution if column damage is imminent) to prove matrix effect. If the drift is repeated in the reanalysis, the analyst must generate an NCM for this occurrence to explain that the drift was most likely attributable to the sample matrix and that the samples may be diluted and reanalyzed to minimize the effect if so desired by the client.

10.3.9.5 For any analyte not detected in the client samples, the %D for that analyte in the bracketing CCVs should also be within 20%, however, the results may be acceptable (with client approval) if the drift is positive (high). An NCM must be written to explain this case.

10.4 Retention Time Window Definition

10.4.1 Before establishing RT windows, be certain that the GC system is within optimum operating conditions. Analyze a diesel fuel CCV Standard (Section 7.2.11) and a Retention Time Reference Standard (section 7.2) three times each throughout the course of a 72-hour period. Serial injections over less than a 72-hour period result in retention time windows that are too tight.

10.4.2 Calculate the mean and standard deviation of the three absolute retention times for each compound, carbon range of interest, and each surrogate. Table 1 lists the boiling points for the aliphatic hydrocarbons used in the retention time reference standard.

10.4.2.1 The width of the retention time window for an individual peak is defined as ± 3 times the standard deviation of the mean absolute retention time established during the 72-hour period for each component.

10.4.2.2 In those cases where the calculated window for a particular analyte is less than the default window, use ± 0.05 minute (AK102 and AK103) ± 0.03 (8000 methods) and ± 0.1 min (Oklahoma) as the retention time window.

- 10.4.3** The laboratory must calculate retention time windows for each standard on each GC column and whenever a new GC column is installed. The data must be retained by the laboratory.

11.0 Procedure

- 11.1** One-time procedural variations are allowed only if deemed necessary in the professional judgment of supervision to accommodate variation in sample matrix, radioactivity, chemistry, sample size, or other parameters. Any variation in procedure shall be completely documented using an NCM. The NCM is approved by the supervisor or appropriate second level review and then automatically sent to the laboratory Project Manager by e-mail so that the client can be notified as appropriate. The NCM process is described in more detail in SOP DV-QA-0031. The NCM shall be filed in the project file and addressed in the case narrative.

- 11.1.1** Any deviations from this procedure identified after the work has been completed must be documented as a nonconformance, with a cause and corrective action described. An NCM must be used for this documentation

11.2 Sample Preparation

Refer to extraction SOPs DV-OP-0006 for aqueous samples and DV-OP-0016 for soil samples. In the case of samples with an organic matrix, waste dilution SOP DV-OP-0012 may apply.

11.3 Instrument Maintenance

Before the start of any daily sequence the instrument system should be evaluated for possible maintenance. If the previous run ended with a failing continuing calibration then the system should be maintained to bring it back into control. The injector septum should be changed after about 200 injections have been completed. If the last CCV that was analyzed indicated a high response then a simple liner change is typically sufficient to bring the system back into control. Analysis of a few solvent blanks or a system bake out may be necessary to drive out any residual contamination on the column. A reduced response may indicate that the system needs to be evaluated for leaks. Poor peak shape may necessitate clipping a loop out of the analytical column. If this fails to solve the peak shape problem then replacement of the columns may be indicated. The goal is to maintain the system as close to top condition as possible as was observed when new columns and injector parts were installed. Re-calibration should not be used to correct for maintenance related issues. Always document any maintenance procedure in the maintenance logbook.

11.4 Analytical Sequence

- 11.4.1** The analytical sequence starts with a RT reference standard, an initial calibration (ICAL) and initial calibration verification (ICV) or with a continuing calibration verification (CCV) (see Section 10).
- 11.4.2** An instrument blank (injection of methylene chloride solvent) must be included in each analytical sequence. The instrument blank must meet the same acceptance criteria as the method blank (with the exception of surrogate recoveries).

- 11.4.3** A CCV standard is interspersed in the analytical sequence after 12 hours have elapsed or after 20 samples have been analyzed, whichever is more frequent. More frequent analysis of the CCV is recommended (and required by some programs) in order to minimize the number of samples needed to be reanalyzed in the event of an out of control recovery for the CCV.
- 11.4.4** Any sample suspected of being highly concentrated should be followed by an instrument blank to prevent carryover. If the blank analysis shows contamination beyond established "blank acceptance criteria", the column must be baked out and subsequent blanks analyzed until the system is shown to be free from contaminants. If possible do not aliquot the entire sample volume. Use limited volume autosample vials so that an unused volume remains for possible repeat analyses.
- 11.4.5** If the measured concentration of any sample exceeds the highest calibration standard concentration, the sample extract must be diluted with methylene chloride and reanalyzed. See section 12.3 for dilution guidelines.
- 11.4.6** The analytical sequence is closed with a final CCV.

11.5 Daily Retention Time Windows

- 11.5.1** At the beginning of each daily analytical sequence, the RT Reference Standard (Section 7.2) is analyzed. The retention time windows for each diesel / motor oil range are adjusted based on the analysis of each n-alkane. The center of the retention time windows for the jet fuels are adjusted based on the analysis of the chromatography of any level of the jet fuel calibration standard. The center of the retention time windows must be updated at the beginning of each analytical sequence but not for any other CCV standards.
- 11.5.2** A notation is made in the run sequence log to identify any standard used for the retention time verification and adjustments.

11.6 Sample Analysis

11.6.1 Baseline Used for Integration

- 11.6.1.1** The same type of baseline must be applied equally to standards and samples. It is important that the baseline is drawn consistently by each analyst in the GC group, which must be part of the training for new analysts.
- 11.6.1.2** For the analysis of samples containing hydrocarbons that completely elute in the C₁₀ to C₂₈ range, the baseline should be drawn as shown in the example in Attachment 1. For routine analysis, this should be similar to the baseline produced by a method blank. Note that because of column bleed, this is not a flat, horizontal common baseline.
- 11.6.1.3** Measure the area of the methylene chloride blank projecting a horizontal baseline across the retention time range for DRO.

- 11.6.1.4** Valley-to-valley baselines should not be used. See the example in Attachment 2. Correct the instrument integration settings to minimize the number of manual integrations as shown in the example.
- 11.6.1.5** Samples containing high concentrations of hydrocarbons heavier than diesel do not completely elute in the C₁₀-C₂₈ range. Precise and consistent integration can be difficult. Construction of the baseline requires some experience and judgment on the part of the analyst. Unless otherwise instructed in the client requirements, baseline to baseline integration will be used.
- 11.6.1.6** When such samples are encountered, it may be necessary to run an additional solvent blank to be sure that there is no carryover between samples.
- 11.6.1.7** The USACE requires construction of a baseline equivalent to that observed in the method blank (see the example in Attachment 3), unless approved project documents specify a different approach.
- 11.6.1.8** Some projects can require a common baseline from the signal at the beginning of the pattern to the signal at the end of the pattern (see the example in Attachment 4).
- 11.6.1.9** Always consult special project instructions for requirements for the baseline.
- 11.6.1.10** The requested fuel in the sample is determined by calculating the concentration of the target fuel using the summation of peak responses (i.e., peak areas) for all chromatographic peaks eluting between the retention time windows as determined in sections 10.4 and 11.4, using the average calibration factor or the calibration function determined in Section 10.

Using the average calibration factor, the concentration of the target fuel in the sample extract is calculated as follows:

$$C_e = \frac{A_e}{\overline{CF}}$$

Where:

C_e = Concentration of target fuel in the sample extract, mg/mL.

A_e = Total area of peaks for target fuel.

\overline{CF} = Average calibration factor for target fuel.

- 11.6.2** Using the least-squares regression calibration, the concentration of the target fuel in the sample extract is calculated by solving the least-squares calibration equation for concentration as follows:

$$C_e = \frac{A_e - b}{m}$$

Where:

- A_e = Area of the chromatographic peak for the target fuel in the sample extract.
- m = Slope of the line as determined by the least-squares regression.
- C_e = Concentration of the target fuel in the sample extract, mg/mL.
- b = Intercept of the line as determined by the least-squares regression.

11.6.3 The concentration of the target fuel in the actual sample can then be calculated using the equation below. Actual calculations are performed by the chromatography software.

$$C = \frac{C_e V_e}{V_s} \times DF$$

Where:

- C = Concentration of target fuel in original sample, mg/L or mg/kg.
- C_e = Concentration of the extract that is injected into the GC. mg/mL.
- V_e = Volume of the extract in mL.
- V_s = Amount of sample extracted in L or kg.
- DF = Dilution factor, if dilution was performed on the sample prior to analysis. If no dilution was made, $DF = 1$ mL/mL.

If required for solid samples, the percent moisture calculation can be included in the data package. Percent moisture corrections are made automatically in the laboratory's LIMS.

11.6.4 Confirmation

Second column confirmation is not normally performed for this method as confirmation of chemical identity does not have to be specific.

11.6.5 Data Review

11.6.5.1 First level review is conducted by the analyst to ensure that all acceptance criteria are met, the analysis is properly documented, and the data are correctly uploaded into the LIMS. This is documented using the checklist prescribed in SOP DV-QA-0020, Organic Data Review.

- 11.6.5.2** Second level review is conducted by the supervisor of the group or an analyst appointed by the supervisor. Details of this review and the documentation are described in SOP DV-QA-0020. If problems are found with the data package, then the data are reviewed with the analyst.
- 11.6.5.3** Other reviews (PM Level III review and QA Data Reviews) are described in the TestAmerica Quality Assurance Manual (QAM), and associated TestAmerica policies and procedures.

12.0 Calculations / Data Reduction

12.1 Calculations

12.1.1 LCS and Surrogate Spike Recovery Calculation

LCS and surrogate spike recoveries are calculated using the following equation:

$$\% \text{ Recovery} = \frac{\text{Concentration (or amount) found}}{\text{Concentration (or amount) spiked}} \times 100\% \quad \text{Equation 15}$$

12.1.2 MS and MSD Recovery Calculation

Matrix spike recoveries are calculated as follows:

$$\text{MS or MSD \% Recovery} = \left(\frac{SSR - SR}{SA} \right) \times 100\% \quad \text{Equation 16}$$

Where:

SSR = Measured concentration in spiked sample.

SR = Measured concentration in unspiked sample.

SA = Concentration of spike added to sample.

12.1.3 MS/MSD RPD Calculation

The relative percent difference between the MS and MSD is calculated as follows:

$$\% \text{ RPD} = \frac{|R_1 - R_2|}{\frac{1}{2}(R_1 + R_2)} \times 100\% \quad \text{Equation 17}$$

Where R_1 is the result for the MS and R_2 is the result for the MSD.

12.1.4 Concentration of Analyte in the Sample Extract

Depending on the calibration function used, the concentration of the analyte in the sample extract is calculated as follows (see Section 10.3 for details on establishing the calibration function):

Average Calibration Factor: $C_e = \frac{A_s}{CF}$ Equation 18

Linear Regression: $C_e = \frac{[A_s - b]}{a}$ Equation 19

Non-Linear Regression: $C_e = f(A_s)$ Equation 20

Where:

- C_e = Concentration of the analyte in the sample extract (ng/mL).
- A_s = Peak area for the analyte in the sample extract injection.
- b = y-intercept of the calibration fit.
- a = Slope of the calibration fit.
- $f(A_s)$ = Mathematical function established by the non-linear regression.

12.1.5 Concentration of Analyte in Original Sample (for 1 uL injection)

$$C_{sample} = \frac{C_e}{1000 \frac{ng}{\mu g}} \times \frac{V_e}{V_s} \times DF$$
 Equation 21

Where:

- C_{sample} = Concentration of analyte in original sample (μg/L or μg/kg).
- C_e = Concentration of analyte in sample extract injected in GC (ng/mL).
- $1000 \frac{ng}{\mu g}$ = Factor to convert ng/mL to μg/mL.
- V_e = Volume of sample extract (mL).
- V_s = Volume (or weight) of original sample (L or kg).
- DF = Dilution Factor (post extraction dilutions)

12.2 Qualitative Identification of Terphenyls

- 12.2.1** Tentative identification of an analyte occurs when a peak is found on the primary column within the RT window for that analyte, at a concentration above the reporting limit, or above the MDL if qualified data (J flags) are to be reported. Identification is confirmed if a peak is also present in the RT window for that analyte on the second (confirmatory) column and if the analyte concentration is greater than the MDL. When confirmation is made using a second column, the analysis on the second column must meet all of the QC criteria for continuing calibration verification and RTs.
- 12.2.2** The experience of the analyst should weigh heavily in the interpretation of the chromatogram. For example, sample matrix or laboratory temperature fluctuation may result in variation of retention times. If a RT shift greater than the RT window occurs for a reported compound the situation must be explained in an NCM.

12.3 Dual-Column Quantitation and Reporting of Terphenyls

- 12.3.1** A primary column is designated. The result from the primary column is normally reported. If the continuing calibration verification fails on one of the columns, the appropriate corrective action must be taken. The result from the secondary (confirmation) column may be reported if either of the following possibilities are true:

12.3.1.1 There is obvious chromatographic interference on the primary column.

12.3.1.2 The result on the primary column is > 40% greater than the result on the secondary column.

12.3.2 Terphenyl Dual Column Results With >40% RPD

12.3.2.1 If the relative percent difference (RPD) between the responses on the two columns is greater than 40%, the higher of the two results is reported unless there is obvious interference documented on the chromatogram.

12.3.2.2 If there is visible positive interference, e.g., co-eluting peaks, elevated baseline, etc., for one column and not the other, then report the results from the column without the interference with the appropriate data qualifier flag, footnote, and/or narrative comment in the final report.

12.3.2.3 If there is visible positive interference for both columns, then report the lower of the two results with the appropriate flag, footnote, and/or narrative comment in the final report.

12.3.2.4 The RPD between two results is calculated using the following equation:

$$RPD = \frac{|R_1 - R_2|}{\frac{1}{2}(R_1 + R_2)} \times 100\%$$

Where R_1 is the result for the primary column and R_2 is the result for the confirmation column.

- 12.4** All data are subject to two levels of review, which is documented on a checklist, as described in SOP DEN-QA-0020.

12.5 Calibration Range and Sample Dilutions

- 12.5.1** If the concentration of any analyte exceeds the working range as defined by the calibration standards, then the sample must be diluted with methylene chloride (record the lot number in the run sequence) and reanalyzed. Dilutions should target the most concentrated analyte in the upper half (over 50% of the high level standard) of the calibration range. Samples that were analyzed immediately following the high sample must be evaluated for carryover. If the samples have results at or above the RL for the analyte(s) that were found to be over the calibration range in the high sample, they must be reanalyzed to rule out carryover, unless other objective evidence indicates that the detection is not the result of carryover. Such evidence may include an observation where carryover was not observed when samples or blanks were analyzed after another sample with similar high compound recovery or when the detection in the sample with suspected carryover is much higher than the expected amount of carryover (i.e. the sample's concentration may be similar to or higher than the concentration found in the previous sample). It may also be necessary to dilute samples because of matrix interferences.
- 12.5.2** If the initial diluted run has no hits or hits below 20% of the calibration range, and the matrix allows for analysis at a lesser dilution, then the sample must be reanalyzed at a dilution targeted to bring the largest hit above 50% of the calibration range.

13.0 Method Performance

13.1 Method Detection Limit Study (MDL)

- 13.1.1** An initial method detection limit study is performed in accordance with Policy DV-QA-005P. An MDL study is performed once a year to satisfy NELAC 2003 requirements. For DoD, AFCEE, and DOE projects, an MDL verification is performed quarterly.
- 13.1.2** The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses

performed; these are performed at least annually unless method requirements require a greater frequency.

13.2 Demonstration of Capabilities

13.2.1 All personnel are required to perform an initial demonstration of proficiency (IDOC) on the instrument they will be using for analysis prior to testing samples. On-going proficiency must be demonstrated annually.

13.2.2 IDOCs and on-going proficiency demonstrations are conducted as follows. Four aliquots of the QC check sample are analyzed using the same procedures used to analyze samples, including sample preparation. The concentration of the QC check sample is typically the LCS spike level. The results of the IDOC study are summarized in the NELAC format, as described in SOP DV-QA-0024. IDOCs are approved by the Quality Assurance Manager and the Technical Director. IDOC records are maintained by the QA staff in the central training files.

13.2.3 The Oklahoma method requires that the analyst must make an initial demonstration of the ability to generate acceptable accuracy and precision with this method by successful analysis of the following:

13.2.3.1 Analysis of 7 replicates of the diesel component standard at a concentration of 100 ug/L of total DRO in organic-free water with recoveries of all components within $\pm 40\%$ of the known concentration and precision of all replicates within $\pm 30\%$.

13.2.3.2 Analysis of 7 replicates of DRO_free sand at a concentration of 10 mg/kg of total DRO with all recoveries within $\pm 40\%$ of the known concentration and precision of all replicates within $\pm 30\%$.

13.2.3.3 As an exception use the NELAC recommended procedure for initial demonstration of capability in place of this procedure.

13.3 Training Requirements

The Group/Team leader has the responsibility to ensure that this procedure is performed by an associate who has been properly trained in its use and has the required experience. See requirements for demonstration of analyst proficiency in SOP DV-QA-0024.

14.0 Pollution Control

It is TestAmerica's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability). Employees must abide by the policies in Section 13 of the Environmental Health and Safety Manual (M-E-001 DV) for "Waste Management and Pollution Prevention."

Standards and reagents are prepared in volumes consistent with laboratory use to minimize the volume of expired standards and reagents requiring disposal.

15.0 Waste Management

15.1 All waste will be disposed of in accordance with Federal, State, and local regulations. Where reasonably feasible, technological changes have been implemented to minimize the potential for pollution of the environment. Employees will abide by this procedure, the policies in section 13, "Waste Management and Pollution Prevention", of the Corporate Environmental Health and Safety Manual, and DV-HS-001P, "Waste Management Program."

15.2 The following waste streams are produced when this method is carried out:

- Expired Chemicals/Reagents/Standards – Contact Waste Coordinator
- Vial waste – Expired Extract Vials – Waste Stream A

NOTE: Radioactive and potentially radioactive waste must be segregated from non-radioactive waste as appropriate. Contact the Radioactive Waste Coordinator for proper management of radioactive or potentially radioactive waste generated by this procedure.

16.0 References / Cross-References

16.1 Determinative Chromatographic Separations, , SW-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition and all promulgated updates, EPA Office of Solid Waste, January 2005.

16.1.1 Method 8000B, Determinative Chromatographic Separations, Revision 2, December 1996

16.1.2 Method 8000C, Determinative Chromatographic Separations, Revision 3, March 2003.

16.1.3 Method 8015B, Nonhalogenated organics by Gas Chromatography, Revision 2, December 1996.

16.1.4 Method 8015C, Nonhalogenated organics by Gas Chromatography, Revision 3, February 2007.

16.1.5 Method 8015D, Nonhalogenated organics by Gas Chromatography, Revision 4, June 2003.

16.1.6 Method 3510C, Separatory Funnel Liquid-Liquid Extraction, Revision 3, December 1996.

16.1.7 Method 3546, Microwave Extraction, Revision 0, February 2007.

- 16.1.8** Method 3550B, Ultrasonic Extraction, Revision 3, December 1996.
- 16.1.9** Method 3550C, Ultrasonic Extraction, Revision 4, February 2007.
- 16.2** State of California "Leaking Underground Fuel Tank Field Manual", December 1987.
- 16.3** Alaska Method AK102, "For the Determination of Diesel Range Organics", Version 04/08/02.
- 16.4** Alaska Method AK103, "For the Determination of Residual Range Organics", Version 04/08/02.
- 16.5** NWTPH-HCID "Hydrocarbon Identification Method for Soil and Water," Manchester Environmental Laboratory, Dept. of Ecology, State of Washington.
- 16.6** Oklahoma Department of Environmental Quality, Methods 8000/8100 (modified), Diesel Range Organics (DRO), October 22, 1997, Rev. 4.1.

17.0 Modifications from Source Methods

- 17.1** The California LUFT method uses carbon disulfide as the extraction solvent, whereas this SOP uses methylene chloride.
- 17.2** The California LUFT method uses a 20-gram sample size, which is extracted for four hours on a mechanical shaker. This SOP uses a 30-gram portion of sample, which is extracted per EPA Method 3550C (sonication).
- 17.3** Alaska Method AK103 for residual range organics (RRO) does not include analysis of aqueous samples. This SOP does provide for the determination of RRO, as defined in the Alaska method, in water.
- 17.4** The NELAC IDOC procedure is used in place of the Oklahoma IDOC procedure.

18.0 Attachments

Table I: Aliphatic Hydrocarbon Standard

Table II: Calibration Levels

Table III: Spike Levels for Quality Control

Table IV: Recommended GC Conditions

Table V: Alaska Methods AK102 and AK103 Acceptance Criteria for Quality Control

Table VI: DRO and RRO Method Summary Comparison Chart

Attachment 1: Routine DRO Integration

Attachment 2: Valley-to-Valley Integration Cannot Be Used

Attachment 3: Heavy Hydrocarbons with Baseline from Method Blank

Attachment 4: Heavy Hydrocarbons with Signal-to-Signal Integration

Attachment 5: Retention Time Reference Standard

Appendix 1: Oklahoma / Boeing Method Specifications

19.0 Revision History

- Revision 3.1, dated 30 June 2012
 - Updated to include Terphenyls
- Revision 3, dated 04 April 2012
 - Updated section 6.2 with current supply list.
 - Added some current vendor sources in section 7.2 for materials used.
 - Added sections 7.3 Standards Verification, 7.4 Storage of Stock Standards, and section 7.5 Non-Routine Compounds.
 - Added holding time clarification to section 8.3.
 - Modified Section 10 for clarity and consistency with other SOP formats.
Removed wording from section 10.3.4 that indicated the need for at least three multi-point curves in order to use a weighted regression. Changed the wording for section 10.4.2.2 to indicate when to use a default RT window.
 - Modified section 11 to include some guidelines for 11.3 Instrument Maintenance.
 - Modified section 12 to be consistent with other SOP formats.
 - Updated Table IV with current configurations.
 - Added Table VI and Attachment 5
- Revision 2, dated 25 March 2011
 - Updated SOP to include requirements for the various revisions of Methods 8000, 8015 and to include state methods for extractable hydrocarbons, including Alaska, California, Oklahoma and Washington.
 - Modified definitions for clarity
 - Updated section 13.
- Revision 1, dated 05 March 2010
 - Added section 6.3
 - Updated to match other GC SOP Format
- Revision 0, dated 31 January 2009

Table I: Aliphatic Hydrocarbon Standard

| <i>Compound Boiling Points</i> | | |
|---------------------------------------|-------------|--------------------------------|
| n-Alkane | Name | B.P.₇₆₀ (°C) |
| C ₈ | Octane | 126 |
| C ₁₀ | Decane | 174 |
| C ₂₄ | Tetracosane | 391 |

| | | |
|-----------------|----------------|-----|
| C ₂₈ | Octacosane | 432 |
| C ₃₂ | Dotriacontane | 468 |
| C ₃₆ | Hextriacontane | 498 |

This Table can be used to get the estimated boiling point ranges of the hydrocarbons reported in a given sample.

Table II: Calibration Levels

| Standard | Level 1 | Level 2 | Level 3 | Level 4 | Level 5 | Level 6 | Level 7 |
|---|---------|---------|---------|---------|---------|---------|---------|
| DRO | 0.1 | 0.25 | 1.00 | 5.00 | 7.50 | 15.00 | 30.00 |
| Jet Fuels 4 and 8 | 0.1 | 0.5 | 1.00 | 2.50 | 5.00 | 10.00 | NA |
| Motor Oil / RRO | 0.1 | 0.25 | 1.00 | 5.00 | 7.50 | 15.00 | 30.0 |
| Ortho-Terphenyl and n-octacosane (surrogates) | 0.0005 | 0.00125 | 0.005 | 0.025 | 0.0375 | 0.075 | --- |

(All concentrations are in mg/L.)

| Standard | Level 1 | Level 2 | Level 3 | Level 4 | Level 5 |
|--------------------|---------|---------|---------|---------|---------|
| o-Terphenyl | 0.005 | 0.020 | 0.05 | 0.1 | 0.15 |
| p-Terphenyl | 0.005 | 0.020 | 0.05 | 0.1 | 0.15 |
| m-Terphenyl | 0.005 | 0.020 | 0.05 | 0.1 | 0.15 |

(All concentrations are in mg/L.)

Table III: Spike Levels for Quality Control

| Laboratory Control Samples (LCS) and Matrix Spike/ Spike Duplicate | | |
|---|----------------------------|---------------------|
| Analyte | Spike Concentration | |
| | Water (mg/L) | Soil (mg/kg) |
| Diesel Range Organics | 2.0 | 66.7 |
| Jet Fuel 8 | 1.0 | 33.3 |
| Jet Fuel 4 | 1.0 | 33.3 |
| Residual Range Organics (or Motor Oil) | 5.0 | 166.5 |

| Surrogate Control Samples | | |
|----------------------------------|----------------------------|-------------------------|
| Analyte | Spike Concentration | |
| | Water (mg/L) | Low Soil (mg/kg) |
| Ortho-Terphenyl | 0.02 | 0.667 |
| n-octacosane | 0.02 | 0.667 |

Table IV: Recommended GC Conditions

| | |
|----------------------------|---|
| Hydrogen Column Pressure | 20 psi (U2) 15 psi (U) |
| Initial Column Temperature | 45 °C for 2.5 minutes (U2) 50 °C for 2 minutes (U) |
| Temperature Ramp | 25 °C / minute (U2) 35 °C / minute(U) |
| Final Column Temperature | 325 °C for 3.3 minutes (U2) 330 °C for 5 minutes (U) |
| Injector Temperature | 285 °C |
| FID Temperature | 325 °C |

Table V. Alaska Methods AK102 and AK103 Acceptance Criteria for Quality Control

| Method AK102 (DRO) Acceptance Criteria | | | | |
|--|---------------------------------|----------------------------------|-------------------|----------------|
| QC Parameter | Water (mg/L)¹ | Soils (mg/kg)¹ | % Recovery | RPD (%) |
| Lab Fortified Blanks (LCS) | 0.5 – 2.0 | --- | 75 - 125 | 20 |
| Continuing Calibration (Includes surrogate compounds) ² | --- | --- | 75 - 125 | --- |
| Calibration Verification | --- | --- | 75 - 125 | --- |
| Surrogate Recovery for "Laboratory Control Sample" ² | 0.02 | 0.8 | 60 - 120 | --- |
| Surrogate Recovery for Field Samples | 0.02 | 0.8 | 50 - 150 | --- |
| Method AK103 (RRO) Acceptance Criteria | | | | |
| QC Parameter | Water (mg/L)¹ | Soils (mg/kg)¹ | % Recovery | RPD (%) |
| Lab Fortified Blanks (LCS) | --- | 500 | 60 - 120 | 20 |
| Continuing Calibration | 2000 | --- | 75 - 125 | --- |
| Calibration Verification | 2000 | --- | 75 - 125 | --- |
| Surrogate (n-triacontane-d ₆₂) Recovery for Control Samples ² | --- | 50 | 60 - 120 | --- |
| Surrogate (n-triacontane-d ₆₂) Recovery for Field Samples | --- | 50 | 50 - 150 | --- |

NOTE: The information in this table is taken verbatim from the referenced Alaska methods. This SOP provides for spiking both DRO and RRO in water and soils. The acceptance limits in this table are used when client or project requirements specify compliance with the Alaska methods.

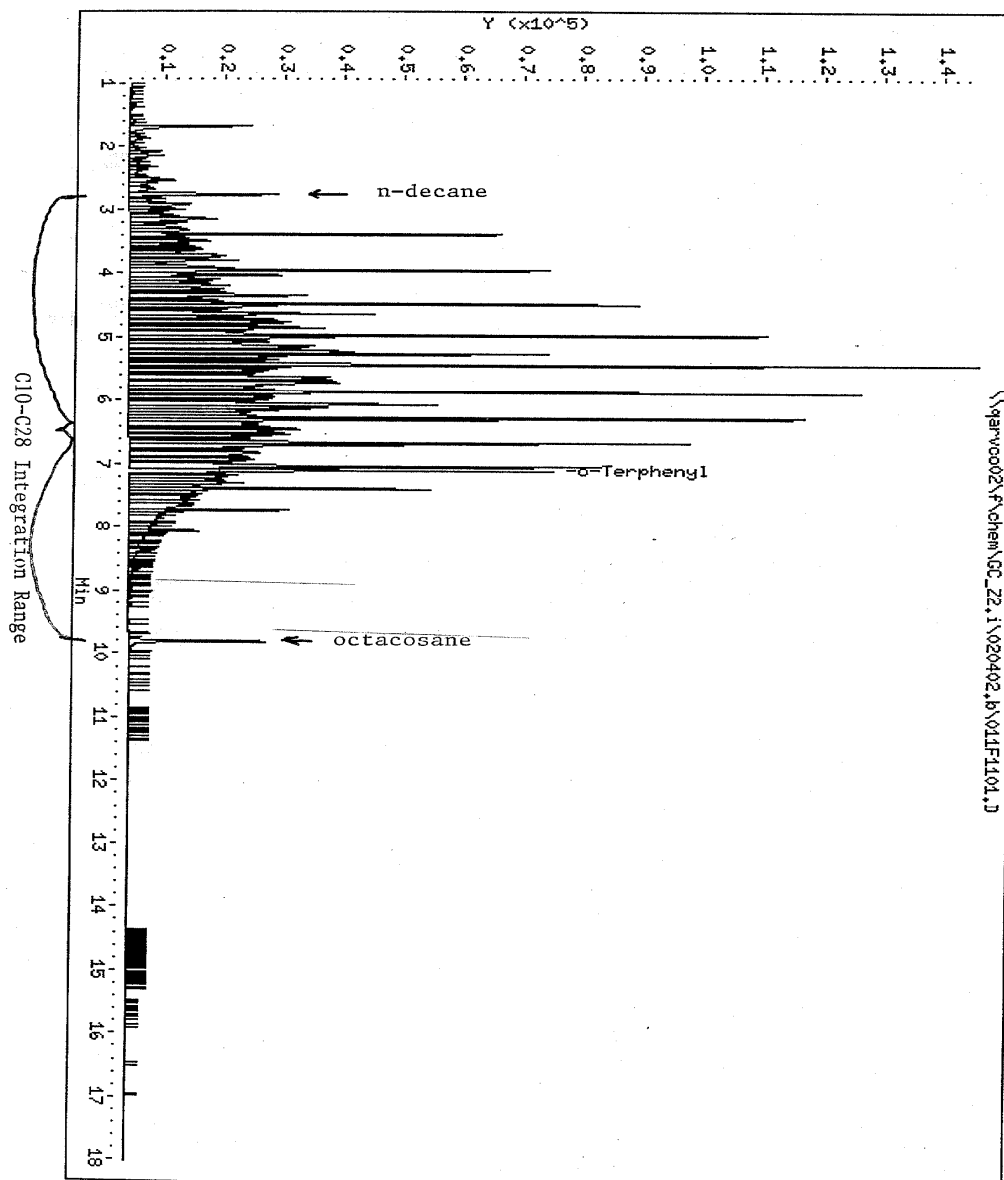
¹ Suggested concentrations. May vary with matrix.

² According to the Alaska methods, this is any laboratory prepared samples used for quality control, except calibration standards. At TestAmerica Denver, this includes the LCS, method blank, MS, and MSD. The continuing calibration for surrogates is verified at the instrument by including them in the continuing calibration DRO sample.

Table VI. DRO and RRO Method Summary Comparison Chart

| Program | Standards Surrogates | Ranges Min RT Windows | Batch Size | MB RL | ICAL # Points RSD r | CCV Bracket size | LCS/MS/Other Sample Size |
|-----------|---|---|--|---|---|---|--|
| 8015B | Commercial Diesel | C ₁₀ - C ₂₈ Apex ± window | 20 Samples | Blank subtraction is allowed | 5 levels; lowest at RL % RSD < 20 | CCV/12 hour window & close; mid range ± 15% All compounds in RT window | Standard QC model |
| 8015C | Commercial #2 Diesel 6 month expiration | C ₁₀ - C ₂₈ Apex ± window | 20 Samples | Blank subtraction is allowed | 5 levels; lowest at RL % RSD < 20 | CCV/12 hour window & close; mid range ± 20% All compounds in RT window | Standard QC model |
| 8015D | Commercial #2 Diesel 6 month expiration | C ₁₀ - C ₂₈ Apex ± window | 20 Samples | Blank subtraction is allowed | 5 levels; lowest at RL % RSD < 20 | CCV/12 hour window & close; mid range ± 20% All compounds in RT window | Standard QC model |
| 8000B | N/A | Default 0.03min; ± 3 standard deviation over 72 hour period; Use center of CCV in beginning or mid-point standard of ICAL *New RT windows with new column installation. | 20 Samples | Less than RL Less than 5% of sample result | 5 Levels; Lowest ≤ RL % RSD < 20% (mean RSD allowed). r ≥ 0.99 6 level for quadratic COD > 0.99 | CCV/12 hour window & close; mid range; every 10 samples recommended ± 15% D (grand mean allowed) 2 levels for quadratic curve | In house limits |
| 8000C | N/A | Default 0.03min; ± 3 standard deviation over 72 hour period; Use center of CCV in beginning or mid-point standard of ICAL *New RT windows with new column installation. | 20 Samples | Less than RL | 5 levels; r ≥ 0.99 5 levels; r ≥ 0.99 Batch calculation is suggested (20% D) | ± 20% 2 different concentrations for quadratic curves | In house limits |
| DRO/AK102 | Commercial #2 Diesel o-terphenyl (60-120% - LCS) (50 150% - Samples) | Beginning C ₁₀ to beginning C ₂₈ ± 0.05 min | 20 Samples | 20 mg/Kg 800 ug/mL Less than POL | r ² > 0.995 At least 3 standards % RSD < 25% | ICV ± 25% CCS/CCV ± 25% Every 20 samples Midpoint of the curve | |
| RRO/AK103 | Equal weights of 30W and 40W motor oil. Surrogate: n-Triacontane | Beginning C ₁₀ to end C ₃₆ ± 0.05 min | 20 Samples | 100 mg/Kg | r ² > 0.995 At least 3 standards % RSD < 25% | ICV ± 25% CCS/CCV ± 25% Every 20 samples Midpoint of the curve | RL - X5 MDL LFB = 60-120% |
| Oklahoma | Ten component blend of alkanes, 10-28 even (store freezer); 6 months expiration | 0.1 min before C ₁₀ to 0.1 min after C ₂₈ (0.1 min) | 20 Samples; Duplicate spikes every 10 samples | 0.1 mg/L 10 mg/Kg Less than POL | minimum 3 levels Lowest at POL r at least 0.99 | CCV ± 20% daily Has special IDOC (see method) | Sample size discretionary, at least 800 mL. Soil not to exceed 20 g. Concentrate to 1 mL LCS/LCSD & MS/MSD - ± 20% water; ± 40% soil |
| NWTPH | #2 Diesel or known other component. Surrogate: o-terphenyl | Must incorporate most of components; break where multi components occur | MB per 20 samples; Duplicate per 10 samples | Diesel: 25 mg/Kg; 0.25 mg/L Motor Oil: 100 mg/Kg; 0.5 mg/L | 5 points r > 0.990 Back quantitate standards to ± 15% | ± 15% midpoint opening and closing | 20 g soil 400 mL water |
| TX1005 | Unleaded Gasoline and #2 Diesel | RF for C ₂₈ ≥ 75% of the RF of C ₂₈ Beginning 0.1 min after the RT of 1st marker compound and ending 0.1 after the RT of the ending marker compound. Two ranges: C ₆ - C ₁₂ ; >C ₁₂ - C ₂₈ default of ± 0.1 minute | 20 Samples | Less than RL | 5 point calibration Peak to valley integration for C ₆ - C ₁₂ Forced baseline projection for >C ₁₂ - C ₂₈ r ≥ 0.995 At least 3 standards % RSD < 25% | Mid-point cal standard performed at the beginning and end of each batch, shift, or work day, whichever is more frequent. RPD ± 25% | %R within 70-130% and RPD ± 20% or within established control limits |

Attachment 1 Routine DRO Integration

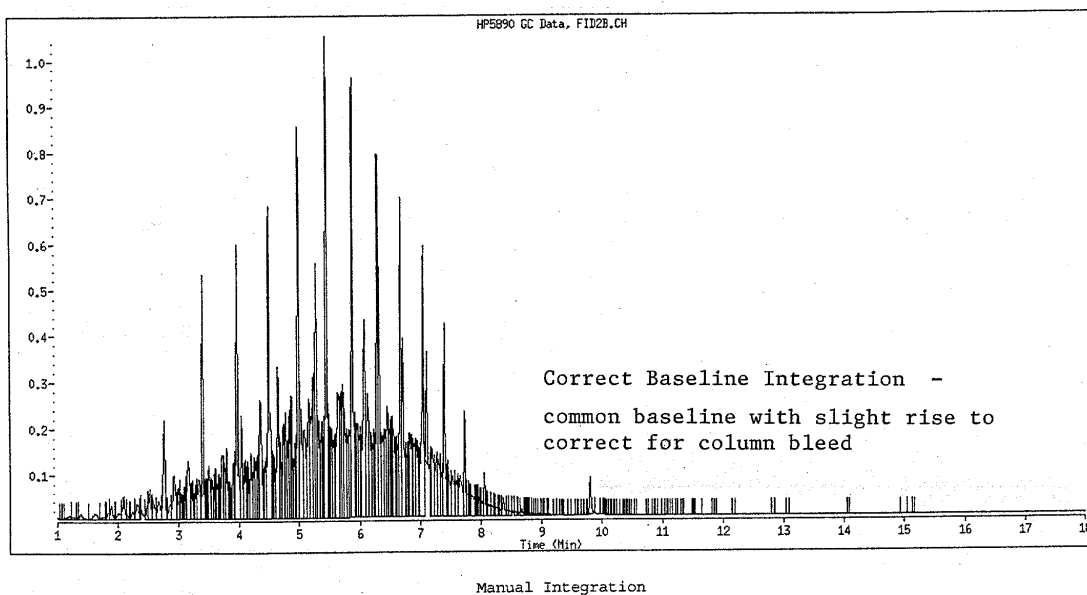
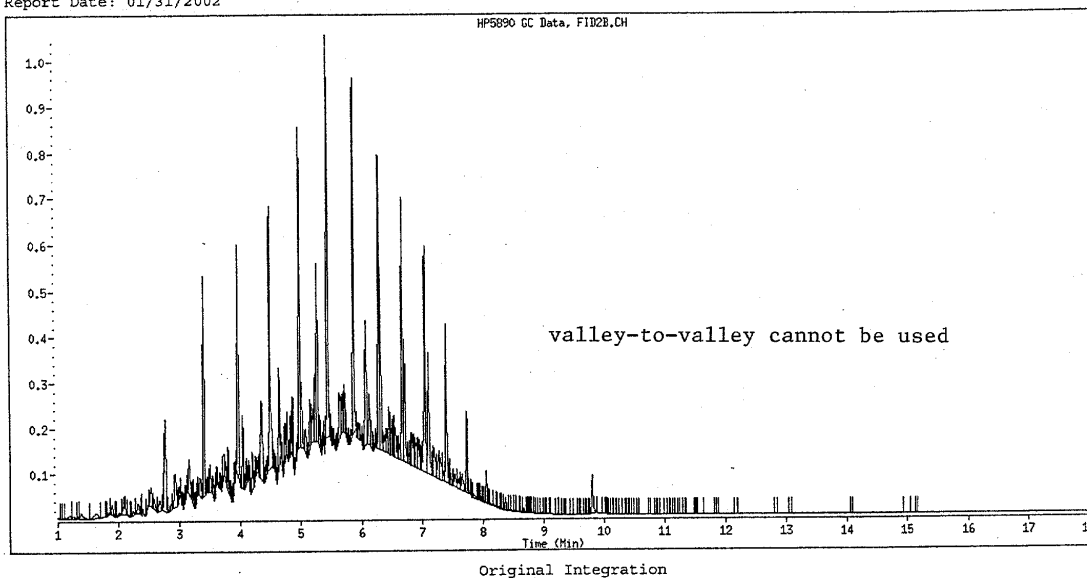


Attachment 2

Valley to Valley Integration cannot be used

MANUAL INTEGRATION TO PRODUCE CORRECT BASELINE

Report Date: 01/31/2002

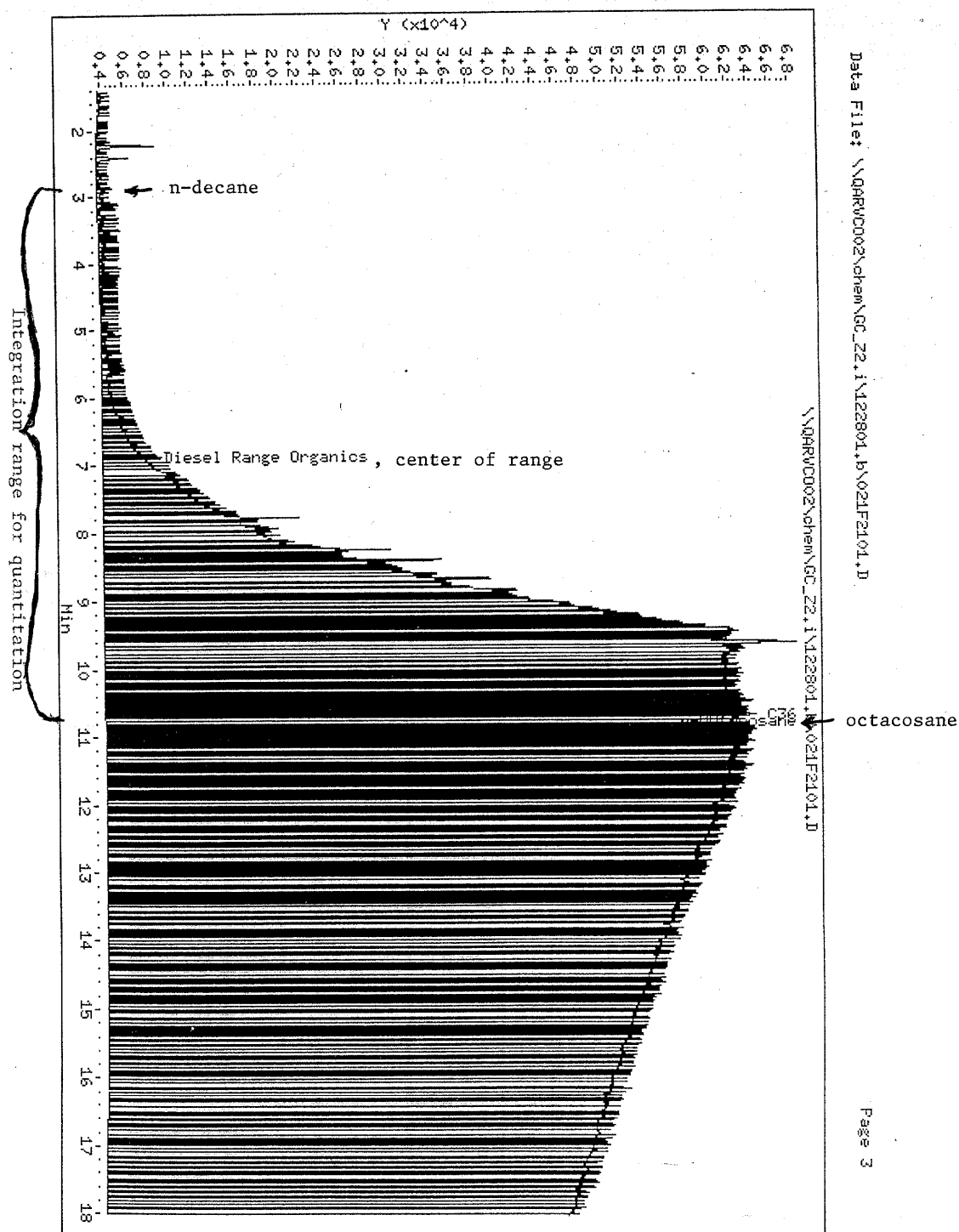


Manually Integrated By: fiedlerh

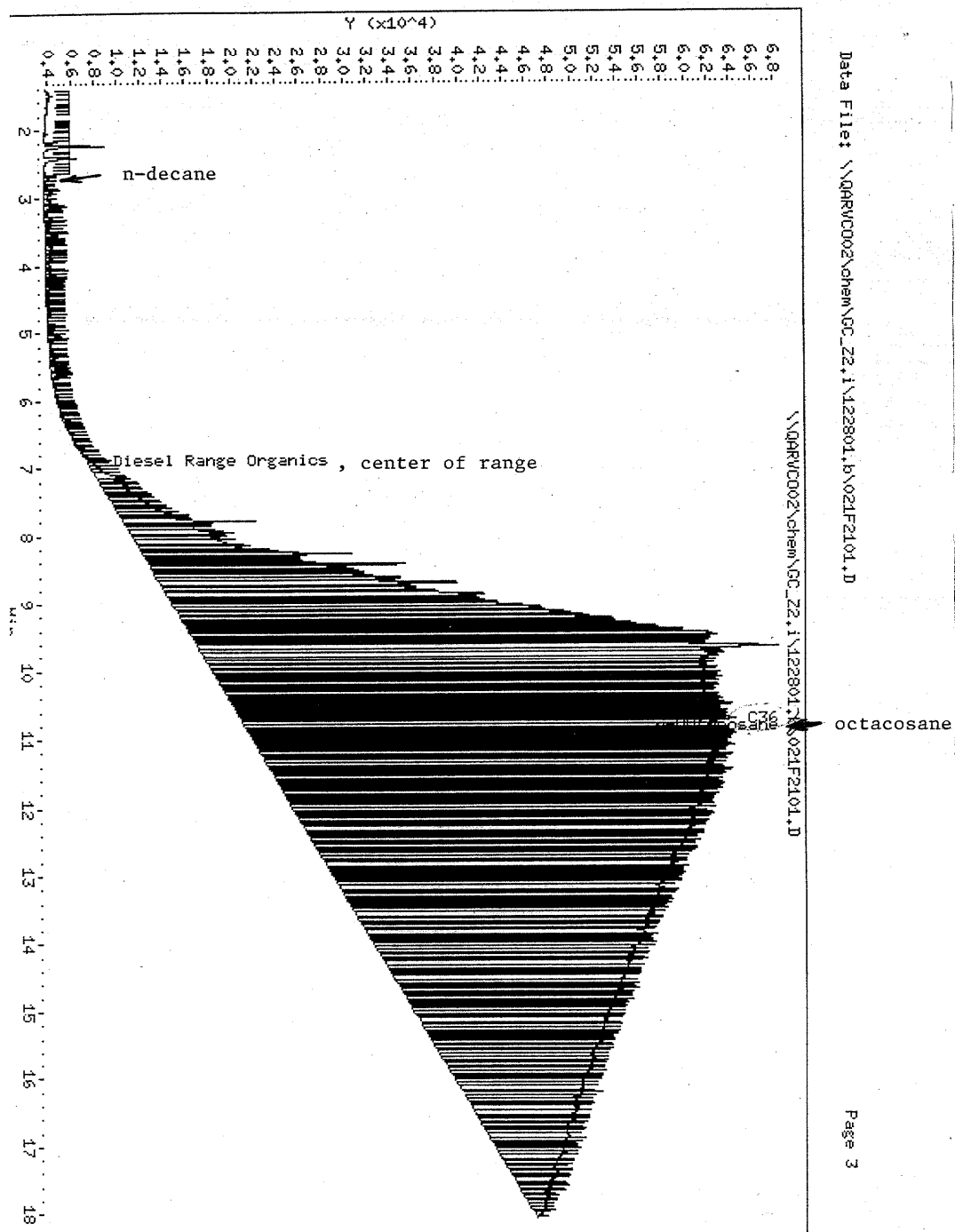
Manual Integration Reason: Baseline Event

HK
1/31/02

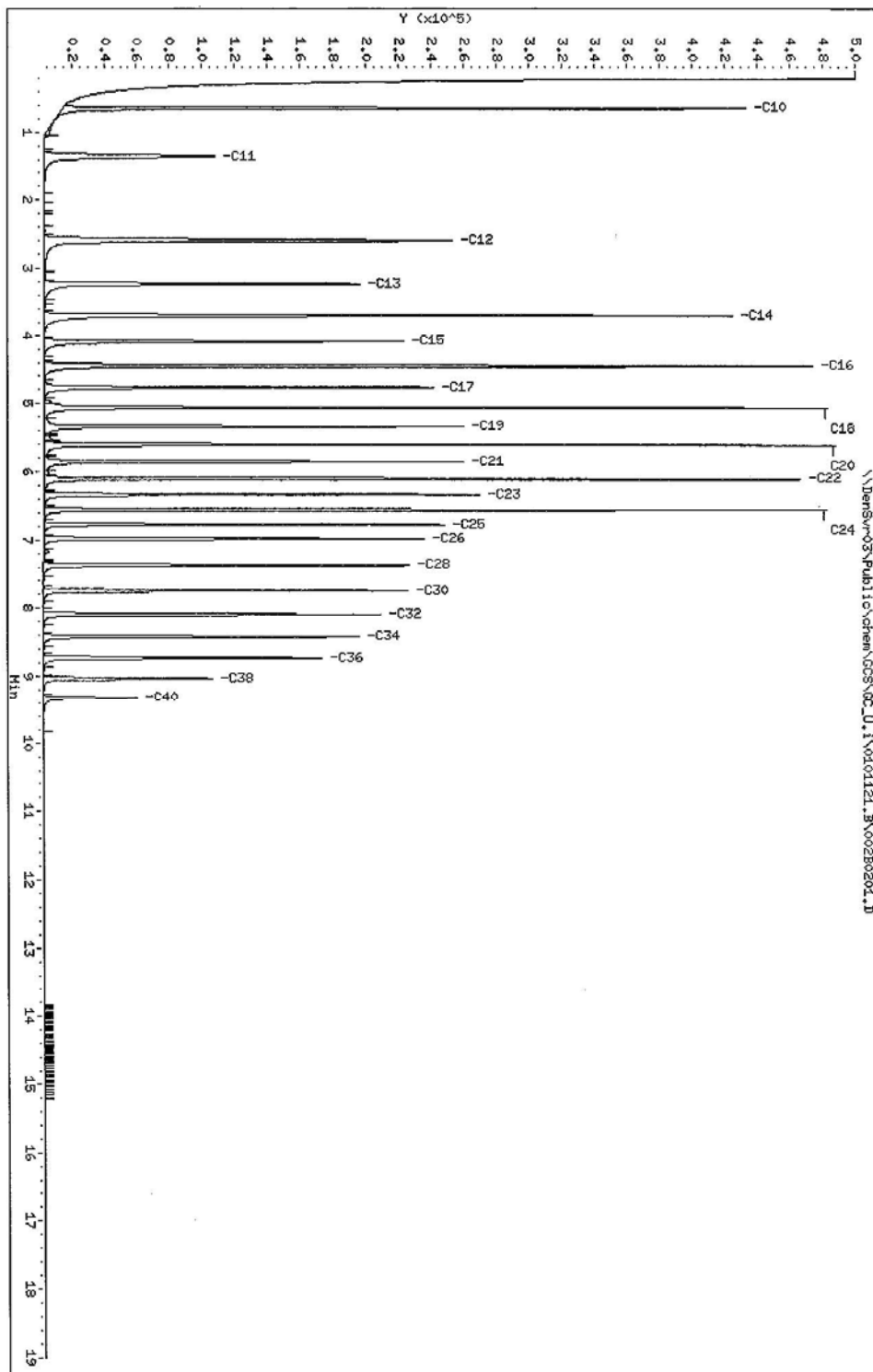
Attachment 3 Heavy Hydrocarbons with Baseline from Method Blank



Attachment 4 Heavy Hydrocarbons with Signal to Signal Integration



Attachment 5 Retention Time Reference Standard



Appendix 1: Oklahoma / Boeing Specifications

Definitions

C₈-C₁₁; C₁₂-C₁₄; C₁₅-C₂₀; C₂₁-C₃₀. Each of these carbon ranges are determined by the retention time defining standard. In terms of retention time, the lab will include instrument response eluting 0.1 minutes prior to the apex of the peak for the first alkane of a given carbon range. The end of a given carbon range is defined by the retention time for the alkane marker that designates the beginning of the next carbon range, finally ending 0.1 minutes after the elution of the C₃₀ marker. Identification and quantification of TPH components requires more analytical judgment than other GC methods. The TPH chromatograms consist of groups of peaks that fall within a noted carbon retention time range. Diesel Fuel will be defined as C₈-C₃₀ for the Oklahoma method.

The standard used for this calibration is a mixture of the even-numbered n-alkanes from C₁₀ – C₂₈. To calibrate for this method, the following determinations are used:

- C₈ – C₁₁ range: based on the response of C₁₀
- C₁₂ – C₁₄ range: based on the responses of C₁₂ and C₁₄
- C₁₅ – C₂₀ range: based on the responses of C₁₆, C₁₈ and C₂₀
- C₂₁ – C₃₀ range: based on the responses of C₂₂, C₂₄, C₂₆, and C₂₈

Standards:

Stock Oklahoma Standard: Supelco TPH1 Standard at 2000 µg/mL of each n-alkane compound.

Stock Oklahoma Second Source Standard: Ultra Scientific EPA/Wisconsin Standard at 2000 µg/mL of each n-alkane compound.

Stock Oklahoma Surrogate Standard: Supelco o-terphenyl solution at 10,000 µg/mL in methylene chloride.

Oklahoma Surrogate Spike Solution: Dilute 5 mLs of Stock Oklahoma Surrogate Solution to a final volume of 200 mL using 90:10 acetone:methylene chloride for a final concentration of 50 µg/mL.

Oklahoma Spike Solution: Dilute 12.5 mLs of Stock Diesel Fuel Second Source Standard to a final volume of 50 mL using acetone for a final concentration of 500 µg/mL of each n-alkane.

Appendix 1: Oklahoma / Boeing Specifications (continued)

Oklahoma / Boeing Calibration Standards: Diesel fuel standards for the Boeing and Oklahoma methods are prepared in methylene chloride at 6 concentration levels using the Stock Oklahoma Standard and the Stock Oklahoma Surrogate Standard as defined for this method.

| Level | Fuel Standard Solution Used | Volume Used (mL) | Final Volume (mL) | Final Conc of each n-alkane (µg/mL) | Surrogate Conc (µg/mL) |
|-------|-----------------------------|------------------|-------------------|-------------------------------------|------------------------|
| 6 | Stock + Stock Surrogate | 0.75 .15 | 1.0 | 1500 | 1500 |
| 5 | Level 6 | .2 | 0.6 | 500 | 500 |
| 4* | Stock + Stock Surrogate | 0.25 0.05 | 5 | 100 | 100 |
| 3 | Level 4 | 0.5 | 1.0 | 50 | 50 |
| 2 | Level 4 | 0.25 | 1.0 | 25 | 25 |
| 1 | Level 4 | 0.1 | 1.0 | 10 | 10 |

NOTE: The Level 4 (*) calibration standard is also used as the continuing calibration verification standard.

Oklahoma Second Source: The second source for this method is prepared by diluting 0.05 mL of the Stock Oklahoma Second Source Standard and 0.01 mL of the Stock Oklahoma Surrogate Standard to a final volume of 1 mL.

Calibration Levels:

| Standard | Level 1 | Level 2 | Level 3 | Level 4 | Level 5 | Level 6 |
|-----------------------------------|---------|---------|---------|---------|---------|---------|
| C ₈ – C ₁₁ | 10 | 25 | 50 | 100 | 500 | 1500 |
| C ₁₂ – C ₁₄ | 20 | 50 | 100 | 200 | 1000 | 3000 |
| C ₁₅ – C ₂₀ | 30 | 75 | 150 | 300 | 1500 | 4500 |
| C ₂₁ – C ₃₀ | 40 | 100 | 200 | 400 | 2000 | 6000 |
| C ₈ – C ₃₀ | 100 | 250 | 500 | 1000 | 5000 | 15000 |
| Ortho-Terphenyl (surrogate) | 10 | 25 | 50 | 100 | 500 | 1500 |

(All concentrations are in mg/L.)

Appendix 1: Oklahoma / Boeing Specifications (continued)

Spike Levels for Quality Control

| Laboratory Control Samples (LCS) and Matrix Spike/ Spike Duplicate | | |
|---|----------------------------|---------------------|
| Analyte | Spike Concentration | |
| | Water (mg/L) | Soil (mg/kg) |
| C ₈ – C ₁₁ | 0.5 | 10 |
| C ₁₂ – C ₁₄ | 1.0 | 20 |
| C ₁₅ – C ₂₀ | 1.5 | 30 |
| C ₂₁ – C ₃₀ | 2.0 | 40 |
| C ₈ – C ₃₀ | 5.0 | 100 |

| Surrogate Control Samples | | |
|----------------------------------|----------------------------|-------------------------|
| Analyte | Spike Concentration | |
| | Water (mg/L) | Low Soil (mg/kg) |
| Ortho-Terphenyl | 0.05 | 1 |



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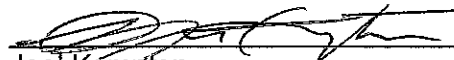
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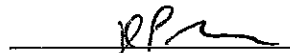
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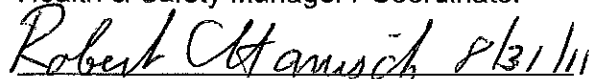
**Title: Polynuclear Aromatic Hydrocarbons by GC/MS Selected Ion
Monitoring (SIM)
[SW 846 Method 8270C and 8270D]**

Approvals (Signature/Date):

 08/30/11
Joel Kempton Date
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 8/30/11
John P. Morris Date
Quality Assurance Manager

 31 Aug 11
Adam Alban Date
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1.0 Scope and Application

- 1.1** This procedure is a Gas Chromatography/Mass Spectrometry (GC/MS) technique for the analysis of polynuclear aromatic hydrocarbons (PAH) and heterocyclic compounds at the part per trillion (ng/L or ng/kg) level in waters or solids. This procedure follows the general guidelines of EPA Methods 8270C and 8270D for Selected Ion Monitoring (SIM) analysis.
- 1.2** The SIM technique optimizes quantitative information at the expense of qualitative information gained from other methods of analysis. It is important to note that this procedure is intended for the analysis of samples previously characterized by another method such as open-scan 8270C/D. The initial characterization is necessary to avoid misidentification of the parent compounds producing the ions used for this analysis.
- 1.3** In addition, this procedure is appropriate only for sample analytes of interest at less than 10,000 ng/L or 330,000 ng/kg. Samples containing semivolatile organics at concentrations greater than 10,000 ng/L and 330,000 ng/kg should be analyzed by a method designed to detect at higher (part per billion) levels. Samples at these levels may still be analyzed by this procedure, however, extra measurement uncertainty would be introduced because of the sample dilutions that would be required.
- 1.4** This procedure is applicable to water and soil samples. For water samples, 1 liter of water is extracted. A 4-liter extraction procedure to achieve lower detection limits is described in SOP DV-MS-0005. For soil samples, a sample aliquot of 30 g is extracted.

1.5 Analytes, Matrix(s), and Reporting Limits

The standard list of compounds that can be analyzed by this procedure is shown in Table IV. Typical reporting limits are 100 ng/L for aqueous samples and 5.0 ug/Kg for soil samples for the PAH compounds.

2.0 Summary of Method

2.1 Sample Preparation

2.1.1 Aqueous Samples

Analytes of interest are extracted from water samples using separatory funnel extraction (EPA 3510C) described in SOP DV-OP-0006. Samples are prepared by the continuous-liquid-liquid-extraction (CLLE) technique (EPA 3520C), which is covered in SOP DV-OP-0008. The PAH compounds are extracted from the sample without any adjustment to pH. The concentration of organic extracts is covered in SOP DV-OP-0007.

2.1.2 Solid Samples

Solid samples are extracted by sonication (EPA 3550C), which is covered in SOP DV-OP-0016 or by microwave extraction (EPA 3546) described in SOP DV-OP-0015. The extraction solvent is a 1:1 mixture of methylene chloride and acetone.

2.2 Instrumental Analysis

Quantitation of the extracted compounds is performed by gas chromatography - mass spectrometry (GC/MS) in the selected ion monitoring mode (SIM). Routine instrument conditions and the ions used for analysis are shown in Tables I and IV, respectively.

Development of a successful SIM method requires identifying the ions to be monitored, the ion dwell times, the ions in each group, and the timing for switching between groups. A quantitation ion is selected with a confirmation ion being monitored for identification purposes (see Table IV). Switching times are set where there is adequate resolution (a gap of 1-2 minutes) between peaks. If there is inadequate time between eluting peaks, small retention time shifts may cause peaks to partially or completely disappear as there are changes in the ions monitored. Dwell times will be set by default once the ions per group and the switching times are identified in the method. These can be adjusted manually in order to optimize sensitivity as needed.

3.0 Definitions

3.1 Refer to TestAmerica Denver's Quality Assurance Manual (QAM) and SOP DV-QA-003P for definitions of the quality control terms used in this document.

3.2 Selected Ion Monitoring - A mass spectrometry technique that provides lower detection level capability by monitoring fewer mass scans for longer periods of time than is done in open-scan methods.

3.3 Primary Ion Area - The signal chosen for quantitation purposes.

3.4 Secondary Ion Area - The signal chosen for identification and confirmation purposes.

4.0 Interferences

4.1 Method interferences may be caused by contaminants in solvents, reagents, glassware, and other sample processing hardware that lead to discrete artifacts and/or elevated baselines in the ion current profiles. All of these materials must be routinely demonstrated to be free from interferences under the conditions of the analysis by running laboratory reagent blanks. The use of high purity reagents and solvents helps to minimize interference problems.

4.2 Matrix interferences may be caused by contaminants that are co-extracted from the sample. The extent of matrix interferences will vary considerably from source to source, depending upon the nature of the environment being sampled.

4.3 An interference that is unique to selected ion monitoring techniques can arise from the presence of an interfering compound which produces the same ion used for quantitation of one of the PAHs. This event results in a positive interference to the reported value for the compound of interest. This interference is controlled to some degree by acquiring data for a confirmation ion. If the ion ratios between the quantitation ion and the confirmation ion are not within the specified limits, then interferences may be present. Open scan analysis to identify compounds throughout the mass range is the most reliable assurance against reporting false positives.

5.0 **Safety**

Employees must abide by the policies and procedures in the Environmental Health and Safety Manual, Radiation Safety Manual and this document.

This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, nitrile or latex gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

5.1 **Specific Safety Concerns or Requirements**

- 5.1.1 Eye protection that satisfies ANSI Z87.1, laboratory coat, and nitrile gloves must be worn while handling samples, standards, solvents, and reagents. Disposable gloves that have been contaminated must be removed and discarded; non-disposable gloves must be cleaned immediately. Latex and vinyl gloves provide no protection against the organic solvents used in this method. Nitrile or similar gloves must be used.
- 5.1.2 The gas chromatograph and mass spectrometer contain zones that have elevated temperatures. The analyst needs to be aware of the locations of those zones, and must cool them to room temperature prior to working on them.
- 5.1.3 The mass spectrometer is under deep vacuum. The mass spectrometer must be brought to atmospheric pressure prior to working on the source.
- 5.1.4 There are areas of high voltage in both the gas chromatograph and the mass spectrometer. Depending on the type of work involved, either turn the power to the instrument off, or disconnect the instrument from its source of power.

5.2 **Primary Materials Used**

The following is a list of the materials used in this method, which have a serious or significant hazard rating.

NOTE: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.

A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

Materials with Serious or Significant Hazard Rating

| Material ⁽¹⁾ | Hazards | Exposure Limit ⁽²⁾ | Signs and symptoms of exposure |
|---|--|---|--|
| Methanol | Flammable Poison Irritant | 200 ppm - TWA | A slight irritant to the mucous membranes. Toxic effects exerted upon nervous system, particularly the optic nerve. Symptoms of overexposure may include headache, drowsiness and dizziness. Methyl alcohol is a defatting agent and may cause skin to become dry and cracked. Skin absorption can occur; symptoms may parallel inhalation exposure. Irritant to the eyes. |
| Methylene Chloride | Carcinogen Irritant | 25 ppm - TWA 125 ppm - STEL | Causes irritation to respiratory tract. Has a strong narcotic effect with symptoms of mental confusion, light-headedness, fatigue, nausea, vomiting and headache. Causes irritation, redness and pain to the skin and eyes. Prolonged contact can cause burns. Liquid degrades the skin. May be absorbed through skin. |
| PAH standards can contain all or some of the following: benzo(a)anthracene benzo(b)fluoranthene benzo(k)fluoranthene benzo(a)pyrene chrysene dibenz(a,h)anthracene indeno(1,2,3-cd)pyrene naphthalene | Carcinogen Carcinogen Carcinogen Carcinogen Carcinogen Carcinogen Carcinogen | 0.2 mg/m ³ - PEL 10 ppm - PEL | Standards contain low concentrations of compounds known to be or suspected to be carcinogens. All PAH compounds are considered to be hazardous, toxic, and irritants. Some or all are reported human carcinogens, mutagens, and/or teratogens. |
| (1) Always add acid to water to prevent violent reactions. (2) Exposure limit refers to the OSHA regulatory exposure limit. | | | |

6.0 Equipment and Supplies

6.1 Instrumentation

Gas Chromatograph (See Table I for operating conditions)

- 6.1.1** The analytical system includes a temperature programmable gas chromatograph and all required accessories including syringes, analytical columns, and gases. The injection port is designed for on-column injection when using packed columns and for splitless injection when using capillary columns.

6.1.2 Mass Spectrometer (See Table I for operating conditions)

A mass spectrometer operating at 70 eV (nominal) electron energy in the electron impact ionization mode and tuned to maximize the sensitivity of the instrument to the compounds being analyzed. The GC capillary column is fed directly into the ion source of the mass spectrometer.

6.1.3 A computer system interfaced to the mass spectrometer that allows the continuous acquisition and storage on machine-readable media of all mass spectra obtained throughout the duration of the chromatographic program. The computer has software that allows searching any GC/MS data file for ions of a specific mass and plotting such ion abundances versus time or scan number. The computer allows acquisition at pre-selected mass windows for selected ion monitoring.

6.1.4 Please refer to the *Master list of Documents, Software, and Hardware* located on G:\QA\Read\Master List of Documents for the current software and hardware to be used for data processing.

6.2 **Supplies**

6.2.1 All glassware used, both within the scope of this SOP and for the initial sample extraction (see SOPs DV-OP-0006, DV-OP-0008, DV-OP-0007, DV-OP-0015, and DV-OP-0016) must be scrupulously cleaned. Clean all glassware as soon as possible after use by rinsing with the last solvent used in it. This should be followed by detergent washing with hot water, and rinses with tap water, reagent water, and finally with acetone.

6.2.2 Glassware should not be oven dried or heated in a muffle furnace. Successive solvent rinses of the CLLE, separatory funnel, sonication, and Kuderna-Danish glassware are required to minimize low level contamination of samples.

6.2.3 Store glassware inverted or in sealed containers capped with aluminum foil.

6.2.4 Gas-tight syringes, various sizes, and SMI pipettors.

6.2.5 Serological pipettes are used for final extract volume measurement.

6.2.6 Micro reaction vessels, 1.8 mL vials with Teflon caps, for storing concentrated extracts.

6.2.7 Column – A Varian VF-5MS 30-meter fused silica capillary column, 0.5 μ m film thickness, 0.25mm ID, plus 10-meter EZguard, or equivalent.

7.0 **Reagents and Standards**

7.1 **Reagents**

All solvents are reagent grade or higher unless specified otherwise. See SOPs CA-Q-S-001 and CA-Q-S-001 DV-1 for a description of the program for testing solvents prior to use.

- 7.1.1 Methanol, reagent grade.
- 7.1.2 Methylene chloride, reagent grade.
- 7.1.3 Helium gas, 99% + purity.

7.2 **Standards**

Commercial standards are received in flame-sealed ampoules or neat, 100% concentration solutions. Standards are verified before use. Details concerning verification of standards are given in SOP DV-QA-0015. Stock standards are stored refrigerated at $\leq 6^{\circ}\text{C}$. All stock standards must be protected from light. Stock standards are monitored for signs of degradation or evaporation. The standards must be replaced annually from the date of receipt or earlier, if the vendor indicates an earlier date.

7.2.1 **GC/MS Tuning Standard**

A methylene chloride solution containing decafluorotriphenylphosphine (DFTPP) at a concentration of 50 $\mu\text{g/mL}$ is prepared.

7.2.2 **Calibration Standards**

Calibration standards for the initial calibration (ICAL) are prepared at 7 concentrations to cover the calibration range by diluting vendor stock standard solutions using methylene chloride. The standards are prepared directly in autosampler vials by using a calibrated microliter syringe to deliver the appropriate volumes of stock standard solution, internal standard solution, and methylene chloride. The following table summarizes a typical set of calibration standards prepared using a PAH SIM stock standard with a concentration of 20 $\mu\text{g/mL}$ for levels 4 through 7. A secondary PAH SIM stock standard with a concentration of 2 $\mu\text{g/mL}$ is used to prepare levels 1 through 3:

| Vol of Stock Used (μL) | Methylene Chloride Added (μL) | Internal Standard Added (μL) | Final Volume (μL) | Final Conc of PAH ($\mu\text{g/mL}$) |
|--|---|--|-----------------------------------|---|
| 5 | 495 | 50 | 500 | 0.02 |
| 25 | 475 | 50 | 500 | 0.1 |
| 75 | 425 | 50 | 500 | 0.3 |
| 15 | 485 | 50 | 500 | 0.6 |
| 30 | 470 | 50 | 500 | 1.2 |
| 62.5 | 437.5 | 50 | 500 | 2.5 |
| 125 | 375 | 50 | 500 | 5.0 |

7.2.3 Initial Calibration Verification (ICV) Standard

A second source initial calibration verification (ICV) standard is prepared using a standard solution that is obtained from a source independent from the source that supplies the standard used for the initial calibration. The final PAH SIM concentration for this ICV standard is 1.2 µg/mL.

7.2.4 Continuing Calibration Verification (CCV) Standard

A standard with the same analytes, concentrations, and lot numbers as the 600 ng/mL calibration standard. The standard may be from the same preparation as the initial calibration or prepared at a later date.

7.2.5 Surrogate Spiking Solutions

The surrogate spike solution contains neutral surrogates at concentrations of 500 ng/mL in methanol. Table II lists the surrogate compounds for the standard list of PAHs. One (1.0) milliliter of the surrogate spike solution is added to a 1.0-liter aliquot of an aqueous sample, or a 30-gram aliquot of a soil or solid sample.

7.2.6 Internal Standard (IS) Solutions

A solution containing each of the internal standards at a concentration of 600 ng/mL each in methylene chloride is prepared from vendor stock. Table III lists the IS compounds.

7.2.7 LCS, MS, and MSD Spike Solution

A methanol solution containing the requested spike compounds at the concentration of 900 ng/mL each for PAH compound is prepared from vendor stock solutions. Following are the final sample concentrations of the spiked compounds for the water and solid extractions:

PAH in water: 900 ng/L

PAH in soil matrices: 30.0 µg/kg

- 7.3** All stock and working standards are stored according to the manufacturer's instructions. Dilutions from stocks may not be assigned expiration dates that exceed the stock standard expiration date set by the manufacturer.

8.0 Sample Collection, Preservation, Shipment and Storage

8.1 Sample Amounts

- 8.1.1** Water samples are collected in pre-cleaned amber glass bottles fitted with a Teflon-lined cap. To guarantee the ability to meet routine reporting limits, two full one-liter bottles of sample should be provided. Additional one-liter portions are needed to satisfy the requirements for matrix spikes and duplicate matrix spikes.

- 8.1.2 Soil samples are collected in an 8-ounce, pre-cleaned, wide-mouth jar with a Teflon-lined lid.
- 8.1.3 If insufficient sample is provided to perform the matrix spikes described in Section 9.4, analysts must prepare a Nonconformance Memo (NCM) as required by SOP DV-QA-0031. The NCM is routed to the laboratory project manager so that the problem can be discussed with the client.
- 8.2 Samples are chilled to a temperature between 0 and 6 °C immediately after collection and shipped via overnight carrier to the laboratory.
- 8.3 Samples and excess sample volume must be stored refrigerated at ≤ 6 °C from when the log-in process is completed (see SOP DV-QA-0003) to storage after analysis.
- 8.4 Water samples must be extracted within 7 days of the time of sample collection, while solid samples must be extracted within 14 days of sampling. Extracts must be analyzed within 40 days from sample extraction.

9.0 Quality Control

- 9.1 The minimum quality controls (QC), acceptance criteria and corrective actions are described in this section. When processing samples in the laboratory, use the LIMS Method Comments to determine specific QC requirements that apply.
 - 9.1.1 The laboratory's standard QC requirements, the process of establishing control limits, and the use of control charts are described more completely in TestAmerica Denver policy DV-QA-003P, *Quality Assurance Program*.
 - 9.1.2 Specific QC requirements for Federal programs, e.g., Department of Defense (DoD), Department of Energy (DOE), AFCEE, etc., are described in TestAmerica Denver policy DV-QA-024P, *Requirements for Federal Programs*.
 - 9.1.3 Project-specific requirements can override the requirements presented in this section when there is a written agreement between the laboratory and the client, and the source of those requirements should be described in the project documents. Project specific requirements are communicated to the analyst via Method Comments and special instructions in the LIMS and in the Quality Assurance Summaries (QAS) available in the public folders.
 - 9.1.4 Any QC result that fails to meet control criteria must be documented in a Nonconformance Memo (NCM). The NCM is automatically sent to the laboratory supervisor and Project Manager by e-mail so that the client can be notified as appropriate. The NCM process is described in more detail in SOP DV-QA-0031. This is in addition to the corrective actions described in the following sections.

9.2 **Method Blank (MB)**

A method blank is processed and analyzed with each analytical batch, not to exceed 20 samples. For aqueous samples, the method blank consists of reagent water spiked with surrogates. For soil samples, the method blank is Ottawa sand spiked with surrogates. This sand is mixed with sodium sulfate for extraction by ultrasonication. Method blanks

are used to assess whether the laboratory has contributed contamination to the sample analysis process that adversely affects the accuracy of the determination of target analytes. The goal is to have no detectable contaminants in the method blank. However, due to the sensitivity of this analysis, it is not uncommon to detect target analytes at levels above the method detection limit (MDL).

Acceptance Criteria: MB results must be less than $\frac{1}{2}$ the reporting limit.

Corrective Action: If the MB exceeds $\frac{1}{2}$ the RL for any target analyte, then one of the following must apply for acceptance of the batch:

The blank contamination is less than $\frac{1}{10}$ of the measured concentration of any sample in the associated preparation batch, or

The blank contamination is less than the concentration present in the samples and is less than $\frac{1}{10}$ of the regulatory limit, or

The same contaminants are not found in the associated samples.

NOTE: Positive method blank results below the reporting limit should still be evaluated by the analyst for potential impact on sample results at or near the reporting limit.

9.3 Laboratory Control Samples (LCS)

A Laboratory Control Sample (LCS) is processed and analyzed with each analytical batch not to exceed 20 samples. For aqueous samples, the LCS consists of reagent water spiked with the analytes of interest and surrogates. For soil samples, the LCS is Ottawa sand spiked with analytes of interest and surrogates. For ultrasonic extraction, sodium sulfate is added to the reagent sand. The LCS spiking solution is described in Section 7.2.7. LCS results are used to determine whether the analytical system is in control. Depending on project requirements, a duplicate LCS (LCSD) may be required to assess the precision of the analytical system.

Acceptance Criteria: The percent recovery for each requested target analyte in the LCS must fall within the established control limits (found in the LIMS system). If the percent recovery for an analyte that is in the LCS, but that is not a requested target analyte for the associated samples, does not fall within the control limits, but all of the requested target analytes that are in the LCS do fall within the control limits, then the LCS is considered to have met acceptance criteria.

Corrective Action: If the percent recovery for any analyte in the LCS exceeds the upper control limit and the analyte is not detected in any of the associated samples, then no further action is required, and data are reported with discussion in the case narrative.

If the percent recovery for any analyte in the LCS exceeds the upper control limit and the analyte is detected in any of the associated samples, then reanalyze the LCS. If similar results are obtained on the second attempt, then investigate and correct any problems. Re-extract and reanalyze the analytical batch.

If the percent recovery for any analyte in the LCS is below the lower control limit, reanalyze the LCS. If similar results are obtained on the second attempt, then investigate and correct any problems. Re-extract and reanalyze the analytical batch.

If re-extraction of samples is not possible, qualify data and explain in the case narrative.

Document all corrective actions taken in an NCM and in the case narrative.

9.4 Matrix Spike and Spike Duplicate (MS/MSD)

One matrix spike (MS) sample and one matrix spike duplicate (MSD) sample are prepared and analyzed for each analytical batch not to exceed 20 samples. An MS sample is a field sample to which known amounts of the target analytes, as well as the surrogates, have been added. An MSD is a second aliquot of the same sample that is spiked the same as the MS. The MS/MSD spiking solution is described in Section 7.2.7. MS results are used to assess the effects of the sample matrix on the accuracy of the analytical system. The MSD results are used to assess the effects of the sample matrix on the precision of the analytical system. Given the expected variability in sample matrix, the MS/MSD results are applicable to only the sample used to prepare the MS and MSD. MS/MSD results should not be extrapolated to other samples without extensive investigation and characterization to demonstrate similarity between samples.

Acceptance Criteria: The percent recovery for each requested target analyte in the MS and MSD must fall within the established control limits (found in the LIMS system). The relative percent difference (RPD) between the MS and MSD must be less than or equal to the established control limit.

Corrective Action: If the percent recovery for any requested target analyte in the MS or MSD falls outside of the established control limits, or the RPD between the MS and MSD exceeds the established limit, but the LCS and instrument QC are within control limits, then the analytical system is considered to be in control. Review sample preparation for any problems and if none are identified, then the MS/MSD failure(s) may be attributed to matrix effects, and data may be reported with an explanation in the case narrative. Depending on project requirements, it may be necessary to reanalyze the MS/MSD to confirm matrix effects.

9.5 Internal Standards

The internal standards listed in Table III and described in Section 7.2.6 are spiked at the same level in all field sample extracts, QC sample extracts, instrument blanks, and calibration standards.

Acceptance Criteria: The peak area for each internal standard in each field sample and QC sample extract should be between 50% and 200% of the peak area for the same internal standard in the midlevel standard of the initial calibration.

Corrective Action: If the internal standard fails acceptance criteria, then perform the following corrective actions:

Inspect system for malfunction and correct as needed.

Reanalyze the affected samples.

If the interference cannot be corrected for field samples, the earlier analysis is reported with discussion in the case narrative.

If QC samples have internal standard failures that are confirmed by re-analysis, the cause of the failures must be investigated.

All corrective actions must be documented.

9.6 Surrogate Compound Analysis

Surrogate compounds listed in Table II and described in Section 7.2.4 are added to all field and QC samples prior to extraction. Surrogate recoveries are used to assess individual sample matrix effects on sample preparation and analysis.

Acceptance Criteria: Surrogate recoveries must fall within established control limits. QC sample results are not acceptable unless the surrogate recoveries for those samples are in control.

Corrective Action: Corrective action must be considered for any surrogate failure and may depend on project-specific instructions. Lacking instructions to the contrary the following actions shall be taken:

Evaluate sample chromatogram and other QC.

If the surrogate(s) fail in the LCS and/or method blank, then re-prepare and reanalyze all associated samples.

For surrogate failures in field samples, re-prepare and reanalyze the samples, unless matrix interference is evident from earlier analysis or from chromatograms. In the latter case, contact the client and the matrix interference in the case narrative.)

9.7 Instrument QC

9.7.1 Instrument Optimization

- 9.7.1.1** The GC/MS system must be tuned to meet manufacturer's specifications, using a suitable calibration such as perfluorotri-n-butylamine (FC-43). This is performed through the auto-tune feature in the software. The mass calibration and resolution of the GCMS system is then verified by the analysis of DFTPP prior to the analysis of any standards or samples.
- 9.7.1.2** The instrument is tuned for DFTPP (decafluorotriphenylphosphine), calibrated initially with a seven-point calibration curve, and verified each 12-hour shift that samples are to be run with one or more continuing calibration verification (CCV) standard(s).

9.7.2 Instrument Tuning

At the beginning of every 12-hour shift when analyses are to be performed, the GC/MS system must be checked to see if acceptable performance criteria (Table VI) are achieved for DFTPP.

- 9.7.2.1** Inject 1 μL of the 50 $\mu\text{g/mL}$ GC/MS tuning standard (see Section 7.2.1) into the GC/MS system.
- 9.7.2.2** The mass spectrum of the DFTPP must be obtained in the following manner: three scans (the peak apex scan and the scans immediately preceding and following the apex) are acquired and averaged. Background subtraction is also required, and must be accomplished using a single scan acquired no more than 20 scans prior to the elution of the DFTPP. Do not subtract part of the DFTPP peak. A procedure compliant with these requirements is programmed into a Macro used to evaluate the DFTPP spectrum. Confirm that all the key m/z criteria in Table VI are achieved.
- 9.7.2.3** If all the criteria are not achieved, the analyst must adjust or retune the mass spectrometer and repeat the test until all criteria are achieved. The performance criteria must be achieved before any samples, blanks, or standards are analyzed.

9.7.3 Initial Calibration (ICAL)

- 9.7.3.1** A new calibration curve must be generated initially, after major changes to the system, or when continuing calibration criteria cannot be met. Major changes include installation of new columns and source maintenance.
- 9.7.3.2** A minimum five-point initial calibration curve must be established for linear fit calibrations (weighted or unweighted). Six points or more are required for second order curve fits. See section 9.7.4 for Calibration Acceptance Criteria.

The concentrations of standards commonly used to construct the PAH calibration curve are 20, 100, 300, 600 (often analyzed before the rest of the standards and called the ICIS), 1200, 2500, and 5000 ng/mL.

9.7.3.3 If the concentration of any target compound in a sample exceeds the calibration range, the extract must be diluted so that the concentrations of all target compounds fall within the range of the calibration curve, and be reanalyzed. Any samples analyzed immediately following the sample that exceeded the linear range may require reanalysis due to possible carryover from the high-level sample.

9.7.3.4 Generally, it is NOT acceptable to remove points from a calibration for the purposes of meeting calibration criteria, unless the points are the highest or lowest on the curve AND the reporting limit and/or the linear range is adjusted accordingly. The only exception is that a level may be removed from the calibration if the reason can be clearly documented, for example a broken vial. A minimum of five levels must remain in the calibration. The documentation must be retained with the initial calibration. Alternatively, if the analyst believes that a point on the curve is inaccurate, the point may be reanalyzed and the reanalysis used for the calibration. All initial calibration points must be analyzed without any changes to instrument conditions, and all points must be analyzed within 12 hours.

9.7.3.5 Calculate the response factor (RF) for each analyte for each calibration standard level as described in Section 10.2. Calculate the mean RF and relative standard deviation (RSD) for each analyte as described in Section 11.3, respectively.

9.7.4 Calibration Acceptance Criteria and Corrective Action:

Acceptance Criteria 8270C:

The RSD of the initial calibration for each analyte of interest must be $\leq 35\%$. (Refer to SOP DV-QA-024P for requirements for federal programs).

Acceptance Criteria 8270D:

Refer to Table VII for the acceptance criteria for minimum response factor and RSD. Two target compounds and surrogates may fail to meet the minimum RRF criteria listed in Table VII but must still meet the minimum RRF criteria of 0.010 (excluding compounds with a minimum RRF requirement of 0.010). In addition, two target compounds and surrogates may fail to meet the RSD criteria listed in Table VII but must still meet the maximum RSD requirement of 40%. (excluding compounds with a maximum RSD requirement of 40%). Refer to SOP DV-QA-024P for requirements for federal programs.

Corrective Actions:

If these criteria cannot be met, least-squares weighted or unweighted linear regression may be used to establish a calibration function as described in Section 11.4. In this case, the correlation coefficient (r) must be greater than 0.995 ($r^2 > 0.990$) or a second-order regression fit with coefficient of determination (COD) greater than 0.990 may be used. If these linearity criteria are not achieved, verify the standard preparation and instrument conditions, and then recalibrate the instrument. If technical acceptance criteria are not met, it may be necessary to clean the ion source, perform injector maintenance, change the column, or take other corrective actions.

9.7.4.1 In the event that a least-squares regression is used, the analyst should evaluate the bias at the lower portion of the curve. This can be accomplished by re-fitting the low point standard back into the curve. The recalculated concentration should be within $\pm 50\%$ of the standard's true concentration. If these criteria are not met, the analyst may have to evaluate the concentration range of the standards, or the lower limit of quantitation.

9.8 Initial Calibration Verification (ICV)

The Initial Calibration Verification (ICV) is a second-source, mid-level standard that is analyzed immediately following the initial calibration standards.

Acceptance Criteria: The absolute value of the difference between the measured PAH analyte concentration and the true value must be $\leq 30\%$.

Corrective Action: If the ICV recovery fails, then take the following actions:

Verify standard preparation, and if incorrect, re-prepare the ICV standard solution.

If preparation of the ICV standard was correct, then re-prepare the initial calibration standards and recalibrate.

Document all actions taken.

9.9 Continuing Calibration Verification (CCV)

Every 12 hours, the mass spectrometer response for each PAH relative to the internal standard is determined by analyzing a standard with the same analytes, concentrations, and lot numbers as the 600 ng/mL calibration standard. The RF for each compound in the continuing calibration verification (CCV) analysis is compared to the RF for that compound in the ICAL.

Acceptance Criteria 8270C:

The absolute value of the difference between the CCV RF for each PAH analyte and the corresponding ICAL value must be $\leq 35\%$. (Refer to SOP DV-QA-024P for requirements for federal programs).

Acceptance Criteria 8270D:

The absolute value of the difference between the CCV RF for each PAH analyte and the corresponding ICAL value must meet the criteria in Table VII. The compounds must also meet the minimum response factor criteria listed in Table VII. Two target compounds and surrogates may fail to meet the minimum RRF criteria in Table VII (excluding compounds with a minimum RRF requirement of 0.010) but must still meet the minimum RRF criteria of 0.010. In addition, two target compounds and surrogates may fail to meet the difference criteria in Table VII (excluding compounds with a maximum percent difference requirement of $\pm 40\%$) but must still meet the maximum difference requirement of $\pm 40\%$. (Refer to SOP DV-QA-024P for requirements for federal programs).

Acceptance Criteria 8270C & 8270D:

The internal standard response of the CCV must be within 50-200% of the internal standard response in the corresponding level of the most recent ICAL sequence.

The internal standard retention time must be within ± 30 seconds of the internal standard retention time in the corresponding level of the most recent ICAL sequence.

Corrective Action:

If, for any analyte, the CCV RF does not meet the stipulated acceptance criteria, a five-point calibration curve must be repeated for that analyte prior to the analysis of samples.

If any internal standard retention time in the CCV changes by more than 30 seconds from that of the corresponding level of the most recent ICAL sequence, the chromatographic system must be inspected for malfunctions and corrections made, as required.

10.0 Procedure

One-time procedural variations are allowed only if deemed necessary in the professional judgment of supervision to accommodate variation in sample matrix, radioactivity, chemistry, sample size, or other parameters. Any variation in procedure shall be completely documented using an NCM. The NCM is automatically sent to the laboratory supervisor and Project Manager by e-mail so that the client can be notified as appropriate. The NCM process is described in more detail in SOP DV-QA-0031. The NCM shall be filed in the project file and addressed in the case narrative.

10.1 Sample Preparation

10.1.1 Aqueous Sample Extraction and Concentration

10.1.1.1 Instructions for the extraction of aqueous samples may be found in SOPs DV-OP-0006 or DV-OP-0008.

10.1.1.2 Instructions for the concentration of extracts may be found in SOP DV-OP-0007.

10.1.2 Soil Sample Extraction and Concentration

- 10.1.2.1** Instructions for the ultrasonic extraction of soil samples may be found in SOP DV-OP-0016.
- 10.1.2.2** Instructions for the microwave extraction of soil samples may be found in SOP DV-OP-0015.
- 10.1.2.3** Instructions for the concentration of extracts may be found in SOP DV-OP-0007.

10.2 Sample Analysis

- 10.2.1** All aliquotting, extract dilutions, and spike additions must be performed in the trace fume hood using equipment dedicated to PAH-SIM analysis. An aliquot of each sample extract is placed into a two-milliliter GC/MS autosampler vial. Sufficient volume of extract remains should reanalysis be necessary.
- 10.2.2** Prior to analysis, internal standard is added to the sample vial giving a final internal standard concentration of 600 ng/mL in the extract.
- 10.2.3** Representative aliquots are injected into the gas chromatograph/mass spectrometer using similar conditions to those summarized in Table I. The injection volume is 1 μ L.
- 10.2.4** Whenever an unusually concentrated sample is encountered, it may be necessary to reanalyze the subsequent sample extracts after analyzing an instrument blank to demonstrate that there is no cross contamination.
- 10.2.5** The following is a typical analytical sequence:
 - Solvent rinses, as needed
 - MS tune
 - ICAL plus ICV or CCV
 - Instrument blank
 - MB, LCS
 - LCSD (if requested by client)
 - Sample extracts
 - MS and MSD are interspersed with sample extracts, and usually run after the sample from which they are produced.
 - The last sample extract must be run within 12 hours of the tune.
- 10.2.6** The sequence may be altered to accommodate reanalysis or additional instrument blank and calibration evaluations. At a minimum, an instrument blank or a method blank shall be included in the sequence. Refer to QC policy DV-QA-003P for additional details.
- 10.2.7** The effluent from the GC capillary column is fed directly into the ion source of the mass spectrometer. The MS is operated in the selected ion monitoring (SIM)

mode using appropriate windows to include the quantitation and confirmation masses for each analyte as shown in Table IV.

- 10.2.8** All compounds detected at concentrations above the method MDL are checked to ensure that the confirmation ion is present at the appropriate ratio.
- 10.2.9** All compounds detected at concentrations above the highest calibration standard require dilution and reanalysis. In addition, any samples that were analyzed immediately following a high-level sample should be reanalyzed to rule out carryover from the high-level sample, unless they are preceded by an acceptable instrument blank or the high compound(s) were not detected in the subsequent samples.

10.2.10 Manual Integrations

Upon completion of the analytical sequence, transfer the raw instrument data to Target DB for further processing. Review the chromatograms to ensure correct assigning of peaks and correct integration of each peak.

Note that certain compounds (e.g., benzo(b)fluoranthene and benzo(k)fluoranthene) may require frequent manual integrations. Special attention must be exercised by the analyst and secondary reviewer for compounds that are commonly mis-integrated in automated software or are manually integrated. If manual data manipulations are necessary, they must be justified and documented. See DV-QA-011P requirements for manual integration.

11.0 Calculations / Data Reduction

11.1 Qualitative Identification

Obtain electronic ion current profiles (EICP) for the primary m/z and the confirmatory ion for detected compounds. The following criteria must be met to make a qualitative identification:

- 11.1.1** The characteristic masses of each parameter of interest must maximize in the same or within one scan of each other.
- 11.1.2** The retention time (RT) of unknown peaks must fall within ± 0.2 minute of the RT for the compound in the daily calibration standard (mid-point ICAL or daily CCV).
- 11.1.3** The relative peak areas of the primary ion compared to the confirmation or secondary ion masses in the EICPs must fall within $\pm 20\%$ of the relative intensities of these masses in a reference mass spectrum. The reference mass spectrum can be obtained from a standard analyzed in the GC/MS system or from a reference library. A compound that does not meet secondary ion confirmation criteria may still be determined to be present in a sample after close inspection of the data by the mass spectroscopist. Supportive information includes correct relative retention time (RRT) and the presence of the secondary ion, but the ratio falls outside of $\pm 20\%$ of the primary ion, which may be caused by an interference of the secondary ion.

11.1.4 Structural isomers that have very similar mass spectra and less than a 30-second difference in retention time, can be explicitly identified only if the resolution between authentic isomers in a standard mix is acceptable. Acceptable resolution is achieved if there is a definitive inflection between the two peaks, according to the analyst's judgment. Otherwise, structural isomers are identified as isomeric pairs.

11.2 Detailed information regarding calibration models and calculations can be found in Corporate SOP CA-Q-S-005, *Calibration Curves (General)* and the public folder *Arizona Calibration Training*.

11.3 Average Response Factor Calibration

The following formula is used to calculate the response factor for each analyte of interest relative to the applicable internal standard for each of the calibration standards:

$$RF = \frac{A_s \times C_{is}}{A_{is} \times C_s}$$

Where:

A_s = Area of the characteristic ion for the target analyte in the calibration standard.
 A_{is} = Area of the characteristic ion for the internal standard.
 C_{is} = Concentration of the internal standard, (ng/mL).
 C_s = Concentration of the target analyte in the calibration standard (ng/mL).

The calibration uses the average response factor for each target analyte, which is calculated as follows:

$$\text{average (mean) } RF = \overline{RF} = \frac{\sum_{i=1}^n RF_i}{n}$$

Where:

RF_i = Response factor for the i^{th} calibration level.
 n = Number of calibration levels.

The standard deviation for the mean RF for each target analyte is calculated as follows:

$$SD = \sqrt{\frac{\sum_{i=1}^n (RF_i - \overline{RF})^2}{n - 1}}$$

The relative standard deviation (RSD) for the average response factor for each target analyte is calculated as follows:

$$RSD = \frac{SD}{\overline{RF}} \times 100\%$$

The concentration of each target analyte in the sample extract is calculated using the average response factor that was calculated in Section 0 as follows:

$$C_e = \frac{A_e \times C_{is}}{A_{is} \times \overline{RF}}$$

Where:

| | | |
|-----------------|---|--|
| C_e | = | Concentration of target analyte in the sample extract, ng/mL. |
| A_e | = | Area of the characteristic ion for the target analyte in the sample extract. |
| A_{is} | = | Area of the characteristic ion for the internal standard. |
| C_{is} | = | Concentration of the internal standard, (ng/mL). |
| \overline{RF} | = | Average response factor for the target analyte as determined by calibration. |

11.4 Linear Least-Squares Regression Calibration (Unweighted)

A linear least-squares regression is performed using the concentration of the target analyte in the calibration standard as the independent variable (x) and the instrument response as the dependent variable (y). The regression produces the slope and intercept terms for a linear equation in the following form:

$$y = mx + b$$

Where:

| | | |
|---|---|---|
| y | = | instrument response (e.g., peak area) |
| x | = | concentration of target analyte in calibration standard |
| m | = | slope of the line |
| b | = | intercept of the line |

For the internal standard calibration, the regression equation is rewritten as follows:

$$\frac{A_s C_{is}}{A_{is}} = m C_s + b$$

Where:

| | | |
|----------|---|--|
| A_s | = | Area of the characteristic ion for the target analyte in the calibration standard. |
| A_{is} | = | Area of the characteristic ion for the internal standard. |
| C_s | = | Concentration of the target analyte in the calibration standard, (ng/mL). |
| C_{is} | = | Concentration of the internal standard, (ng/mL). |
| m | = | slope of the line |
| b | = | intercept of the line |

The concentration in an unknown extract is then calculated by rearranging the calibration equation as follows:

$$C_e = \frac{\left[\frac{A_s C_{is}}{A_{is}} - b \right]}{m}$$

Where C_e is the concentration of the target analyte in the sample extract, and A_e is the area of the characteristic ion for the target analyte in the sample extract.

The actual sample concentration (C) for each compound is calculated as follows:

$$C = C_e \times \left(\frac{V_e}{V_o} \right) \times DF$$

Where:

| | | |
|-------|---|--|
| C | = | Concentration of the target analyte in the original sample, ng/L (aqueous sample) or ng/kg (solid sample). |
| C_e | = | Concentration of the target analyte in the sample extract, ng/mL. |
| V_e | = | Final extract volume, mL. |
| V_o | = | The original volume or weight of the sample that was extracted, L (aqueous sample) or kg (solid sample). |
| DF | = | Dilution factor, if appropriate. |

11.5 Additional Regression Calibration Models

As needed, weighted linear least-squares or second order regressions may be utilized for this analysis. See Corporate SOP CA-Q-S-005, *Calibration Curves (General)*, Attachment 1, and the public folder *Arizona Calibration Training* for calculations and further explanations.

- 11.6 A second-level technical review of the organic data is performed prior to data reporting. This review is performed by a peer or supervisor using the guidelines and checklists detailed in SOP DV-QA-0020.

12.0 Method Performance

12.1 Method Detection Limit Study (MDL)

A valid method detection limit (MDL) must be determined for each analyte of interest prior to analyzing samples and must be verified at least annually thereafter. MDLs are determined using laboratory reagent water (for aqueous samples) and sand (for solid samples) that is spiked with the target analytes at concentrations near the estimated MDL. The MDL must be below the reporting limit for each analyte. The procedure for determination of the method detection limit is given in 40 CFR Part 136, Appendix B, and further defined in TestAmerica Denver Policy DV-QA-005P.

12.2 Demonstration of Capabilities

Each analyst must successfully complete an initial demonstration of capability (DOC) prior to analyzing samples. Demonstrations of capability for both soil and water matrices are

required. On-going DOCs must be performed by each analyst annually. This requires analysis of QC check samples containing all of the standard analytes for the method. For some tests it may be necessary to use more than one QC check mix to cover all analytes of interest. Details for the initial and on-going DOCs are provided in SOP DV-QA-0024.

12.3 Training Requirements

The group/team leader has the responsibility to ensure that this procedure is performed by an analyst who has been properly trained in its use and has the required experience. Training and qualification requirements are detailed in SOP DV-QA-0024.

12.4 Retention Time Study

12.4.1 Expected absolute retention times (RTs) are initially determined by analyzing all target analytes in the open-scan mode. Example RTs are listed in Table V.

12.4.2 Relative retention times (RRTs) are then calculated for samples in each analytical run based on the RTs found in the continuing calibration verification standard (CCV).

12.4.3 RTs are re-established after any significant instrument maintenance, including source cleaning and changing columns, or whenever compounds are not adequately detected in CCVs or LCSs.

13.0 Pollution Control

Standards and reagents are prepared in volumes consistent with laboratory use to minimize the volume of expired standards and reagents requiring disposal.

14.0 Waste Management

14.1 All waste will be disposed of in accordance with Federal, State, and local regulations. Where reasonably feasible, technological changes have been implemented to minimize the potential for pollution of the environment. Employees will abide by this procedure, the policies in section 13, "Waste Management and Pollution Prevention", of the Environmental Health and Safety Manual, and DV-HS-001P, "Waste Management Program."

14.2 The following waste streams are produced when this method is carried out:

14.2.1 Expired Chemicals/Reagents/Standards – Contact Waste Coordinator

14.2.2 Methylene chloride solvent rinse waste – Waste Stream B

14.2.3 Expired extract vial waste – Waste Stream A

14.2.4 Radioactive and potentially radioactive waste must be segregated from non-radioactive and mixed waste as appropriate. Contact the Radioactive Waste Coordinator for proper management of radioactive or potentially radioactive waste generated by this procedure.

15.0 References / Cross-References

- 15.1** Test Methods for Evaluating Soil Waste Physical/Chemical Methods (SW-846), Third Edition, September 1986, Final update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final update IIB, January 1995; Final Update III, December 1996, Final Update IV January 2008.
- 15.1.1** Method 8000B, Determinative Chromatographic Separations, Revision 2, December 1996.
- 15.1.2** Method 8270C, Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS), Revision 3, December 1996.
- 15.1.3** Method 8000C, Determinative Chromatographic Separations, Revision 2, February 2007.
- 15.1.4** Method 8270D, Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS), Revision 4, February 2007.
- 15.1.5** Method 3510C, Separatory funnel Liquid-Liquid Extraction, Revision 3, December 1996.
- 15.1.6** Method 3520C, Continuous Liquid-Liquid Extraction, Revision 3, December 1996.
- 15.1.7** Method 3550B, Ultrasonic Extraction, Revision 2, December 1996.
- 15.1.8** Method 3546, Microwave Extraction, Revision 0, February 2006.
- 15.2** CLP Statement of work for Multi-Media, Multi-Concentration Organics Analysis, SOM01.2. June 2007.

16.0 Method Modifications

- 16.1** The CLP SOW referenced in 8270D does not require the analysis of DFTPP prior to the analysis of samples. The method relies on the successful analysis of calibration standards to verify acceptable function of the mass spectrometer. TestAmerica Denver utilizes the DFTPP check to identify any operational issues with the mass spectrometer prior to the analysis of the calibration standards. This allows the analyst to identify possible problems independent of the GC. As a result, the laboratory will start the 12 hour clock with the injection of the DFTPP, not the calibration standard as required in the method.
- 16.2** Method 8270C serves as the basis for this SOP, but the method has been modified extensively for low-level analysis using selected ion monitoring (SIM) and optimizing instrument conditions for the low-level analysis. Consequently the sensitivity of the method has been enhanced and it is not uncommon to detect low-level contamination in the method blank at levels well below the limits of detection for the less sensitive GC/MS method. For example, Method 8270C states that the RSD of the initial and continuing calibration must less than or equal to 15% and 20% respectively. Due to the low-level nature of the analysis, this SIM procedure allows both of these criteria to be less than or equal to 35%.

16.3 Method 8270C stipulates qualitative identification based on relative retention time (RRT), which is calculated by dividing the retention time (RT) of the target analyte by the RT of the internal standard. The RRT of the suspected target analyte in the sample extract must be within ± 0.06 RRT units of the RRT for that analyte in the calibration standard. This SOP stipulates qualitative identification based on an absolute RT. Namely the RT of the suspected target analyte in the sample extract must be within ± 0.2 minute of the RT for that analyte in the calibration standard. Additionally, the RT for the internal standard in the sample extract must also be within ± 0.2 minute of the RT for the internal standard in the calibration standard. The criteria used in this SOP are more restrictive than those imposed by the referenced method. For the earliest eluting compounds, the RT for the internal standard is typically 8 minutes. The earliest eluting target analyte must be at a RRT of at least 0.8, which translates to a RT of 6.4 minutes. Assuming a worst-case scenario where the RT of the internal standard is 0.2 minute higher (i.e., 8.2 minutes) and the RT of the target analyte is 0.2 minute lower (i.e., 6.2 minutes), the calculated RRT is 0.76. The total deviation from the expected RRT is 0.04 RRT units, which is smaller than what is allowed by Method 8270C.

17.0 Attachments

| | |
|-------------|--|
| Table I: | Routine Instrument Operating Conditions |
| Table II: | Surrogates for Standard List Analysis |
| Table III: | Internal Standards for Standard List Analysis |
| Table IV: | PAH Compounds and Ions Used for Analysis |
| Table V: | Example Retention Times, IS and Surrogate Associations |
| Table VI: | DFTPP Key Ions and Ion Abundance Criteria for 8270C and 8270D |
| Table VII: | 8270D Relative Response Factor Criteria for Initial and Continuing Calibration |
| Appendix I: | Extended List PAHs |

18.0 Revision History

- Revision 6.2: 31 August 2011
 - Inserted Section 7.2.4.
 - Revised QC section (Section 9)
 - Inserted paragraph 10.2.10. regarding manual integration
 - Added Section 11.5
 - Revised Section 16.2 regarding calibration criteria
 - Updated prep methods used and inserted prep methods in reference section
 - Annual Technical Review
 - Grammatical and formatting changes throughout
- Revision 6.1: August 2010.
 - Annual Technical Review
- Revision 6: August 2009.
 - Removed the requirement to have PCP in the DFTPP tune standard.
 - Calibration sections were updated to reflect the criteria in method 8270D and the CLP Multi-media and Multi-concentration for Organic Analysis.
 - Section 2 on instrument conditions was expanded.
 - Table VII was added.
- Revision 5.1: June 2009.

- Added Appendix I for extended list PAHs.
 - Removed all references to Pentachlorophenol (PCP), the lab no longer supports this method for the analysis of PCP.
- Revision 5: April 2008.
 - Revised calibration levels in section 7.4 to include the low level standard for the initial calibration.
 - Changed references to TestAmerica and adjusted format to comply with TestAmerica format.

Table I: Routine Instrument Operating Conditions

| GC Conditions | |
|-------------------------------------|---|
| Inlet | Splitless at 275 °C |
| Capillary Column | Varian VF-5MS, 30 m length, 0.25 mm diam ID, 0.5 µm thickness |
| Column Mode | Constant flow, 3.4 mL/min |
| Temperature Program | Initial temp = 50 °C 25 °C/min ramp to 170 °C 35 °C/min ramp to 325 °C and hold for at least 1 minute past the elution time of the last compound. |
| Run Time | About 20 minutes with a new column. |
| Carrier Gas | Helium Purge flow = 25.0 mL/min, 3.00 min Total flow ≈ 31 mL/min |
| Injection Volume | 1.0 µL |
| Transfer Line | 290 °C or 300 °C |
| Mass Spectrometer Conditions | |
| MS Source | 230 °C or 240 °C |
| MS Quadrupole | 200 °C |
| Dwell Time per Ion | Ranges from 30 to 100 milliseconds |
| Ions | See following tables |

NOTE: The conditions listed above are subject to final fine adjustments to maximize instrument sensitivity. Changes to the above conditions are acceptable as long as method criteria are met.

Table II: Surrogates for Standard List Analysis

| PAH Surrogates | Mass Ion | Confirmation Ion |
|-----------------------------|-----------------|-------------------------|
| Nitrobenzene-d ₅ | 82 | 128 |
| 2-Fluorobiphenyl | 172 | 171 |
| Terphenyl-d ₁₄ | 244 | 122 |

Table III: Internal Standards for Standard List Analysis

| Compound | Mass Ion | Confirmation Ion |
|------------------------------|----------|------------------|
| Acenaphthene-d ₁₀ | 164 | 162 |
| Phenanthrene-d ₁₀ | 188 | 94 |
| Chrysene-d ₁₂ | 240 | 120 |

Table IV: PAH Compounds and Ions Used for Analysis

| Compound | Mass Ion | Confirmation Ion |
|------------------------|----------|------------------|
| Acenaphthene | 153 | 152 |
| Acenaphthylene | 152 | 151 |
| Anthracene | 178 | 179 |
| Benzo(a)anthracene | 228 | 229 |
| Benzo(a)pyrene | 252 | 253 |
| Benzo(b)fluoranthene | 252 | 253 |
| Benzo(g,h,i)perylene | 276 | 277 |
| Benzo(k)fluoranthene | 252 | 253 |
| Chrysene | 228 | 226 |
| Dibenzo(a,h)anthracene | 278 | 139 |
| Dibenzofuran | 168 | 139 |
| Fluoranthene | 202 | 101 |
| Fluorene | 166 | 165 |
| Indeno(1,2,3,cd)pyrene | 276 | 138 |
| 1-Methylnaphthalene | 142 | 115 |
| 2-Methylnaphthalene | 142 | 115 |
| Naphthalene | 128 | 129 |
| Phenanthrene | 178 | 179 |
| Pyrene | 202 | 101 |

Table V: Example Retention Times, IS and Surrogate Associations

| Compound | RT (min.) | IS # | Surrogate # |
|------------------------------|-----------|------|-------------|
| Naphthalene | 5.921 | 1 | 1 |
| 2-Methylnaphthalene | 6.595 | 1 | 1 |
| 1-Methylnaphthalene | 6.700 | 1 | 1 |
| Acenaphthylene | 7.512 | 1 | 2 |
| Acenaphthene | 7.686 | 1 | 2 |
| Dibenzofuran | 7.861 | 1 | 2 |
| Fluorene | 8.210 | 1 | 2 |
| Phenanthrene | 9.194 | 2 | 2 |
| Anthracene | 9.255 | 2 | 2 |
| Fluoranthene | 10.768 | 2 | 2 |
| Pyrene | 11.166 | 2 | 2 |
| Benzo(a)anthracene | 13.827 | 3 | 3 |
| Chrysene | 13.924 | 3 | 3 |
| Benzo(b)fluoranthene | 17.004 | 3 | 3 |
| Benzo(k)fluoranthene | 17.089 | 3 | 3 |
| Benzo(a)pyrene | 18.034 | 3 | 3 |
| Indeno(1,2,3,cd)pyrene | 21.509 | 3 | 3 |
| Dibenz(a,h)anthracene | 21.583 | 3 | 3 |
| Benzo(g,h,i)perylene | 22.306 | 3 | 3 |
| Acenaphthene-d ₁₀ | 7.657 | 1 | - |
| Phenanthrene-d ₁₀ | 9.177 | 2 | - |
| Chrysene-d ₁₂ | 13.856 | 3 | - |
| Nitrobenzene-d ₅ | 5.201 | 1 | 1 |
| 2-Fluorobiphenyl | 6.945 | 1 | 2 |
| Terphenyl-d ₁₄ | 11.38 | 3 | 3 |

**Table VI: DFTPP Key Ions and Ion Abundance Criteria
8270C**

| Mass | Ion Abundance Criteria |
|-------------|-------------------------------------|
| 51 | 30-60 % of mass 198 |
| 68 | < 2 % of mass 69 |
| 69 | Mass 69 relative abundance |
| 70 | < 2 % of mass 69 |
| 127 | 40-60 % of mass 198 |
| 197 | < 1 % of mass 198 |
| 198 | Base peak, 100 % relative abundance |
| 199 | 5-9 % of mass ion 198 |
| 275 | 10-30 % of mass 198 |
| 365 | > 1 % of mass 198 |
| 441 | Present, but less than mass 443 |
| 442 | 40-100 % of mass 198 |
| 443 | 17-23 % of mass 442 |

With the exception of mass 442, the tune criteria for SW846 method 8270D are less stringent for the criteria required in SW846 method 8270C. For 8270D, the 442 mass must be greater than 50% of mass 198 to meet the tune criteria. By using the 8270C criteria, the rest of the data will be within the 8270D criteria.

Table VII: 8270D Relative Response Factor Criteria for Initial and Continuing Calibration

| Compound | Minimum RRF | Maximum %RSD | Maximum %Diff |
|------------------------|-------------|--------------|---------------|
| Acenaphthene | 0.900 | 20 | 25 |
| Acenaphthylene | 0.900 | 20 | 25 |
| Anthracene | 0.700 | 20 | 25 |
| Benzo(a)anthracene | 0.800 | 20 | 25 |
| Benzo(a)pyrene | 0.700 | 20 | 25 |
| Benzo(b)fluoranthene | 0.700 | 20 | 25 |
| Benzo(g,h,i)perylene | 0.500 | 20 | 25 |
| Benzo(k)fluoranthene | 0.700 | 20 | 25 |
| Chrysene | 0.700 | 20 | 25 |
| Dibenzo(a,h)anthracene | 0.400 | 20 | 25 |
| Dibenzofuran | 0.800 | 20 | 25 |
| Fluoranthene | 0.600 | 20 | 25 |
| Fluorene | 0.900 | 20 | 25 |
| Indeno(1,2,3,cd)pyrene | 0.500 | 20 | 25 |
| 1-Methylnaphthalene | 0.400 | 20 | 25 |
| 2-Methylnaphthalene | 0.400 | 20 | 25 |
| Naphthalene | 0.700 | 20 | 25 |
| Phenanthrene | 0.700 | 20 | 25 |
| Pyrene | 0.600 | 20 | 25 |

Appendix I: Extended List PAH Analysis by GC/MS

Summary of Method

This is the extended list for the SIM analysis that some clients require.

Modifications from the SIM analysis are as follows:

- The DFTPP tune has tailing factors that are calculated for Pentachlorophenol and Benzidine and a DDT breakdown check is performed.
- The instrument is calibrated at eight concentration levels. The calibration levels are made by diluting two stock standards with concentrations of 20 µg/mL [PAHXSIM stock (#1)] and 2µg/mL [PAHXSIM 2^o stock (#2)] down to the concentrations listed below, in methylene chloride. All phthalate compounds and 2-methylnaphthalene are at a ratio of 2:1 in the stock standards. Therefore, if the concentration is 0.02µg/mL for the target analytes, the phthalates are at 0.04µg/mL.

| Level (µg/mL) | Stock ID | Stock Amt (µL) | Solvent amount (µL) | IS amount (µL) | Final Volume (µL) |
|------------------|-------------|----------------------|---------------------------|-------------------|-------------------------|
| 0.02 µg/mL | #2 | 5 | 495 | 50 | 500 |
| 0.1 µg/mL | #2 | 25 | 475 | 50 | 500 |
| 0.3 µg/mL | #2 | 75 | 425 | 50 | 500 |
| 0.6 µg/mL | #1 | 15 | 485 | 50 | 500 |
| 1.2 µg/mL | #1 | 30 | 470 | 50 | 500 |
| 2.5 µg/mL | #1 | 62.5 | 437.5 | 50 | 500 |
| 5.0 µg/mL | #1 | 125 | 375 | 50 | 500 |
| 10.0 µg/mL | #1 | 250 | 250 | 50 | 500 |

Response factors for each compound must be ≤20% RSD. If any compound is >20%RSD, must use the best curve fit.

Initial Calibration Verification

- The second source calibration stock is also at 20 µg/mL (PAHSIM SSV stock).

- The second source verification (SSV or ICV) is analyzed at 1.2 µg/mL.
- The acceptance criterion for the ICV is $\pm 25\%D$.

Continuing Calibration Verification

- The CCV is run at 0.6µg/mL
- The criterion: The Average %D for all compounds must be <20%D, with no single compound exceeding 30%D.

Sample extraction: See DV-OP-0008 (aqueous) and DV-OP-0009 (soil).

Sample concentration: See DV-OP-0007.

Internal Standard final concentration is 6 µg/mL in standards and extracts. The stock is at 400 µg/mL

Control limits are stored in the LIMS system.

| Target Analytes |
|------------------------|
| Acenaphthene |
| Acenaphthylene |
| Anthracene |
| Benzo(a)anthracene |
| Benzo(k)fluoranthene |
| Benzo(b)fluoranthene |
| Benzo(g,h,i,)perylene |
| Benzo(a)pyrene |
| Dibenzo(a,h)anthracene |
| Fluoranthene |
| Indeno(1,2,3-cd)pyrene |
| 2-Methylnaphthalene |
| 1-Methylnaphthalene |
| Phenanthrene |
| Pyrene |
| Naphthalene |
| Fluorene |
| Chrysene |
| Hexachlorobutadiene |
| Hexachlorobenzene |
| Dibenzofuran |

| Extended List Compounds |
|-----------------------------|
| 1,4 Dioxane |
| N-Nitrosodiphenylamine |
| N-Nitrosodimethylamine |
| Butyl Benzyl Phthalate |
| Dimethyl Phthalate |
| Diethyl Phthalate |
| Bis(2-Ethylhexyl) Phthalate |
| Di-n-octyl Phthalate |
| Di-n-butyl Phthalate |

The recovery for the spike pair must be within the control limits stored in the LIMS. The MS/MSD pair is aliquotted and run two times on the instrument, to confirm the results. If the results to be reported are from the first analysis, it is not required that the second analysis be within the 12 hour tune clock.

Some of the above compounds have advisory limits (30-150% Recovery). There is not enough data to sufficiently determine accurate control limits. As sufficient data are collected (ideally at least 30 data points), the spike control limits will be updated to ± 3 standard deviations of the historical mean % recovery. Limits will be updated annually.

The GCMS instrumentation is configured the same as in the SIM analysis, but the ramp parameters are the following:

| Ramp | Rate (°C/min) | Temp Hold (°C) | Time of Hold (min) |
|------|---------------|----------------|--------------------|
| -- | -- | 40 | 2 |
| 1 | 25 | 190 | 0 |
| 2 | 35 | 325 | varies * |

- * The length of the last hold is dependent on the length of the column. This hold is typically 1-1 ½ minutes after the last compound elutes.

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1.0 Scope and Application

- 1.1 This method is applicable to the determination of volatile organic compounds (VOCs) in water, wastewater, soils, sludges, and other solid matrices. Standard analytes are listed in Tables 1 and 2.
- 1.2 This SOP is applicable to Method 8260B, which is appropriate for compliance testing under RCRA regulations. Appendices A and B present modifications to the procedures in the main SOP necessary for wastewater by Method 624 (CWA compliance testing). It is important that the differences among these methods are carefully observed.
- 1.3 This method can be used to quantify most volatile organic compounds that have boiling points below 200 °C and are insoluble or slightly soluble in water. Volatile water-soluble compounds can be included in this analytical technique; however, for more soluble compounds, quantitation limits are approximately ten times higher because of poor purging efficiency.
- 1.4 The method is based upon a purge-and-trap, gas chromatograph/mass spectrometric (GC/MS) procedure. The approximate working range is 0.5 to 60 µg/L for 8260B waters, 2.5 to 200 µg/kg for low-level soils, and 200 to 30,000 µg/kg for medium-level soils. The working range for Method 624 (5 mL purge) is 5-200 µg/L.
- 1.5 Reporting limits are listed in Tables 1, 2, and 3.
- 1.6 Method performance is monitored through the use of surrogate compounds, matrix spike/matrix spike duplicates (MS/MSD), and laboratory control spike samples (LCS).
- 1.7 Appendix A of this method contains the modifications needed to run the instrument in the selected ion monitoring mode for 1,4-Dioxane.

2.0 Summary of Method

- 2.1 Volatile compounds are introduced into the gas chromatograph by the purge and trap method. The components are separated via the gas chromatograph and detected using a mass spectrometer, which is used to provide both qualitative and quantitative information.
- 2.2 Aqueous samples are purged directly. Generally, soils are preserved by extracting the volatile analytes into methanol. If especially low detection limits are required, soil samples may be preserved with sodium bisulfate and purged directly.
- 2.3 In the purge-and-trap process, an inert gas is bubbled through the solution at ambient temperature or at 40 °C (40 °C is required for low-level soils), and the volatile components are efficiently transferred from the aqueous phase to the vapor phase. The vapor is swept through a sorbent column where the volatile components are trapped. After purging is completed, the sorbent column (trap) is heated and backflushed with inert gas to desorb the components onto a gas chromatographic column. The gas chromatographic column is then heated to elute the components, which are detected with a mass spectrometer.
- 2.4 Qualitative identifications are confirmed by analyzing standards under the same conditions used for samples and comparing the resultant mass spectra and GC retention

times. Each identified component is quantified by relating the MS response for an appropriate selected ion produced by that compound to the MS response for another ion produced by an internal standard.

3.0 Definitions

3.1 Terms

The quality control terms used in this procedure are consistent with SW-846 terminology. Definitions are provided in the glossary of the TestAmerica Denver Quality Assurance Manual (QAM).

3.2 Calibration Check Compound (CCC)

CCCs are a representative group of compounds that are used to evaluate initial calibrations and continuing calibrations. Relative percent difference for the initial calibration and % drift for the continuing calibration response factors are calculated and compared to the specified method criteria.

3.3 System Performance Check Compounds (SPCC)

SPCCs are compounds that are sensitive to system performance problems and are used to evaluate system performance and sensitivity. A response factor from the continuing calibration is calculated for the SPCC compounds and compared to the specified method criteria.

3.4 Initial Calibration Verification (ICV)

The ICV is a second-source calibration verification standard. In this SOP, the LCS and the MS/MSD spikes are second-source standards.

3.5 Continuing Calibration Verification (CCV)

A solution of method analytes, surrogate compounds, and internal standards used to evaluate the performance of the instrument system with respect to a defined set of method criteria.

3.6 Selected Ion Monitoring (SIM)

Operation of the mass spectrometer in the selected ion monitoring mode to optimize the quantitative information at the expense of qualitative information gained from other methods of analysis.

4.0 Interferences

4.1 Method interferences may be caused by contaminants in solvents, reagents, glassware, and other processing apparatus that lead to discrete artifacts. All of these materials must be routinely demonstrated to be free from interferences under conditions of the analysis by running laboratory method blanks as described in the Quality Control section. The use of ultra high purity gases, pre-purged purified reagent water, and approved lots of purge-and-trap-grade methanol will greatly reduce introduction of contaminants. In extreme cases, the purging vessels may be pre-purged to isolate the instrument from laboratory air contaminated by solvents used in other parts of the laboratory.

4.2 Samples can be contaminated by diffusion of volatile organics (particularly methylene chloride and fluorocarbons) into the sample through the septum seal during shipment and

storage. A field blank prepared from reagent water and carried through the sampling and handling protocol can serve as a check on such contamination.

- 4.3 Matrix interferences may be caused by non-target contaminants that are co-extracted from the sample. The extent of matrix interferences will vary considerably from source to source depending upon the nature and diversity of the site being sampled.
- 4.4 Cross-contamination can occur whenever high-level and low-level samples are analyzed sequentially or in the same purge position on an autosampler. Whenever an unusually concentrated sample is analyzed, it should be followed by one or more blanks to check for cross-contamination. The purge and trap system may require extensive bake-out and cleaning after a high-level sample.
- 4.5 Some samples may foam when purged due to surfactants present in the sample. When this kind of sample is encountered, an antifoaming agent (e.g., J.T. Baker's Antifoam B silicone emulsion) can be used. A blank spiked with this agent must be analyzed with the sample. (See Section 10.1.3.8.)
- 4.6 Interferences are observed with the surrogate Toluene-d₈ when the samples appear to be treated with potassium permanganate.

5.0 **Safety**

Employees must abide by the policies and procedures in the Environmental Health and Safety Manual, Radiation Safety Manual and this document.

This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, nitrile gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

5.1 **Specific Safety Concerns or Requirements**

- 5.1.1 The gas chromatograph and mass spectrometer contain zones that have elevated temperatures. The analyst needs to be aware of the locations of those zones, and must cool them to room temperature prior to working on them.
- 5.1.2 The mass spectrometer is under deep vacuum. The mass spectrometer must be brought to atmospheric pressure prior to working on the source.
- 5.1.3 There are areas of high voltage in both the gas chromatograph and the mass spectrometer. Depending on the type of work involved, either turn the power to the instrument off, or disconnect it from its source of power.

5.2 **Primary Materials Used**

The following is a list of the materials used in this method, which have a serious or significant hazard rating. **Note: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.** A complete list of materials used in the

method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

| Material ⁽¹⁾ | Hazards | Exposure Limit ⁽²⁾ | Signs and symptoms of exposure |
|--|---------------------------------|-------------------------------|---|
| Methanol | Flammable Poison Irritant | 200 ppm (TWA) | A slight irritant to the mucous membranes. Toxic effects exerted upon nervous system, particularly the optic nerve. Symptoms of overexposure may include headache, drowsiness, and dizziness. Methyl alcohol is a defatting agent and may cause skin to become dry and cracked. Skin absorption can occur; symptoms may parallel inhalation exposure. Irritant to the eyes. |
| (1) Always add acid to water to prevent violent reactions. | | | |
| (2) Exposure limit refers to the OSHA regulatory exposure limit. | | | |

6.0 **Equipment and Supplies**

6.1 **Instrumentation**

- 6.1.1** Purge and Trap Device: The purge and trap device consists of the sample purger, the trap, and the desorber.
- 6.1.2** Sample Purger: The recommended purging chamber is designed to accept between 5 mL and 25 mL samples with a water column at least 3 cm deep. The purge gas must pass through the water column as finely divided bubbles, each with a diameter of less than 3 mm at the origin. The purge gas must be introduced no more than 5 mm from the base of the water column. Alternative sample purge devices may be used provided equivalent performance is demonstrated. Low level soils are purged directly from a VOA vial.
- 6.1.3** Trap: A variety of traps may be used, depending on the target analytes required. The O.I. #10 (Tenax / Silica gel / Carbon Molecular Sieve) is recommended. Other traps such as the Vocarb 3000 or Vocarb 4000 may be used if the Quality Control criteria are met.
- 6.1.4** Desorber: The desorber should be capable of rapidly heating the trap up to 270 °C depending on the trap packing material. Many such devices are commercially available.
- 6.1.5** Sample Heater: A heater capable of maintaining the purge device at 40 °C is necessary for low level soil analysis.
- 6.1.6** Purge-and-trap Autosampler: An autosampler capable of sampling from a sealed vial, Varian Archon, or equivalent.

- 6.1.7** Gas Chromatograph: The gas chromatograph (GC) system must be capable of temperature programming.
- 6.1.8** Gas Chromatographic Columns: Capillary columns are used. Some typical columns are listed below:
- 6.1.8.1** Column 1: 60 m X 0.25 ID DB-624 with 1.4 μ m film thickness.
- 6.1.8.2** Column 2: 75 m X 0.53 ID DB-624 wide bore with 3 μ m film thickness.
- 6.1.8.3** Mass Spectrometer: The mass spectrometer must be capable of scanning 35-300 amu every two seconds or less, using 70 volts electron energy in the electron impact mode and capable of producing a mass spectrum that meets the required criteria when 50 ng of 4-bromofluorobenzene (BFB) are injected onto the gas chromatograph column inlet.
- 6.1.9** GC/MS interface: In general glass jet separators are used but any interface (including direct introduction to the mass spectrometer) that achieves all acceptance criteria may be used.
- 6.1.10** Data System: A computer system that allows the continuous acquisition and storage on machine-readable media of all mass spectra obtained throughout the duration of the chromatographic program. The computer must have software that allows searching any GC/MS data file for ions of a specified mass and plotting such ion abundances versus time or scan number. This type of plot is defined as an Extracted Ion Current Profile (EICP). Software must also be available that allows integrating the abundances in any EICP between the specified time or scan-number limits. In addition, for the non-target compounds, software must be available that allows for the comparison of sample spectra against reference library spectra. The most recent release of the NIST/EPA mass spectral library should be used as the reference library. The computer system must also be capable of backing up data for long-term off-line storage.

6.2 Computer Software and Hardware

- 6.2.1** Please refer to the master list of documents, software and hardware located on G:\QA\Read\Master List of Documents\Master List of Documents, Software and Hardware.xls for the current software and hardware to be used for data processing.

6.3 Supplies

- 6.3.1** Microsyringes: 10 μ L and larger, 0.006-inch ID needle.
- 6.3.2** Syringe: 5 or 25 mL glass with Luerlok tip, if applicable to the purging device.
- 6.3.3** Balance: Analytical balance capable of accurately weighing 0.0001 g, and a top-loading balance capable of weighing 0.1 g
- 6.3.4** Glassware:
- 6.3.5** Vials: 20 mL with screw caps and Teflon liners.

6.3.6 Volumetric flasks: 10 mL and 100 mL, class A with ground-glass stoppers.

6.3.7 Spatula: Stainless steel.

6.3.8 Disposable pipettes: Pasteur.

6.3.9 pH paper: Wide range.

6.3.10 Gases:

6.3.11 Helium: Ultra high purity, gr. 5, 99.999%.

6.3.12 Compressed air: Used for instrument pneumatics.

7.0 Reagents and Standards

7.1 Methanol: Purge and Trap Grade, High Purity

7.2 Reagent Water: High purity water that meets the requirements for a method blank when analyzed. (See Section 9.2.) Reagent water may be purchased as commercial distilled water and prepared by purging with an inert gas overnight. Other methods of preparing reagent water are acceptable.

7.3 Sand: Reagent grade Ottawa sand or equivalent.

7.4 Antifoam B, Silicon Emulsion, J. T. Baker, 100% purity.

7.5 If stock or secondary dilution standards are purchased in sealed ampoules they may be used up to the manufacturers' expiration date.

7.6 Calibration Stock Standard Solutions: Stock solutions may be purchased as certified solutions from commercial sources or prepared from pure standard materials as appropriate. These standards are prepared in methanol and stored in Teflon-sealed screw-cap bottles with minimal headspace at -10 to -20 °C. Stock standards and aliquots for gases must be replaced at least every week. Other stock standards must be replaced at least every 6 months.

7.7 Calibration Working standards: A working solution containing the compounds of interest prepared from the stock solution(s) in methanol. These standards are stored in the freezer or as recommended by the manufacturer. Working standards are monitored by comparison to the initial calibration curve. If any of the calibration check compounds drift in response from the initial calibration by more than 20%, then corrective action is necessary. This may include steps such as instrument maintenance, preparing a new calibration verification standard or tuning the instrument. If the corrective actions do not correct the problem then a new initial calibration must be performed.

7.8 Aqueous calibration standards are prepared in reagent water using the secondary dilution standards. These aqueous standards must be prepared daily.

7.9 Internal standards (IS) are added to all samples, standards, and blank analyses. Refer to Table 9 for internal standard components.

- 7.10** Surrogate Standards: Refer to Table 10 for surrogate standard components and spiking levels.
- 7.11** Laboratory Control Sample Spiking Solutions: Refer to Table 11 for LCS components and spiking levels.
- 7.12** Matrix Spiking Solutions: The matrix spike contains the same components as the LCS. Refer to Table 11.
- 7.13** Tuning Standard: A standard is made up that will deliver 50 ng on column upon injection. A recommended concentration of 50 ng/μL of BFB in methanol is prepared as described in Sections 7.5 and 7.6.

8.0 Sample Collection, Preservation, Shipment and Storage

- 8.1** Water samples are normally preserved at pH < 2 with 1:1 hydrochloric acid. If residual chlorine is present, 2 drops of 10% sodium thiosulfate are added. The holding time for acid-preserved samples is 14 days from sample collection. For compliance with Method 624 and 8260B, unpreserved samples must be tested within 7 days of collection.

- 8.2** Some compounds require special preservation. These are listed below:

8.2.1 Acrolein

Both 40CFR and SW846 (chapter 4) have special preservation requirements to adjust the pH to between 4-5. For properly preserved samples (pH 4-5) the holding time is 14 days. There are no regulatory options for HCL preservation to pH < 2, however there are options for an unpreserved water sample.

8.2.1.1 40 CFR 136 (Method 624): Unpreserved sample – if Acrolein is a target analyte the holding time is 3 days.

8.2.1.2 SW846 (Method 8260) Chapter 4: SW846 does not provide guidance for processing unpreserved samples. However, EPA MICE has interpreted the holding time on an unpreserved sample as 7 days.

8.2.2 Acrylonitrile

Both 40 CFR 136 and SW846 (Chapter 4) have special preservation requirements to adjust the pH between 4-5. For properly preserved sample (pH 4-5) the holding time is 14 days. However, according to 40 CFR 136, the pH adjustment is not necessary for Acrylonitrile therefore the holding time for unpreserved samples is also 14 days.

8.2.2.1 40 CFR (Method 624): Unpreserved sample – if only Acrylonitrile (no acrolein) is a target analyte the holding time is 14 days.

8.2.2.2 SW846 (Method 8260) Chapter 4: SW846 does not provide guidance on the processing of unpreserved samples. However, EPA MICE has interpreted the holding time on an unpreserved sample as 7 days.

8.2.3 2-Chloroethylvinyl ether (2-CEVE)

According to 40 CFR 136 purgeable halocarbons (2-CEVE's category) do not require acid preservation. When aromatics are included as compounds of interest, acid preservation is required due to the rapid breakdown through bio degradation. The method 624 is designed to use unpreserved containers, but includes a caveat that refrigeration won't suffice for aromatics stored past 7 days. When aromatics are required, the method recommends collection of a separate acidified sample followed by refrigeration for 14 days. SW846 includes specific information on the handling of this analyte.

8.2.3.1 40 CFR 136 (Method 624): Unpreserved sample – Purgeable halocarbons (2-CEVE) do not require acid preservation and the holding time is 14 days.

8.2.3.2 SW846 (Method 8260) Chapter 4: Unpreserved sample – If 2-chloroethylvinylether is an analyte of interest, collect a second set of samples without acid preservation and analyze as soon as possible – 7 days.

Preservation and Holding time for Volatiles (dechlorination as needed per method):

| Analyte | Method | Preservation | Holding time |
|---------------|--------|---------------|--------------|
| Acrolein | 8260 | <6°C (no HCL) | 7 days |
| | 8260 | <6°C, pH 4-5 | 14 days |
| | 624 | <6°C (no HCL) | 3 days |
| Acrylonitrile | 624 | <6°C, pH 4-5 | 14 days |
| | 8260 | <6°C (no HCL) | 7 days |
| | 8260 | <6°C, pH 4-5 | 14 days |
| | 624 | <6°C (no HCL) | 14 days |
| 2-CEVE | 624 | <6°C, pH 4-5 | 14 days |
| | 8260 | <6°C (no HCL) | 7 days |
| | 624 | <6°C (no HCL) | 14 days |

If aromatics are compounds of interest and biological activity is known or suspected, preserved aliquots must be collected.

8.2.4 The State of Colorado Attorney General's office issued a letter on July 1, 1998 requiring that all samples collected for analysis of volatile organic compounds in groundwater must be collected without acid preservation. The letter explains that this is done to avoid effervescence with alkaline samples and loss of volatiles. The letter also explains that the holding time for unpreserved ground waters is 14 days.

8.3 Preserved Soils

8.3.1 Solid samples are field preserved with sodium bisulfate solution for low-level analysis, or with methanol for high-level analysis. The holding time for sodium bisulfate or methanol preserved samples is 14 days.

8.3.2 Soil samples can also be taken using the EnCore™ sampler and preserved in the laboratory within 48 hours of sampling. At specific client request, unpreserved soil samples may be accepted. The holding time for EnCore™ samples varies based on client specifications and can be 48 hours, 7 days, or 14 days.

8.3.3 Soil samples can also be preserved with deionized water and then frozen. The holding time for frozen samples varies based on client specifications and can be 48 hours, 7 days, or 14 days.

8.4 There are several methods of sampling soil. The recommended method, which provides the minimum of field difficulties, is to take an EnCore™ sample. (The 5 g or 25 g sampler can be used, depending on client preference). Following shipment back to the laboratory, the soil is preserved in methanol. This is the high-level procedure. If very low detection limits are needed (i.e., $< 50 \mu\text{g/kg}$ for most analytes) then it will be necessary to use two additional 5 g EnCore™ samplers or to use field preservation.

8.5 Sample Collection for High-Level Analysis using EnCore™ Samplers.

8.5.1 Ship one 5 g (or 25 g) EnCore™ sampler per field sample position.

8.5.2 An additional bottle must be shipped for percent moisture determination.

8.5.3 When the samples are returned to the laboratory, extrude the (nominal) 5g (or 25 g) sample into a tared VOA vial containing 5 mL of methanol (25 mL of methanol for the 25 g sampler). Obtain the weight of the soil added to the vial and record it on the label.

8.5.4 Add the correct amount of surrogate spiking mixture for a final concentration of $2 \mu\text{g/mL}$ (example: $4 \mu\text{L}$ of $2500 \mu\text{g/mL}$ for a nominal 5 g sample or $20 \mu\text{g/mL}$ for a nominal 25 g sample).

8.5.5 Add the correct amount of matrix spiking solution to the matrix spike and matrix spike duplicate samples for a final concentration of $2 \mu\text{g/mL}$. The addition of spike introduces a slight error (0.4%), which can be neglected, into the calculations.

8.5.6 Prepare an LCS for each batch by adding the correct amount of matrix spiking solution to clean methanol for a final concentration of $2 \mu\text{g/mL}$.

8.5.7 Shake the samples for two minutes to distribute the methanol throughout the soil.

8.5.8 Allow to settle, then remove a portion of methanol and store in a clean Teflon-capped vial at $< 6^\circ\text{C}$ until analysis.

8.6 Sample Collection for High-Level Analysis using Field Methanol Preservation

8.6.1 Prepare a 2-ounce sample container by adding 25 mL of purge-and-trap grade methanol. (If a 5 g sample is to be used, add 5 mL of methanol to a 2-ounce container or VOA vial).

8.6.2 Seal the bottle and attach a label.

8.6.3 Weigh the bottle to the nearest 0.01g and record the weight on the label.

8.6.4 Ship with appropriate sampling instructions.

8.6.5 Each sample will require an additional bottle with no preservative for percent moisture determination.

- 8.6.6** At client request, the methanol addition and weighing may also be performed in the field.
- 8.6.7** When the samples are returned to the laboratory, obtain the weight of the soil added to the vial and record it on the label.
- 8.6.8** Add the correct amount of surrogate spiking mixture for a final concentration of 2 µg/mL (example: 4 µL of 2500 µg/mL for a nominal 5 g sample or 20 µg/mL for a nominal 25 g sample).
- 8.6.9** Add the correct amount of matrix spiking solution to the matrix spike and matrix spike duplicate samples for a final concentration of 2 µg/mL. The addition of spike introduces a slight error (0.4%), which can be neglected, into the calculations.
- 8.6.10** Prepare an LCS for each batch by adding the correct amount of matrix spiking solution to clean methanol: 50 µL of spike to 25 mL of methanol or 10 µL of spike to 5 mL of methanol.
- 8.6.11** Shake the samples for two minutes to distribute the methanol throughout the soil.
- 8.6.12** Allow the soil to settle, then remove a portion of methanol and store in a clean, Teflon-capped vial at <6 °C until analysis.

8.7 Low-Level Procedure

- 8.7.1** If low detection limits are required (typically < 50 µg/kg) low level preservation must be used. There are two options for low level, reagent water or sodium bisulfate. Sodium bisulfate can be problematic due to sample effervescence and is generally used only when client requested. It is also necessary to take a sample for the high-level (field methanol preserved or using the EnCore™ sampler) procedure, in case the concentration of analytes in the soil is above the calibration range of the low-level procedure.
- 8.7.2** A purge-and-trap autosampler capable of sampling from a sealed vial is required for analysis of samples collected using this method.
- 8.7.3** The soil sample is taken using a 5g EnCore™ sampling device and returned to the laboratory. It is recommended that two EnCore™ samplers be used for each field sample position, to allow for any reruns that may be necessary. A separate sample for percent moisture determination is also necessary.
- 8.7.4** Prepare VOA vials by taring the vial. Extrude the soil sample from the EnCore™ sampler into the VOA vial. Record the weight to the nearest 0.1 g in LIMS and on the label. Add a magnetic stir bar and 5 mL of reagent water (in addition, add approximately 1 g of sodium bisulfate if requested).
- 8.7.5** Seal and label the vial. It is strongly recommended that the vial is labeled with an indelible marker rather than a paper label, since paper labels may cause the autosampler to bind and malfunction. The label absolutely must not cover the neck of the vial or the autosampler will malfunction.

8.7.6 Soils containing carbonates may effervesce if using a sodium bisulfate solution. If this is the case at a specific site, add 5 mL of water instead, and store at -10°C until analysis.

8.7.7 Alternatively the preservation may be performed in the field. Each sample will require an additional bottle with no preservative for percent moisture determination, and an additional bottle preserved with methanol for the high-level procedure. Depending on the type of soil it may also be necessary to ship vials with no or extra preservative.

8.8 Unpreserved Soils

At specific client request unpreserved soils packed into glass jars or brass tubes may be accepted and subsampled in the laboratory. This is the old procedure based on Method 5030A. It is no longer included and is likely to generate results that are biased low, possibly by more than an order of magnitude.

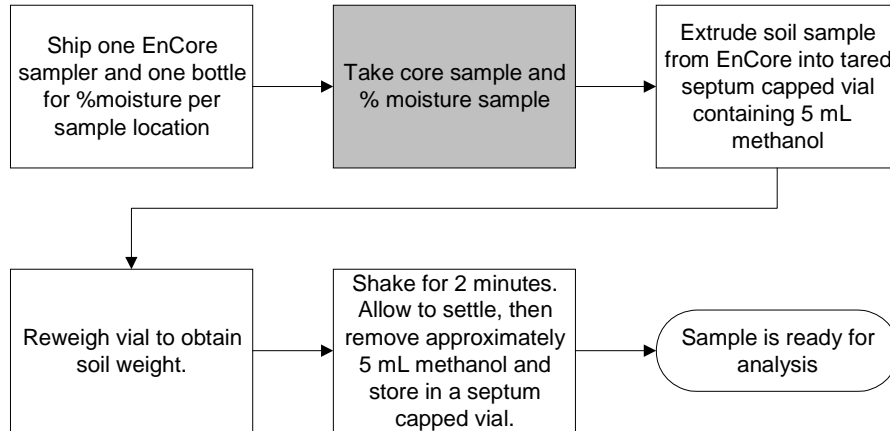
8.9 Aqueous samples are stored in glass containers with Teflon lined septa at $<6^{\circ}\text{C}$, with minimum headspace.

8.10 High-level solid extracts are aliquoted into two 1.5 mL glass vials with Teflon-lined caps and stored at $<6^{\circ}\text{C}$. The extracts are stored with minimum headspace.

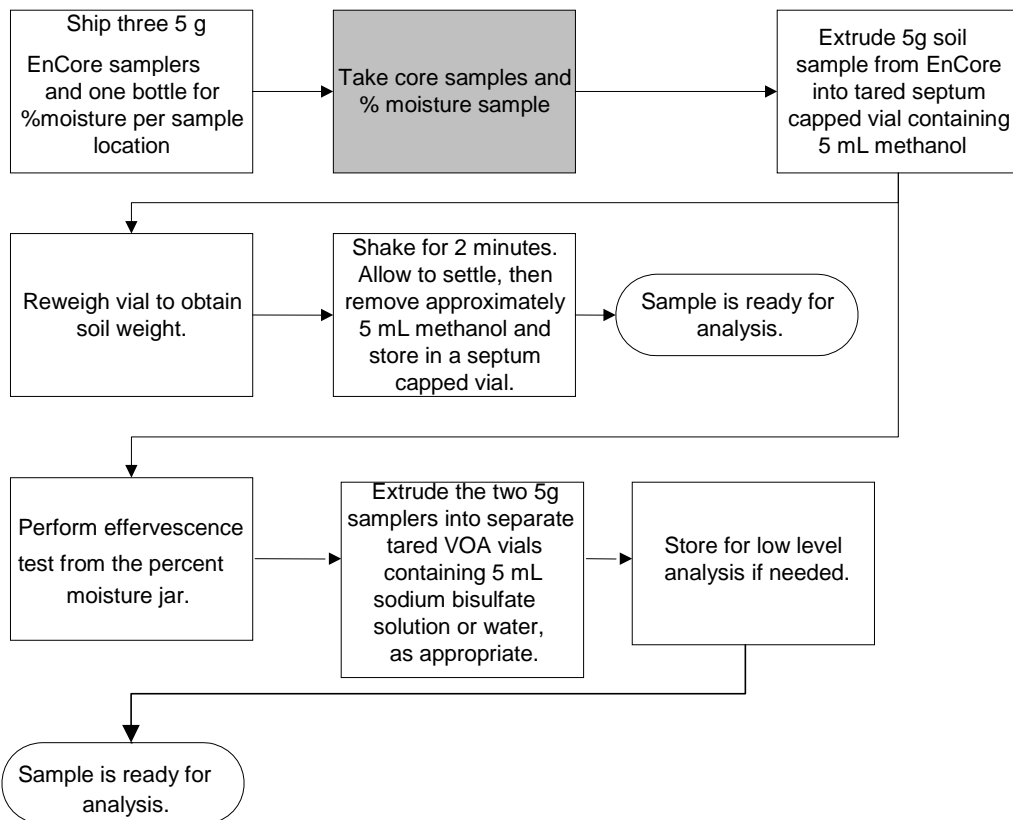
8.11 The maximum holding time is 14 days from sampling until the sample is analyzed. (Samples that are found to be unpreserved still have a 14 day holding time. However they should be analyzed as soon as possible. The lack of preservation should be addressed in the case narrative). Maximum holding time for the EnCore™ sampler (before the sample is added to methanol or sodium bisulfate) is 48 hours.

8.12 A holding blank is stored in each refrigerator with the samples. This is analyzed every 7 – 14 days (see SOP DV-QA-0013).

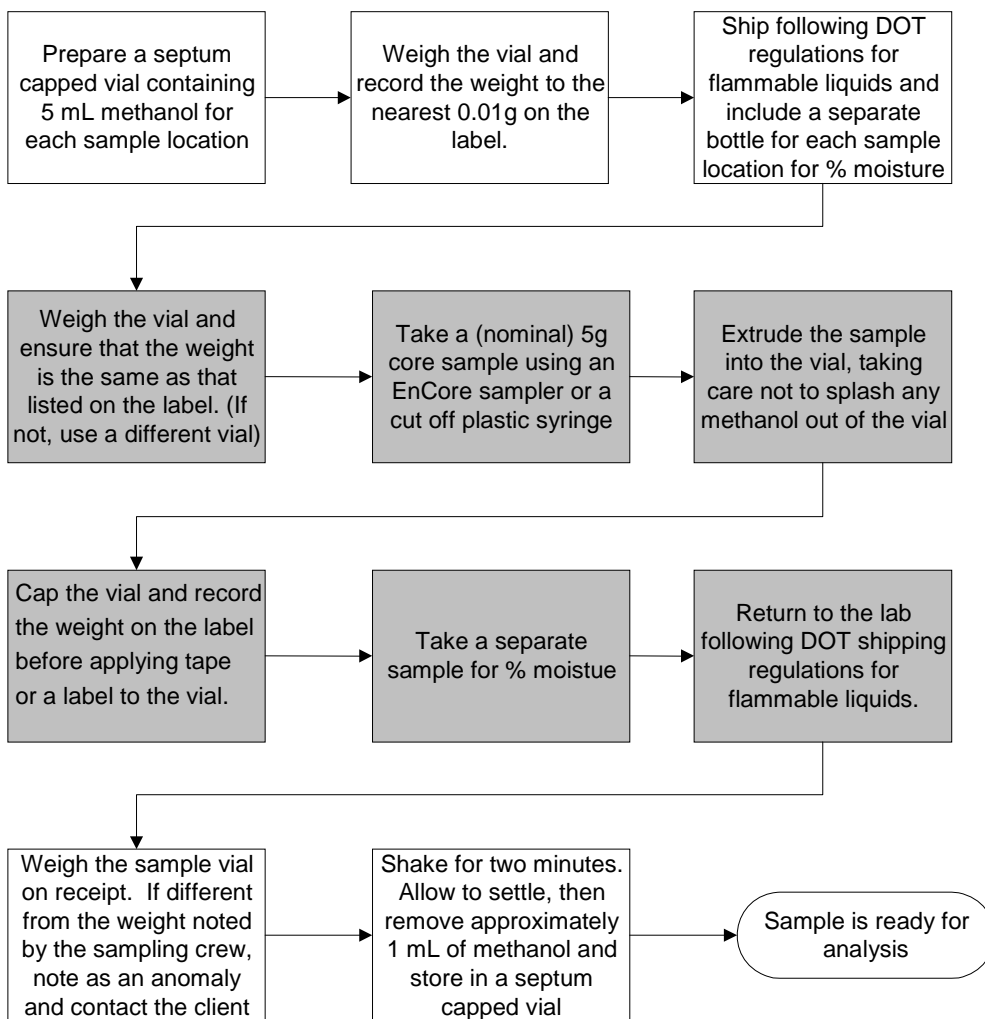
EnCore procedure when low level is not required (field steps in gray)



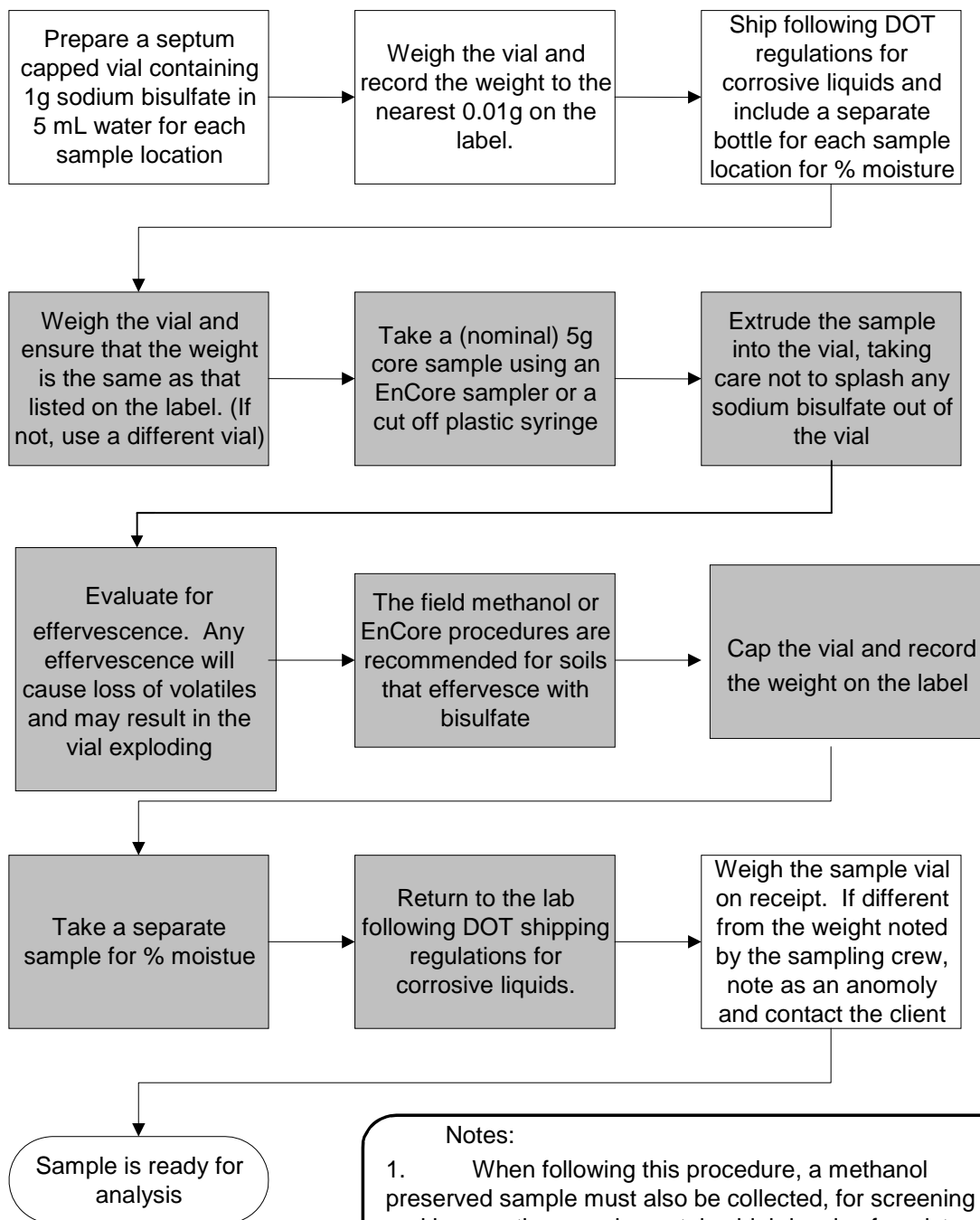
EnCore procedure when low level is required



Field methanol extraction procedure (field steps in gray)



Field bisulfate preservation procedure (field steps in gray)



Notes:

1. When following this procedure, a methanol preserved sample must also be collected, for screening and in case the sample contains high levels of analytes.
2. Due to the high probability of sampling problems, this method is not recommended

9.0 **Quality Control**

The minimum quality controls (QC), acceptance criteria, and corrective actions are described in this section. When processing samples in the laboratory, use the LIMS QC program code and special instructions to determine specific QC requirements that apply.

- The laboratory's standard QC requirements, the process of establishing control limits, and the use of control charts are described more completely in TestAmerica Denver policy DV-QA-003P, Quality Control Program.
- Specific QC requirements for Federal programs, e.g., Department of Defense (DoD), Department of Energy (DOE), AFCEE, etc., are described in TestAmerica Denver policy DV-QA-024P, Requirements for Federal Programs.
- Project-specific requirements can override the requirements presented in this section when there is a written agreement between the laboratory and the client, and the source of those requirements should be described in the project documents. Project-specific requirements are communicated to the analyst via special instructions in the LIMS.
- Any QC result that fails to meet control criteria must be documented in a Nonconformance Memo (NCM). The NCM is approved by the supervisor and then automatically sent to the laboratory Project Manager by e-mail so that the client can be notified as appropriate. The QA group also receives NCMs by e-mail for tracking and trending purposes. The NCM process is described in more detail in SOP DV-QA-0031. This is in addition to the corrective actions described in the following sections.

Sample QC- The following quality control samples are prepared with each batch of samples.

9.1 **Batch Definition**

Batches are defined at the sample preparation stage. The batch is a set of up to 20 samples of the same matrix, plus required QC samples, processed using the same procedures and reagents within the same time period. Batches should be kept together through the whole analytical process as far as possible, but it is not mandatory to analyze prepared extracts on the same instrument or in the same sequence. The method blank must be run on each instrument. See Policy DV-QA-003P for further details.

9.2 **Method Blanks**

For each batch of samples, analyze a method blank. The method blank is analyzed after the calibration standards, normally before any samples. For low-level volatiles in water, the method blank consists of reagent water. For low-level volatiles in soil, the blank medium is Ottawa sand. For medium-level volatiles, the method blank consists of 5.0 mL of methanol. Surrogates are added and the method blank is carried through the entire analytical procedure.

Acceptance Criteria: The method blank must not contain any analyte of interest at or above one-half the reporting limit (except common laboratory contaminants, see below) or at or above 5% of the measured concentration of that analyte in the associated samples, whichever is higher.

The method blank must have acceptable surrogate recoveries.

Corrective Actions: If the analyte is a common laboratory contaminant (i.e., methylene chloride, acetone, 2-butanone), the data may be reported with qualifiers if the concentration of the analyte is less than five times the reporting limit. Such action must be taken in consultation with the client.

Reanalysis of samples associated with an unacceptable method blank is required when reportable concentrations are determined in the associated samples.

If there is no target analyte greater than one-half the RL in the samples associated with an unacceptable method blank, the data may be reported with qualifiers. Such action should be done in consultation with the client.

If surrogate recoveries in the blank are not acceptable, the data must be evaluated to determine if the method blank has served the purpose of demonstrating that the analysis is free of contamination. If surrogate recoveries are low and there are reportable analytes in the associated samples, re-extraction of the blank and affected samples will normally be required. Consultation with the client should take place.

If reanalysis of the batch is not possible due to limited sample volume or other constraints, the method blank is reported, all associated samples are flagged with a "B", and appropriate comments may be made in a narrative to provide further documentation.

9.3 Surrogates

Every sample, blank, and QC sample is spiked with surrogates. Surrogate recoveries in samples, blanks, and QC samples must be assessed to ensure that recoveries are within established limits. The compounds included in the surrogate spiking solutions are listed in Table 10.

Acceptance Criteria: Acceptance limits for surrogate recoveries are set at ± 3 standard deviations around the historical mean. Surrogate recovery limits are updated semi-annually and stored in the LIMS

Corrective Actions: If any surrogates are outside limits, the following corrective actions must take place (except for dilutions):

- Check all calculations for error.
- Ensure that instrument performance is acceptable.
- Recalculate the data and/or reanalyze if either of the above checks reveal a problem.
- Re-prepare and reanalyze the sample or flag the data as "Estimated Concentration" if neither of the above resolves the problem.

The decision to reanalyze or flag the data should be made in consultation with the client. It is necessary to re-prepare/reanalyze a sample only once to demonstrate that

poor surrogate recovery is due to matrix effect, unless the analyst believes that the repeated out of control results are not due to matrix effect.

If the surrogates are out of control for the sample, matrix spike, and matrix spike duplicate, then matrix effect has been demonstrated for that sample and re-preparation/reanalysis is not necessary. If the sample is out of control and the MS and/or MSD is in control, then reanalysis or flagging of the data is required.

9.4 Laboratory Control Samples (LCS)

An LCS is analyzed for each batch. The LCS is analyzed after the calibration standard, and normally before any samples. The LCS is prepared from a different source than are the calibration standards. The LCS contains a representative subset of the analytes of interest (See Table 11), and must contain the same analytes as the matrix spike. For low-level volatiles in water, the LCS medium is reagent water. For low-level volatiles in soil, the LCS medium is Ottawa sand.

Acceptance Criteria: The LCS recovery for the control analytes must be within established control limits. Unless otherwise specified in a reference method or project requirements, the control limits are set at ± 3 standard deviations around the mean of the historical data. An LCS that is determined to be within acceptance criteria effectively demonstrates that the analytical system is in control and validates system performance for the samples in the associated batch. Recovery limits are updated semi-annually and stored in the LIMS

If there are a large number of analytes in the LCS, then a specified number of results may fall beyond the LCS control limit (3 standard deviations), but within the marginal exceedance (ME) limits, which are set at ± 4 standard deviations around the mean of historical data. Marginal exceedances are recognized and allowed by NELAC, the DoD, AFCEE, and the DOE. The number of marginal exceedances is based on the number of analytes in the LCS, as shown in the following table:

| # of Analytes in LCS | # of Allowed Marginal Exceedances |
|----------------------|-----------------------------------|
| > 90 | 5 |
| 71 – 90 | 4 |
| 51 – 70 | 3 |
| 31 – 50 | 2 |
| 11 – 30 | 1 |
| < 11 | 0 |

If more analytes exceed the LCS control limits than is allowed, or if any analyte exceeds the ME limits, the LCS fails and corrective action is necessary. Marginal exceedances must be random. If the same analyte repeatedly fails the LCS control limits, it is an indication of a systematic problem. The source of the error must be identified and corrective action taken.

Note: Additional criteria are stated in the North Carolina QAS.

Note: Some programs (e.g., South Carolina) do not allow marginal exceedances. Please see the QSAS's in the public folders for the current requirements.

Corrective Actions: If any analyte or surrogate is outside established control limits as described above, the system is out of control and corrective action must occur. Corrective action will normally be re-preparation and reanalysis of the batch.

If the batch is not re-extracted and reanalyzed, the reasons for accepting the batch must be clearly presented in the project records and the report. Examples of acceptable reasons for not reanalyzing might be that the matrix spike and matrix spike duplicate are acceptable, and sample surrogate recoveries are good, demonstrating that the problem was confined to the LCS. This type of justification should be reviewed and documented with the client before reporting.

If re-extraction and reanalysis of the batch is not possible due to limited sample volume or other constraints, the LCS is reported, all associated samples are flagged, and appropriate comments are made in a narrative to provide further documentation.

9.5 Matrix Spike and Matrix Spike Duplicate (MS/MSD)

For each QC batch, analyze a matrix spike and matrix spike duplicate. Spiking compounds and levels are given in Table 11. The matrix spike/duplicate must be analyzed at the same dilution as the unspiked sample, even if the matrix spike compounds will be diluted out.

Acceptance Criteria: The MS/MSD recovery for the control analytes must be within established control limits. Unless otherwise specified in a reference method or project requirements, the control limits are set at ± 3 standard deviations around the mean of the historical data. The relative percent difference (RPD) between the MS and the MSD must be less than the established RPD limit, which is based on statistical analysis of historical data. MS/MSD recovery and RPD limits are updated semi-annually and stored in the LIMS.

Corrective Actions: If any individual recovery or RPD falls outside the acceptable range, corrective action must occur. The initial

corrective action will be to check the recovery of that analyte in the LCS. Generally, if the recovery of the analyte in the LCS is within limits, then the laboratory operation is in control and analysis may proceed. The reasons for accepting the batch must be documented.

If the recovery for any component is outside QC limits for both the matrix spike/ spike duplicate and the LCS, the laboratory is out of control and corrective action must be taken. Corrective action will normally include reanalysis of the batch.

If an MS/MSD is not possible due to limited sample, then an LCS duplicate should be analyzed. The RPD between the LCS and LCSD is compared to the established acceptance limit.

9.6 Acid Preservation or pH adjustment

The stability of 2-chloroethylvinylether, acrolein, and according to the regulations, acrylonitrile is reduced when subjected to low pH. It is therefore not recommended that these compounds be analyzed routinely from preserved VOA vials and since there is no reasonable way to achieve pH between 4 and 5, it is recommended that unpreserved vials be used for the analysis of these compounds.

Acceptance Criteria: To ensure detection of these compounds, samples must be processed correctly. Where method 624 is being used for compliance purposes, the regulatory hold times take precedence.

Corrective Actions: If 624 data are not being generated for compliance purposes, the technical stability of the compounds may be considered. Where method 8260 is the base method, it is allowable to qualify the results estimated. To deviate from the regulatory hold times, the following documentation must be maintained:

A NCM must be generated by the lab that the samples are for non-compliance.

A NCM must be generated that results are not method compliant.

9.7 Quality Assurance Summaries (QAS)

Certain clients may require specific project or program QC which may supersede these method requirements. Quality Assurance Summaries should be developed to address these requirements. Quality Assurance Summaries are posted in the Public folders under Public Folders\All Public Folders\Analytical\Denver\Denver QASs.

10.0 Procedure

One-time procedural variations are allowed only if deemed necessary in the professional judgment of supervision to accommodate variation in sample matrix, radioactivity, chemistry, sample size, or other parameters. Any variation in procedure shall be completely documented using an NCM. The NCM is approved by the supervisor and then automatically sent to the laboratory Project Manager by e-mail so that the client can be notified as

appropriate. The QA group also receives NCMs by e-mail for tracking and trending purposes. The NCM process is described in more detail in SOP DV-QA-0031. The NCM shall be filed in the project file and addressed in the case narrative.

Any deviations from this procedure identified after the work has been completed must be documented in an NCM, with a cause and corrective action described.

10.1 Sample Preparation

10.1.1 Preliminary Evaluation

10.1.1.1 Where possible, samples are screened by headspace or GC/MS off-tune analysis to determine the correct aliquot for analysis. Alternatively, an appropriate aliquot can be determined from sample histories.

10.1.1.2 Dilutions should be done just prior to the GC/MS analysis of the sample. Dilutions are made in volumetric flasks or in a Luerlok syringe. Calculate the volume of reagent water required for the dilution. Fill the syringe with reagent water, compress the water to vent any residual air and adjust the water volume to the desired amount. Adjust the plunger to the mark and inject the proper aliquot of sample into the syringe. If the dilution required would use less than 5 μ L of sample, then serial dilutions must be made in volumetric flasks.

The diluted concentration is to be estimated to be in the upper half of the calibration range.

10.1.2 Sample Analysis Procedure

10.1.2.1 All analysis conditions for samples must be the same as for the continuing calibration standards (including purge volume, time and flow, desorb time and temperature, column temperatures, multiplier setting etc.).

10.1.2.2 All samples must be analyzed as part of a batch. The batch is a set of up to 20 samples of the same matrix processed using the same procedures and reagents within the same time period. The batch also must contain a MS/MSD, an LCS, and a method blank.

10.1.2.2.1 If there is insufficient time in the 12-hour tune period to analyze 20 samples, the batch may be continued into the next tune period. The 12-hour tuning requirements in Section 10.1.11.3 and 12-hour continuing calibration requirements in 10.1.13 must still be met. However, if any re-tuning or recalibration of the instrument is necessary, or if a period of greater than 24 hours from the preceding BFB tune has passed, a new batch must be started. For high-level soils the batch is defined at the sample preparation stage.

10.1.2.2.2 Laboratory generated QC samples (Blank, LCS, MS/MSD) do not count towards the maximum 20 samples in a batch. Field QC samples are included in the batch count.

10.1.2.2.3 It is not necessary to reanalyze batch QC with reanalyses of samples. However, any reruns must be as part of a valid batch.

10.1.3 Water Samples

- 10.1.3.1 All samples and standard solutions must be at ambient temperature before analysis.
- 10.1.3.2 Fill a syringe with the sample. If a dilution is necessary, it may be made in the syringe if the sample aliquot is $\geq 5 \mu\text{L}$. Check and document the pH of the remaining sample.
- 10.1.3.3 Add 200 ng of each internal and surrogate standard (10 μL of a 20 $\mu\text{g/mL}$ solution, refer to Tables 9 and 10). The internal standards and the surrogate standards may be mixed and added as one spiking solution (this results in a 10 $\mu\text{g/L}$ solution for a 20 mL sample). Inject the sample into the purging chamber.
- 10.1.3.4 For TCLP samples, use 2.0 mL of TCLP leachate and spike it with 5 μL of the 40 $\mu\text{g/mL}$ TCLP spiking solution.
- 10.1.3.5 Purge the sample for eleven minutes (the trap should be below 50 °C).
- 10.1.3.6 After purging is complete, desorb the sample, start the GC temperature program, and begin data acquisition. After desorption, bake the trap for 2-5 minutes to condition it for the next analysis. When the trap is cool, it is ready for the next sample.
- 10.1.3.7 Desorb time, bake time, and temperature are optimized for the type of trap in use. **The same conditions must be used for samples and standards.**
- 10.1.3.8 If foaming of the sample occurs, reanalyze the sample with the addition of 1 μL of an antifoaming agent such as Antifoam B (J. T. Baker). A method blank spiked with 1 μL of the Antifoam B must also be analyzed with the sample. Document in an NCM.

10.1.4 Methanol Extract of Soils

- 10.1.4.1 Rinse a gas-tight syringe with organic-free water. Fill the syringe with the same volume of organic-free water as used in the calibrations.
- 10.1.4.2 Add no more than 100 μL of methanolic extract (from Section 8.5 or 8.5.8) to the syringe. Add internal standard.
- 10.1.4.3 Load the sample onto the purge and trap device and analyze as for aqueous samples.
- 10.1.4.4 If less than 5 μL of methanolic extract is to be added to the water, dilute the methanolic extract such that a volume greater than 5 μL will be added to the water in the syringe.

10.1.5 Liquid Wastes that are Soluble in Methanol and Insoluble in Water

- 10.1.5.1 Pipette 2 mL of the sample into a tared vial. Use a top-loading balance. Record the weight to the nearest 0.1 gram.
- 10.1.5.2 Quickly add 7 mL of methanol, then add 1 mL of surrogate spiking solution to bring the final volume to 10 mL. Cap the vial and shake for 2 minutes to mix thoroughly. For an MS/MSD pair or LCS, 6 mL of methanol, 1 mL of surrogate solution, and 1 mL of matrix spike solution are used.

- 10.1.5.3 Rinse a gas-tight syringe with organic-free water. Fill the syringe with the same volume of organic-free water as used in the calibrations.
- 10.1.5.4 Add no more than 100 μL of methanolic extract (from Section 8.5 or 8.5.8) to the syringe. Add internal standard (if used).
- 10.1.5.5 Load the sample onto the purge and trap device and analyze as for aqueous samples.
- 10.1.5.6 If less than 5 μL of methanolic extract is to be added to the water, dilute the methanolic extract such that a volume greater than 5 μL will be added to the water in the syringe.

10.1.6 Aqueous and Low -Level Soil Sample Analysis (purge-and-trap units that sample directly from the VOA vial)

- 10.1.6.1 Purge-and-trap units that sample from the VOA vial should be equipped with a module that automatically adds surrogate and internal standard solution to the sample prior to purging the sample.
- 10.1.6.2 If the autosampler uses automatic IS/SS injection, no further preparation of the VOA vial is needed. Otherwise, the internal and surrogate standards must be added to the vial.

NOTE: Aqueous samples with high amounts of sediment present in the vial may not be suitable for analysis on this instrumentation, or they may need to be analyzed as soils.

- 10.1.6.3 Sample remaining in the vial after sampling with one of these mechanisms is no longer valid for further analysis. A fresh VOA vial must be used for further sample analysis.
- 10.1.6.4 For aqueous samples, check the pH of the sample remaining in the VOA vial after analysis is completed.

10.1.7 Low-Level Solids Analysis using Discrete Autosamplers

NOTE: This technique may seriously underestimate analyte concentration and must not be used except at specific client request for the purpose of comparability with previous data. It is no longer part of SW-846.

- 10.1.7.1 This method is based on purging a heated sediment/soil sample mixed with sodium bisulfate solution containing the surrogate and, if applicable, internal and matrix spiking standards. Analyze all reagent blanks and standards under the same conditions as the samples (e.g., heated). The calibration curve is also heated during analysis. Purge temperature is 40 $^{\circ}\text{C}$.
- 10.1.7.2 Do not discard any supernatant liquids. Mix the contents of the container with a narrow metal spatula.
- 10.1.7.3 Weigh out 5 g (or other appropriate aliquot) of sample into a disposable culture tube or other purge vessel. Record the weight to the nearest 0.1 g. If method sensitivity is demonstrated, a smaller aliquot may be used. Do not use aliquots less than 1.0 g. If the sample is contaminated with analytes such that a purge amount less than 1.0 g is appropriate, use the high-level method described in Section 10.1.4.

- 10.1.7.4** Connect the purge vessel to the purge and trap device.
- 10.1.7.5** Rinse a 5 mL gas-tight syringe with organic-free water, and fill. Compress to 5 mL. Add surrogate/internal standard (and matrix spike solutions if required.). Inject the spiked water into the purge chamber that contains the soil sample.
- 10.1.7.6** The above steps should be performed rapidly and without interruption to avoid loss of volatile organics.
- 10.1.7.7** Add the heater jacket or other heating device and start the purge-and-trap unit.
- 10.1.7.8** Soil samples that have low internal standard recovery when analyzed (<50%) should be reanalyzed once to confirm matrix effect.

10.1.8 Initial Review and Corrective Actions

- 10.1.8.1** If the retention time for any internal standard in the continuing calibration changes by more than 0.5 minute from the mid-level initial calibration standard, the chromatographic system must be inspected for malfunctions and corrected. Reanalysis of samples analyzed while the system was malfunctioning is required.
- 10.1.8.2** If the internal standard response in the continuing calibration is more than 200% or less than 50% of the response in the mid-level of the initial calibration standard, the chromatographic system must be inspected for malfunctions and corrected. Reanalysis of samples analyzed while the system was malfunctioning is required.

Sample internal standard areas are compared to the mid-point of the supplemental initial calibration internal standard areas. Responses from 50% to 200% are acceptable. If a sample fails to meet these internal standard criteria, further investigation is necessary. If the change in sensitivity is a matrix effect confined to an individual sample, reanalysis is not necessary. If the change in sensitivity is due to instrumental problems, all affected samples must be reanalyzed after the problem is corrected.
- 10.1.8.3** The surrogate standard recoveries are evaluated to ensure that they are within limits. Corrective action for surrogates out of control will normally be to reanalyze the affected samples. However, if the surrogate standard response is out high and there are no target analytes or tentatively identified compounds, reanalysis may not be necessary. Out of control surrogate standard response may be a matrix effect. It is only necessary to reanalyze a sample once to demonstrate matrix effect, but reanalysis at a dilution should be considered.

10.1.9 Dilutions

If the response for any compound exceeds the working range of the GC/MS system, a dilution of the extract is prepared and analyzed. An appropriate dilution should be in the upper half of the calibration range. Samples may be screened to determine the appropriate dilution for the initial run. If the initial diluted run has no hits or hits below 20% of the calibration range and the matrix allows for analysis at a lesser dilution,

then the sample must be reanalyzed at a dilution targeted to bring the largest hit above 50% of the calibration range.

10.1.9.1 Guidance for Dilutions Due to Matrix

If the sample is initially run at a dilution and the baseline rise is less than half the height of the internal standards, or if individual non target peaks are less than twice the height of the internal standards, then the sample should be reanalyzed at a more concentrated dilution. This requirement is approximate and subject to analyst judgment.

10.1.9.2 Reporting Dilutions

The most concentrated dilution with no target compounds above the calibration range will be reported. Other dilutions will be reported only at client request.

10.1.10 Summary

Prior to the analysis of samples and blanks, the GC/MS system must be tuned and calibrated. Tuning is accomplished by analyzing 4-bromofluorobenzene (BFB) to establish that the GC/MS system meets the standard mass spectral abundance criteria. The GC/MS system must be calibrated initially at a minimum of five concentrations to determine the linearity of the response utilizing target calibration standards. The calibration must be verified each twelve-hour time period for each GC/MS system. The use of separate calibrations is required for water and low soil matrices.

10.1.11 Recommended Instrument Conditions

10.1.11.1 General

| | |
|-----------------------|--|
| Electron Energy: | 70 volts (nominal) |
| Mass Range: | 35–300 amu |
| Scan Time: | to give at least 5 scans/peak, ≤ 2 second/scan |
| Injector Temperature: | 200 – 250 °C |
| Source Temperature: | According to manufacturer's specifications |
| Transfer Line: | Temperature: 250 – 300 °C |
| Purge Flow: | 40 mL/minute |
| Carrier Gas Flow: | 1-15 mL/minute, dependent upon column specifications |

10.1.11.2 Gas Chromatograph Suggested Temperature Program

The following temperature programs vary with the column type used.

BFB Analysis

Initial Temperature: 150 °C (On)
Initial Hold Time: 0.00 minutes
Ramps:
#1: Rate: 50.00, Final Temp: 220 °C, Final Time: 4.00
#2: 0.0 (Off)

Post Temperature: 0 °C

Post Time: 0.00 minutes

Run Time: 5.40 minutes

Sample Analysis

Initial Temperature: 40 °C

Initial Hold Time: 4 minutes

Temperature Program: 8 °C/minute

Final Temperature: 184 °C

Second Temperature Program: 40
°C/minute

Final Temperature: 240 °C

Final Hold Time: 2.6 minutes

10.1.11.3 Instrument Tuning

Each GC/MS system must be hardware-tuned to meet the abundance criteria listed in Table 12 for a maximum of a 50 ng injection or purging of BFB. Analysis must not begin until these criteria are met. These criteria must be met for each twelve-hour time period. The twelve-hour time period begins at the moment of injection of BFB.

10.1.12 Initial Calibration

10.1.12.1 Detailed information regarding calibration models and calculations can be found in Corporate SOP CA-Q-S-005, *Calibration Curves (General)*.

10.1.12.2 A series of five or more initial calibration standards is prepared and analyzed for the target compounds and each surrogate compound. Certain analytes are prepared at higher concentrations due to poor purge performance. Tables 4, 5, and 6 list the calibration levels for each analyte. The purge volume for Method 624 is 5 mL (see calibration levels in Table A-3). Other calibration levels and purge volumes may be used depending on the capabilities of the specific instrument or program requirements. Calibration levels below the reporting limit may be removed provided that there is a minimum of five calibration points, and the lowest standard is at or below the TestAmerica reporting limit.

10.1.12.3 The same purge volume must be used for calibration and sample analysis, and the low level standard must be at or below the reporting limit.

10.1.12.4 It may be necessary to analyze more than one set of calibration standards to encompass all of the analytes required for some tests.

10.1.12.5 Internal standard calibration is used. The internal standards are listed in Table 9. Target compounds should reference the nearest internal standard. Each calibration standard is analyzed and the response factor (RF) for each compound is calculated using the area response of the characteristic ions against the concentration for each

compound and internal standard. See equation 1, Section 12, for calculation of response factor.

- 10.1.12.6** Evaluation of retention times – The relative retention time of each target analyte in each calibration standard should agree within 0.06 relative retention time units.
- 10.1.12.7** The % RSD of the calibration check compounds (CCC) must be less than or equal to 30%. Refer to Table 14. See Table A-3 for method 624 criteria.
- 10.1.12.8** The average RF must be calculated for each compound. A system performance check is made prior to using the calibration curve. The five system performance check compounds (SPCC) are checked for a minimum average response factor. Refer to Table 13 for the SPCC compounds and required minimum response factors.
- 10.1.12.9** If the software in use is capable of routinely reporting curve coefficients for data validation purposes and the necessary calibration reports can be generated, then the analyst should evaluate analytes with %RSD > 15% for calibration on a curve. If it appears that substantially better accuracy would be obtained using quantitation from a curve then the appropriate curve should be used for quantitation. The correlation coefficient (coefficient of determination for non-linear curves) must be ≥ 0.990 .

Note: Additional criteria are stated in the North Carolina QAS.

- 10.1.12.10** If the software in use is capable of routinely reporting curve coefficients for data, and if the average of all the %RSDs in the calibration is > 15%, then calibration on a curve must be used for all analytes with %RSD > 15%. The analyst should consider instrument maintenance to improve the linearity of response. Otherwise, the correlation coefficient, r (coefficient of determination, r^2 for non-linear curves) must be ≥ 0.990 .

Note: Some states (like Arizona) and federal programs do not allow the use of grand mean. Refer to the Arizona QAS and SOP DV-QA-024P.

- 10.1.12.11** Once the initial calibration has been evaluated and determined to be valid, the calibration must be verified with an Initial Calibration Verification (ICV) using a standard prepared from an alternate source. All compounds in the ICV must be <35 % drift when compared to the initial calibration, except poor performers (see Table 17) which must be <55% drift. The ICV is generally run at the same concentration as the level 5 standard. See Table A-2 for method 624 criteria.
- 10.1.12.12** If time remains in the 12-hour period initiated by the BFB injection before the initial calibration, samples may be analyzed. Otherwise, proceed to continuing calibration, Section 10.1.13.
- 10.1.12.13** A separate five point calibration must be prepared for analysis of low-level soils. Low-level soils analysis requires the use of a closed vial autosampler. Each standard is prepared by spiking the methanol standard solution through the septum of a VOA vial containing 5 mL of water. The standards are heated to 40°C for purging. All low-level

soil samples, standards, and blanks must also be heated to 40°C for purging. Methanol soil extracts should be analyzed using the water calibration curve.

10.1.12.14 Non-standard analytes are sometimes requested. For these analytes, it is acceptable to analyze a single standard at the reporting limit with each continuing calibration rather than a five point initial calibration. The primary ion for the single standard must generate a peak clearly visible over background noise (greater than three standard deviations at a minimum) and be free of spectral interferences. If the analyte is detected in any of the samples, a five point initial calibration must be generated and the sample(s) reanalyzed for quantitation. However, if the analyte is not detected, the non-detect may be reported and no further action is necessary. A footnote or narrative comment should describe the basis of the reported result.

10.1.12.15 Sodium Bisulfate must be added to the calibration when analyzing samples preserved with it.

10.1.13 Continuing Calibration

10.1.13.1 The initial calibration must be verified every twelve hours.

10.1.13.2 Continuing calibration begins with analysis of BFB as described in Section 10.1.11.3. If the system tune is acceptable, the continuing calibration standard(s) are analyzed. The level 4 calibration standard is used as the continuing calibration standard. See Table A-2 for method 624 criteria.

10.1.13.3 The RF data from the standards are compared with the initial five-point calibration to determine the percent drift of the CCC compounds. The calculation is given in equation 4, Section 11.4.4.

10.1.13.4 The % drift of the CCCs must be $\leq 20\%$ for the continuing calibration to be valid. The SPCCs are also monitored. The SPCCs must meet the criteria described in Table 13. In addition, the % drift for most non-CCC analytes must be $\leq 35\%$, and for poor performers $\leq 50\%$ (See Table 17), with allowance for up to six target analytes to have a % drift greater than the applicable limit. For agencies that require specific control limits for non-CCC compounds (i.e., State of Arizona) see Table 16. See Table A-2 for method 624 criteria.

Note: Additional criteria are stated in the North Carolina QAS.

10.1.13.4.1 If none of the CCCs are required analytes, project specific calibration specifications (which may include the use of the CCCs listed in Table 14) must be agreed with the client.

10.1.13.4.2 Cyclohexanone, is unstable in the calibration solution, forming 1,1-dimethoxycyclohexane. No calibration criteria are applied to cyclohexanone and quantitation is tentative. Cyclohexanone is included on the Universal Treatment Standard and FO-39 regulatory lists.

- 10.1.13.5** The retention time of the internal standards in the continuing calibration standard cannot change by more than 30 seconds when compared to the most recent five-point calibration. The internal standard areas must not change by more than a factor of 2 (50 - 200 %) from the mid point standard of the most recent five-point calibration.
- 10.1.13.6** If the CCCs and/or the SPCCs do not meet the criteria in Sections 10.1.13.3 and 10.1.13.4, the system must be evaluated and corrective action must be taken. The BFB tune and continuing calibration must be acceptable before analysis begins. Extensive corrective action, such as a different type of column, will require a new initial calibration.
- 10.1.13.7** Once the above criteria have been met, sample analysis may begin. Initial calibration average RFs (or the calibration curve) will be used for sample quantitation, not the continuing calibration RFs. Analysis may proceed until 12 hours from the injection of the BFB have passed. (A sample desorbed less than or equal to 12 hours after the BFB is acceptable.)
- 10.1.13.8** Sodium Bisulfate must be added to the CCV when analyzing samples preserved with it.

11.0 Calculations / Data Reduction

- 11.1** Detailed calibration equations can be found in the corporate SOP CA-Q-S-005 "Calibration Curves" and under the public folder, Arizona Calibration Training.

11.2 Qualitative Identification

- 11.2.1** An analyte is identified by retention time and by comparison of the sample mass spectrum with the mass spectrum of a standard of the suspected compound (standard reference spectrum). Mass spectra for standard reference may be obtained on the user's GC/MS by analysis of the calibration standards or from the NIST Library (same library as used for routine sample analysis). Two criteria must be satisfied to verify identification: (1) elution of sample component at the same GC retention time as the standard component; and (2) correspondence of the sample component and the standard component characteristic ions.

NOTE: *Care must be taken to ensure that spectral distortion due to co-elution is evaluated.*

- 11.2.1.1** The sample component retention time must compare to within ± 0.2 min. of the retention time of the standard component. For reference, the standard must be run within the same twelve hours as the sample.
- 11.2.1.2** All ions present in the standard mass spectra at a relative intensity greater than 10% (most abundant ion in the spectrum equals 100%) should be present in the sample spectrum.
- 11.2.1.3** The relative intensities of ions should agree to within $\pm 30\%$ between the standard and sample spectra. (Example: For an ion with an abundance of 50 % in the standard spectra, the corresponding sample

abundance must be between 20 and 80 %.)

11.2.2 If a compound cannot be verified by all the above criteria, but in the technical judgment of the analyst, the identification is correct, then the analyst shall report that identification and proceed with quantitation.

11.2.3 All data are subject to two levels of technical review, as described in SOP DV-QA-0020.

11.3 Tentatively Identified Compounds (TICs)

11.3.1 If the client requests components not associated with the calibration standards, a search of the NIST library may be made for the purpose of tentative identification. The following guidelines apply:

11.3.1.1 Relative intensities of major ions in the reference spectrum (ions > 10% of the most abundant ion) should be present in the sample spectrum.

11.3.1.2 The relative intensities of the major ions should agree to within 20%. (Example: If an ion shows an abundance of 50% in the standard spectrum, the corresponding sample ion abundance must be between 30% and 70%).

11.3.1.3 Molecular ions present in the reference spectrum should be present in the sample spectrum.

11.3.1.4 Ions present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or presence of co-eluting compounds.

11.3.1.5 Ions present in the reference spectrum but not in the sample spectrum should be reviewed for possible subtraction from the spectrum because of background contamination or co-eluting peaks. (Data system reduction programs can sometimes create these discrepancies.)

11.3.1.6 Computer-generated library search routines should not use normalization routines that would misrepresent the library or unknown spectra when compared to each other. Only after visual inspection of the sample with the nearest library searches should the analyst *assign a tentative identification*.

11.4 Calculations.

11.4.1 Response factor (RF):

$$RF = \frac{A_x C_{is}}{A_{is} C_x} \quad \text{Equation 1}$$

Where:

A_x = Area of the characteristic ion for the compound to be measured.

A_{is} = Area of the characteristic ion for the specific internal standard.

C_{is} = Concentration of the specific internal standard, ng.

C_x = Concentration of the compound being measured, ng.

11.4.2 Standard deviation (SD):

$$SD = \sqrt{\frac{\sum_{i=1}^n (X_i - \bar{X})^2}{n-1}}$$

Equation 2

Where:

X_i = Value of X at i through n .
 n = Number of points.
 \bar{X} = Average value of X_i .

11.4.3 Percent relative standard deviation (%RSD):

$$\% RSD = \frac{SD}{\overline{RF}} \times 100\%$$

Equation 3

Where \overline{RF} is the mean of RF values for the calibration.

11.4.4 Percent drift between the initial calibration and the continuing calibration:

$$\% Drift = \frac{C_{expected} - C_{found}}{C_{expected}} \times 100\%$$

Equation 4

Where:

$C_{expected}$ = Known concentration in standard.
 C_{found} = Measured concentration using selected quantitation method.

11.4.5 See SOP CA-Q-S-005 for more detailed calibration equations.

11.4.6 Target compound and surrogate concentrations:

Concentrations in the sample may be determined from linear or second order (quadratic) curve fitted to the initial calibration points, or from the average response factor of the initial calibration points. Average response factor may only be used when the % RSD of the response factors in the initial calibration is $\leq 15\%$.

11.4.6.1 Calculation of concentration using Average Response Factors:

$$\text{Concentration } (\mu\text{g/L}) = \frac{x}{\overline{RF}}$$

Equation 5

11.4.6.2 Calculation of concentration using Linear fit:

$$\text{Concentration } (\mu\text{g/L}) = A + Bx$$

Equation 6

11.4.6.3 Calculation of concentration using Quadratic fit:

$$\text{Concentration}(\mu\text{g} / \text{L}) = A + Bx + Cx^2 \quad \text{Equation 7}$$

Where:

- x = see equations 8, 9, and 10.
 A = intercept of the calibration function.
 B = slope of calibration function.
 C = curvature of a second-order calibration function.

11.4.6.4 Calculation of x for Water and water-miscible waste:

$$x = \frac{A_x I_s D_f}{A_{is} V_0} \quad \text{Equation 8}$$

Where:

- A_x = Area of characteristic ion for the compound being measured (secondary ion quantitation is allowed only when there are sample interferences with the primary ion).
 A_{is} = Area of the characteristic ion for the internal standard.
 I_s = Amount of internal standard added in ng.
 $D_f = \frac{\text{Total volume purged (mL)}}{\text{Volume of original sample used (mL)}}$
 V_0 = Volume of water purged, mL.

11.4.6.5 Calculation of x for High-level soils:

$$x = \frac{(A_x)(I_s)(V_t)(1000)D_f}{(A_{is})(V_a)(W_s)(D)} \quad \text{Equation 9}$$

Where:

- $A_x, I_s, D_f, A_{is},$ = same as used in equation 8 above.
 V_t = Volume of total extract, mL (typically 25 mL).
 V_a = Volume of extract added for purging, μL .
 W_s = Weight of sample extracted, g.
 $D = \frac{100 - \% \text{moisture}}{100}$

11.4.6.6 Calculation of x for Low level soils:

$$x = \frac{(A_x)(I_s)}{(A_{is})(W_s)(D)} \quad \text{Equation 10}$$

Where:

- $A_x, I_s, D_f, A_{is},$ = same as used in equation 8 above.
 D = same as in equation 9 above.

W_s = Weight of sample added to the purge vessel, g.

11.4.6.7 Calculation of TICs

The calculation of TICs (tentatively identified compounds) is identical to the above calculations with the following exceptions:

A_x = Area in the total ion chromatogram for the compound being measured.

A_{is} = Area of the total ion chromatogram for the nearest internal standard without interference.

RF = 1

In other words, the concentration is equal to x as defined in equations 8, 9, and 10.

11.4.7 MS/MSD Recovery

$$\% \text{ Recovery} = \frac{SSR - SR}{SA} \times 100\% \quad \text{Equation 11}$$

Where:

SSR = Spike sample result.

SR = Sample result.

SA = Spike added.

11.4.8 Relative % Difference calculation for the MS/MSD:

$$RPD = \frac{|MSR - MSDR|}{\frac{1}{2}(MSR + MSDR)} \times 100\% \quad \text{Equation 12}$$

Where:

RPD = Relative percent difference.

MSR = Matrix spike result.

$MSDR$ = Matrix spike duplicate result.

12.0 Method Performance

12.1 Method Detection Limit Study (MDL)

12.1.1 Method Detection Limit Study an initial method detection limit study must be performed on each instrument before samples can be analyzed. MDL studies are conducted annually as follows:

12.1.1.1 Prepare seven samples at three to five times the estimated MDL concentration.

12.1.1.2 Prepare and analyze the MDL standards as described in Section 10.

12.1.1.3 Calculate the average concentration found (X) in $\mu\text{g/L}$, and the standard deviation of the concentration(s) in $\mu\text{g/L}$, for each analyte. Then, calculate the MDL (single-tailed, 99% confidence level, as described in Policy # DV-QA-005P) for each analyte.

12.1.1.4 MDL studies are repeated annually, and MDL results are stored in the laboratory LIMS system. See Policy # DV-QA-005P for further details concerning MDL studies. It may be acceptable to perform MDLVs in lieu of 7-replicate studies.

- The current MDL value is maintained in the TestAmerica Denver LIMS.

12.2 Demonstration of Capabilities

12.2.1 All personnel are required to perform an initial demonstration of proficiency (IDOC) on the instrument they will be using for analysis prior to testing samples. On-going proficiency must be demonstrated annually. IDOCs and on-going proficiency demonstrations are conducted as follows.

12.2.1.1 Four aliquots of the QC check sample are analyzed using the same procedures used to analyze samples, including sample preparation. The concentration of the QC check sample should be equivalent to a mid-level calibration.

12.2.1.2 Calculate the average recovery and standard deviation of the recovery for each analyte of interest.

12.2.1.3 If any analyte does not meet the acceptance criteria, the test must be repeated. Only those analytes that did not meet criteria in the first test need to be evaluated. Repeated failure for any analyte indicates the need for the laboratory to evaluate the analytical procedure and take corrective action.

12.2.1.4 Further details concerning demonstrations of proficiency are described in SOP# DV-QA-0024.

12.3 Training Requirements

12.3.1 The Group Leader is responsible for ensuring that this procedure is performed by an associate who has been properly trained in its use and has the required experience. See requirements for demonstration of analyst proficiency in SOP DV-QA-0024.

12.3.2 Each analyst performing the method must complete a demonstration of capability (DOC) by successfully preparing and/or analyzing four consecutive LCSs, or a blind performance evaluation (PE) sample, or other acceptable QC samples. The results of the DOC study are summarized in the NELAC format, as described in SOP DV-QA-0024. DOCs are approved by the Quality Assurance Manager and the Technical Director. DOC records are maintained by the QA staff in the central training files. Analysts who continue to perform the method must successfully complete a demonstration of capability annually.

13.0 Pollution Control

It is TestAmerica's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability).

14.0 Waste Management

All waste will be disposed of in accordance with Federal, State, and local regulations. Where reasonably feasible, technological changes have been implemented to minimize the potential for pollution of the environment. Employees will abide by this procedure, the policies in section 13, "Waste Management and Pollution Prevention", of the Environmental Health and Safety Manual, and DV-HS-001P, "Waste Management Program."

14.1 The following waste streams are produced when this method is carried out:

14.1.1 Methanol Waste - Vial Waste and Flammable – Waste Streams A and C

14.1.2 Expired Chemicals/Reagents/Standards – Contact Waste Coordinator

14.1.3 Acidified Water – Waste Stream W

NOTE: Radioactive waste, mixed waste, and potentially radioactive waste must be segregated from non-radioactive waste as appropriate. Contact the Radioactive Waste Coordinator for proper management of these materials.

15.0 References / Cross-References

15.1 Method 8260B, Volatile Compounds by Gas Chromatography/Mass Spectrometry (GC/MS), Revision 2, December, 1996, SW-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition and all promulgated updates, EPA Office of Solid Waste, January 2005.

15.2 40 CFR Part 136, Appendix A (Method 624).

15.3 Method 5030B, Purge-and-Trap for Aqueous Samples, Revision 2, December, 1996, SW-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition and all promulgated updates, EPA Office of Solid Waste, January 2005.

15.4 Method 5035, Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples, Revision 0, December, 1996, SW-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition and all promulgated updates, EPA Office of Solid Waste, January 2005.

16.0 Method Modifications:

| Item | Method | Modification |
|------|----------------|--|
| 1 | SW846 8260B | Ion 119 is used as the quantitation ion for chlorobenzene-d ₅ . |

| Item | Method | Modification |
|------|----------------|---|
| 2 | SW846 8260B | The quantitation and qualifier ions for some compounds have been changed from those recommended in SW-846 in order to improve the reliability of qualitative identification. |
| 3 | SW846 8260B | This SOP has been written to allow for a 20 mL purge volume for waters. An additional 5 mL of DI water is added to all samples, QC and calibration standards. The final purge volume is 25 mL. |
| 4 | SW846 8260B | Method 8260B recommends that the purge vessel is run through an additional purge cycle after 25 mL sample analysis to remove carryover. Instead, purge vessels are oven baked between analyses or disposable vessels are used one time only. |
| 5 | SW846 8260B | SW-846 recommends that a curve be used for any analytes with %RSD of the response factors > 15%. However, some industry standard data systems and forms generation software cannot report this data with the necessary information for data validation. In addition, most software available does not allow weighting of the curve. Unweighted curves may exhibit serious errors in quantitation at the low end, resulting in possible false positives or false negatives. Therefore, if the overall average is $\leq 15\%$ then the ICAL is considered acceptable and any compounds that are not $\leq 15\%$ will use linear regression. |
| 6 | EPA 624 | Method 624 is required for demonstration of compliance with CWA permits, e.g., NPDES wastewater discharge permits. This method can be applied only to aqueous matrices. The standard analyte list and reporting limits are listed in Table A-1. If compounds are added to the analysis, all of the method criteria must be satisfied for the additional compounds. |
| 7 | EPA 624 | The tune period for this method is defined as 24 hours, which is the maximum elapsed time before the tune check is performed. Calibration verifications are done at the same 24 hour frequency. |
| 8 | EPA 624 | The initial calibration curve for this method requires at least three points, as shown in Table A-3. |
| 9 | EPA 624 | Sample concentrations are calculated using the average RRF from the initial calibration curve. |
| 10 | EPA 624 | Each target analyte is assigned to the closest eluting internal standard. |

| Item | Method | Modification |
|------|---------|--|
| 11 | EPA 624 | Initial demonstration of Proficiency <ul style="list-style-type: none"> The spiking level for the four replicate initial demonstration of proficiency is 20 µg/L. The acceptance criteria are listed in Table A-2 |
| 12 | EPA 624 | Initial calibration curve requirements: <ul style="list-style-type: none"> Target compounds must have RSD ≤ 35%. If this requirement can not be met, a regression curve must be constructed for the non-compliant compounds. There is no correlation coefficient requirement for the regression curve. |
| 13 | EPA 624 | Continuing calibration verification requirements: <ul style="list-style-type: none"> The continuing calibration standard is from a different source than the initial calibration standard. The daily CCAL concentration is 20 ug/L. The acceptance criteria are listed in Table A-2. Matrix Spike and LCS Requirements <ul style="list-style-type: none"> The matrix spike and LCS are spiked at 20 µg/L, prepared from the same source containing all analytes of interest. A matrix spike duplicate is not necessary for this method. The recovery limits for matrix spike and LCS recovery are listed in Table A-2. |
| 14 | EPA 624 | Consistent with the other volatile methods, corrections for recovery are not allowed. |
| 15 | EPA 624 | Qualitative Identification - The relative intensities of ions should agree to within ±20% between the standard and sample spectra. (Example: For an ion with an abundance of 50% in the standard spectra, the corresponding sample abundance must be between 20 and 80 percent.) |
| 16 | EPA 624 | Section 5.2.2 of the source method describes the trap packing materials as Tenax GC, Methyl silicone, silica gel and coconut charcoal. TestAmerica routinely employs the OI #10 trap which consists of Tenax/Silica Gel/ Carbon Molecular Sieve or the Supelco Vocab 3000 which consists of Carboxen B, Carboxen1000 and 1001. |
| 17 | EPA 624 | Section 5.3.2 of the source method describes a packed analytical column. TestAmerica routinely employs capillary columns when performing this method. |
| 18 | EPA 624 | The source method provides a suggested list of compounds |

| Item | Method | Modification |
|------|---------|--|
| | | for internal and surrogate standards. Others are permitted by the method. TestAmerica uses three internal standards, including chlorobenzene-d ₅ and 1,4-dichlorobenzene-d ₄ , which are not listed in Table 3 of the source method. Toluene-d ₈ is used as a surrogate compound, which is also not listed in the source method. |
| 19 | EPA 624 | The lab is preparing internal standards at 10 ug/L and applying the same criteria designed for 30 ug/L in the Method. The lower the concentration is consistent with the greater sensitivity provided by capillary columns as compared to the older packed columns described in the method. It could only be more challenging for the lab to meet the acceptance criteria at 10 ug/L; it provides a higher level of data quality. |
| 20 | EPA 624 | Method 624 describes a mass scan range of 25 to 260 amu. Table 13 lists all of the ions used for analysis. None of the ions are below 35 amu. Therefore, we scan from 35 to 300 and include all ions needed for analysis. |
| 21 | EPA 624 | Method 624 describes dilutions "if response of any m/z" exceeds the response for the highest m/z in the ICAL. As the m/z ratio is always directly proportional to the concentration, evaluation based on dilution (per 11.10) is equivalent. |
| 22 | EPA 624 | Method 624 has criteria for unresolved isomers. The problems of isomeric resolution for the routine analytes listed in this SOP were worked through when the laboratory developed its implementation of the method. For example, we know through experience that meta- and para-xylenes will not be resolved and it was not necessary to include an evaluation for the xylenes in each analysis. Any development work to add compounds would take this into account. |

17.0

Attachments

| | |
|----------|--|
| Table 1. | TestAmerica Primary List Reporting Limits for 8260B |
| Table 2. | TestAmerica 8260 Secondary List Reporting Limits |
| Table 3. | TestAmerica Appendix IX List Reporting Limits |
| Table 4. | Soil Calibration Levels, 5-gram Purge |
| Table 5. | TestAmerica Appendix IX List Calibration Levels, 5-gram Purge, µg/kg |
| Table 6. | Water 8260 List Calibration Levels (µg/L) |
| Table 7. | Low-Level Soil AFCEE 8260 List Calibration Levels (µg/kg) |
| Table 8. | Water AFCEE 8260 List Calibration Levels (µg/L) |
| Table 9. | Manually added Internal Standards |

| | |
|---------------|--|
| Table 9A. | Automatically added Internal Standards |
| Table 10. | Manually added Surrogate Standards |
| Table 10A. | Automatically added Surrogate Standards |
| Table 11. | Matrix Spike and LCS Standard |
| Table 12. | BFB Key Ion Abundance Criteria |
| Table 13. | SPCC Compounds and Minimum Response Factors |
| Table 14. | CCC Compounds |
| Table 15. | Characteristic Ions |
| Table 16. | State of Arizona CCV Limits (% Recovery) |
| Table 17. | List 1 Poorly performing Compounds |
| Table A-1. | Method 624 Analytes and Reporting Limits, 5-mL Purge |
| Table A-2. | Method 624 QC Acceptance Criteria |
| Table A-3. | Calibration Levels for 624, 5 mL Purge |
| Appendix A. | Modifications for analysis of 1,4-Dioxane by Selected Ion Monitoring |
| Table Ap-1. | TAL Method 8260SIM Standard Reporting Limits |
| Table Ap-2. | Method 8260SIM Calibration Levels |
| Table Ap-3. | Method 8260SIM LCS Spike Concentrations |
| Table Ap-4. | 8260SIM Surrogate Compounds |
| Table Ap-5. | 8260SIM Internal Standard Compounds |
| Table Ap-6. | 8260 Selected Masses |
| Table Ap-7. | Suggested Instrument Conditions for 8260SIM |
| Attachment 1. | Gas Standards Tracking Log |

18.0 **Changes from Previous Revision**

- Revision 6.4, dated 28 December 2011
 - Changed the column ID and film thickness in section 6.1.8.1
 - Updated the calibration levels in Table AP-2
- Revision 6.3, dated 26 October 2011
 - Added Section 4.6 regarding interferences with toluene-d₈ surrogate when potassium permanganate may have been added to sample
 - Updated path to QAS folders in the public folders, section 9.7
 - Added J. T. Baker Antifoam B and reagent sand, sections 7.3, 7.4
 - Added description of procedure for use of antifoaming agent B, section 10.1.3.8
 - Formatting
- Revision 6.2, dated 25 August, 2011
 - Added requirements to section 9.4 for the use of Ottawa sand in soil LCS's.
- Revision 6.1, dated 31 January, 2011
 - Added details to Appendix A for the analysis of soils by SIM
 - Added Tables AP-1 through Ap-7
 - Added Attachment 1, Gas Standards Tracking Log
 - Added section 11.1 referencing corporate SOP CA-Q-S-005 "Calibration Curves"
- Revision 6, dated 02 November, 2010
 - Added analysis information concerning BFB

- Revision 4, dated May 5, 2010
 - Updated Tables to reflect current report limits.
 - Updated low level procedure to include water option for preservation.
 - Updated surrogate and spike amounts.
- Revision 3.1, dated 11 December 2009
 - Added Trichloroethene to Table 11.
 - Updated section 16 to describe the process of adding and additional 5 ml of DI water to all samples and QC.
 - Added a note to section 9.4 that marginal exceedances are not allowed for some programs.
 - Updated the language in section 16 item 5 to describe the current practice.
- Revision 3.0, dated 21 January 2009
 - Added clarification of sample preservation requirements to section 8.
 - Adjusted Table 16 for South Carolina requirements to utilize default limits.
 - Added Table 8A for AFCEE water calibration levels.
- Revision 2.1, dated 16 July 2007
 - Add reference to North Carolina QAS for additional requirements to sections 9.6, 10.4.8, and 10.5.4.
 - Remove Nitrogen as an allowable substitution for Helium in section 6.8.
 - Added the current list of spike compounds to Table 11.
 - Updated references to include 5030B and 5035.
 - Removed EPA 524.2 references.
- Revision 2.0
 - The method blank acceptance criteria and corrective actions were updated in Section 9.4.

Table 1. TestAmerica Primary List Reporting Limits for 8260B

| Compound | CAS Number | Reporting Limits ¹ | | |
|--|------------|-------------------------------|------------------|------------------|
| | | 20 mL Water(µg/L) | Low Soil (µg/kg) | Med Soil (µg/kg) |
| Dichlorodifluoromethane | 75-71-8 | 2 | 10 | 400 |
| Chloromethane | 74-87-3 | 2 | 10 | 400 |
| Bromomethane | 74-83-9 | 2 | 10 | 400 |
| Vinyl chloride | 75-01-4 | 1 | 5 | 400 |
| Chloroethane | 75-00-3 | 2 | 10 | 400 |
| Trichlorofluoromethane | 75-69-4 | 2 | 10 | 400 |
| Acrolein | 107-02-8 | 20 | 100 | 4000 |
| Acetone | 67-64-1 | 10 | 20 | 800 |
| Trichlorotrifluoroethane | 76-13-1 | 3 | 20 | 200 |
| Ethanol | 64-17-5 | 300 | 600 | 20,000 |
| Iodomethane | 74-88-4 | 1 | 5 | 200 |
| Carbon disulfide | 75-15-0 | 2 | 5 | 200 |
| Methylene chloride | 75-09-2 | 5 | 5 | 200 |
| tert-Butyl alcohol | 75-65-0 | 50 | 200 | 8,000 |
| 1,1-Dichloroethene | 75-35-4 | 1 | 5 | 200 |
| 1,1-Dichloroethane | 75-34-3 | 1 | 5 | 200 |
| trans-1,2-Dichloroethene | 156-60-5 | 1 | 2.5 | 200 |
| Acrylonitrile | 107-13-1 | 20 | 100 | 4000 |
| Methyl <i>tert</i> -butyl ether (MTBE) | 1634-04-4 | 5 | 20 | 800 |
| Hexane | 110-54-3 | 2 | 5 | 200 |
| cis-1,2-Dichloroethene | 156-59-2 | 1 | 2.5 | 200 |
| 1,2-Dichloroethene (Total) | 540-59-0 | 2 | 5 | 400 |
| Tetrahydrofuran | 109-99-9 | 7 | 20 | 800 |
| Chloroform | 67-66-3 | 1 | 5 | 200 |
| 1,2-Dichloroethane | 107-06-2 | 1 | 5 | 200 |
| Dibromomethane | 74-95-3 | 1 | 5 | 200 |
| 2-Butanone | 78-93-3 | 6 | 10 | 800 |
| 1,4-Dioxane | 123-91-1 | 200 | 500 | 20,000 |
| 1,1,1-Trichloroethane | 71-55-6 | 1 | 5 | 200 |
| Carbon tetrachloride | 56-23-5 | 1 | 5 | 200 |
| Bromodichloromethane | 75-27-4 | 1 | 5 | 200 |
| 1,2-Dichloropropane | 78-87-5 | 1 | 5 | 200 |

Table 1. TestAmerica Primary List Reporting Limits for 8260B

| Compound | CAS Number | Reporting Limits ¹ | | |
|--|-------------|-------------------------------|------------------|------------------|
| | | 20 mL Water(µg/L) | Low Soil (µg/kg) | Med Soil (µg/kg) |
| cis-1,3-Dichloropropene | 10061-01-5 | 1 | 5 | 200 |
| Trichloroethene | 79-01-6 | 1 | 5 | 200 |
| Dibromochloromethane | 124-48-1 | 1 | 5 | 200 |
| 1,2-Dibromoethane | 106-93-4 | 1 | 5 | 200 |
| 1,2,3-Trichloropropane | 96-18-4 | 1 | 5 | 200 |
| 1,1,2-Trichloroethane | 79-00-5 | 1 | 5 | 200 |
| Benzene | 71-43-2 | 1 | 5 | 200 |
| Ethylmethacrylate | 97-63-2 | 3 | 5 | 200 |
| Trans-1,3-Dichloropropene | 10061-02-6 | 3 | 5 | 200 |
| Bromoform | 75-25-2 | 1 | 5 | 200 |
| 4-Methyl-2-pentanone | 108-10-1 | 5 | 20 | 800 |
| 2-Hexanone | 591-78-6 | 5 | 20 | 800 |
| Tetrachloroethene | 127-18-4 | 1 | 5 | 200 |
| Toluene | 108-88-3 | 1 | 5 | 200 |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | 1 | 5 | 200 |
| 2-Chloroethyl vinyl ether ² | 110-75-8 | N/A ² | 50 | 800 |
| Vinyl acetate | 108-05-4 | 3 | 10 | 400 |
| Chlorobenzene | 108-90-7 | 1 | 5 | 200 |
| Ethylbenzene | 100-41-4 | 1 | 5 | 200 |
| Styrene | 100-42-5 | 1 | 5 | 200 |
| t-1,4-Dichloro-2-butene | 110-57-6 | 1 | 5 | 200 |
| m and p Xylenes | 179601-23-1 | 1 | 3.5 | 200 |
| o-xylene | 95-47-6 | 1 | 2.5 | 200 |
| Total xylenes | 1330-20-7 | 2 | 10 | 400 |
| 1,3-Dichlorobenzene | 541-73-1 | 1 | 5 | 200 |
| 1,4-Dichlorobenzene | 106-46-7 | 1 | 5 | 200 |
| 1,2-Dichlorobenzene | 95-50-1 | 1 | 5 | 200 |

¹ Reporting limits listed for soil/sediment are based on wet weight. The reporting limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, will be higher.

² 2-Chloroethyl vinyl ether cannot be reliably recovered from acid preserved samples

Table 2. TestAmerica 8260 Secondary List Reporting Limits

| Compound | CAS Number | Reporting Limits ¹ | | |
|-----------------------------|------------|-------------------------------|-------------------|----------------------|
| | | 20 mL Water µg/L | Low Soil µg/kg | Medium Soil µg/kg |
| 2,2-Dichloropropane | 590-20-7 | 5 | 5 | 200 |
| Bromochloromethane | 74-97-5 | 1 | 5 | 200 |
| 1,1-Dichloropropene | 563-58-6 | 1 | 5 | 200 |
| 1,3-Dichloropropane | 142-28-9 | 1 | 5 | 200 |
| 1-Chlorohexane | 544-10-5 | 1 | 5 | 200 |
| 1,1,1,2-Tetrachloroethane | 630-20-6 | 1 | 5 | 200 |
| Isopropylbenzene | 98-82-8 | 1 | 5 | 200 |
| Bromobenzene | 108-86-1 | 1 | 5 | 200 |
| n-Propylbenzene | 103-65-1 | 1 | 5 | 200 |
| 2-Chlorotoluene | 95-49-8 | 1 | 5 | 200 |
| 4-Chlorotoluene | 106-43-4 | 1 | 5 | 200 |
| 1,3,5-Trimethylbenzene | 108-67-8 | 1 | 5 | 200 |
| tert-Butylbenzene | 98-06-6 | 1 | 5 | 200 |
| 1,2,4-Trimethylbenzene | 95-63-6 | 1 | 5 | 200 |
| sec-Butylbenzene | 135-98-8 | 1 | 5 | 200 |
| 4-Isopropyltoluene | 99-87-6 | 1 | 5 | 200 |
| n-Butylbenzene | 104-51-8 | 1 | 5 | 200 |
| 1,2-Dibromo-3-chloropropane | 96-12-8 | 5 | 5 | 200 |
| 1,2,4-Trichlorobenzene | 120-82-1 | 1 | 5 | 200 |
| Naphthalene | 91-20-3 | 1 | 5 | 200 |
| Hexachlorobutadiene | 87-68-3 | 1 | 5 | 200 |
| 1,2,3-Trichlorobenzene | 87-61-6 | 1 | 5 | 200 |

Table 3. TestAmerica Appendix IX List Reporting Limits

| Compound | CAS Number | Reporting Limits ¹ | | |
|-----------------------------|------------|-------------------------------|-------------------|----------------------|
| | | 20 mL Water µg/L | Low Soil µg/kg | Medium Soil µg/kg |
| Allyl Chloride | 107-05-1 | 1 | 5 | 400 |
| Acetonitrile | 75-05-8 | 30 | 100 | 4000 |
| Dichlorofluoromethane | 75-43-4 | 2 | 10 | 400 |
| Isopropyl ether | 108-20-3 | 10 | 50 | 400 |
| Chloroprene | 126-99-8 | 1 | 5 | 200 |
| n-Butanol | 71-36-3 | 60 | 200 | 8,000 |
| Propionitrile | 107-12-0 | 20 | 50 | 800 |
| Methacrylonitrile | 126-98-7 | 10 | 50 | 200 |
| Isobutanol | 78-83-1 | 110 | 200 | 8,000 |
| Methyl methacrylate | 80-62-6 | 4 | 5 | 200 |
| 1,1,1,2-Tetrachloroethane | 630-20-6 | 1 | 5 | 200 |
| 1,2-Dibromo-3-chloropropane | 96-12-8 | 5 | 10 | 400 |
| Ethyl ether | 60-29-7 | 2 | 10 | 400 |
| Ethyl Acetate | 141-78-6 | 5 | 10 | 800 |
| 2-Nitropropane | 79-46-9 | 3 | 10 | 400 |
| Cyclohexanone ² | 108-94-1 | N/A ² | N/A ² | N/A ² |
| Isopropylbenzene | 98-82-8 | 1 | 5 | 200 |

¹ Reporting limits listed for soil/sediment are based on wet weight. The reporting limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, will be higher.

² Cyclohexanone decomposes to 1,1-dimethoxycyclohexane in methanolic solution. Reporting limits cannot be accurately determined.

Table 4. Soil Calibration Levels, 5-gram Purge

| Compound | Calibration Level, µg/kg | | | | | | |
|--|--------------------------|---------|---------|---------|---------|---------|---------|
| | Level 1 | Level 2 | Level 3 | Level 4 | Level 5 | Level 6 | Level 7 |
| Dichlorodifluoromethane | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Chloromethane | 2 | 5 | 10 | 20 | 25 | 100 | 200 |
| Bromomethane | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Vinyl chloride | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Chloroethane | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Trichlorofluoromethane | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Acrolein | 20 | 50 | 100 | 200 | 500 | 1,000 | 2,000 |
| Acetone | 8 | 20 | 40 | 80 | 200 | 400 | 800 |
| Trichlorotrifluoroethane | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Ethanol | 100 | 250 | 500 | 1,000 | 2,500 | 5,000 | 10,000 |
| Iodomethane | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Carbon disulfide | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Methylene chloride | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| tert-Butyl alcohol | 40 | 100 | 200 | 400 | 1,000 | 2,000 | 4,000 |
| 1,1-Dichloroethene | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 1,1-Dichloroethane | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| trans-1,2-Dichloroethene | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Acrylonitrile | 20 | 50 | 100 | 200 | 500 | 1,000 | 2,000 |
| Methyl <i>tert</i> -butyl ether (MTBE) | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Hexane | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| cis-1,2-Dichloroethene | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Tetrahydrofuran | 4 | 10 | 20 | 40 | 100 | 200 | 400 |
| Chloroform | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 1,2-Dichloroethane | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Dibromomethane | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 2-Butanone | 8 | 20 | 40 | 80 | 200 | 400 | 800 |
| 1,4-Dioxane | 100 | 250 | 500 | 1,000 | 2,500 | 5,000 | 10,000 |
| 1,1,1-Trichloroethane | 2 | 5 | 10 | 20 | 50 | 100 | 200 |

Table 4. Soil Calibration Levels, 5-gram Purge (cont.)

| Compound | Calibration Level, µg/kg | | | | | | |
|---------------------------|--------------------------|---------|---------|---------|---------|---------|---------|
| | Level 1 | Level 2 | Level 3 | Level 4 | Level 5 | Level 6 | Level 7 |
| Carbon tetrachloride | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Bromodichloromethane | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 1,2-Dichloropropane | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| cis-1,3-Dichloropropene | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Trichloroethene | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Dibromochloromethane | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 1,2-Dibromoethane | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 1,2,3-Trichloropropane | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 1,1,2-Trichloroethane | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Benzene | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Ethylmethacrylate | 4 | 10 | 20 | 40 | 100 | 200 | 400 |
| trans-1,3-Dichloropropene | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Bromoform | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 4-Methyl-2-pentanone | 8 | 20 | 40 | 80 | 200 | 400 | 800 |
| 2-Hexanone | 8 | 20 | 40 | 80 | 200 | 400 | 800 |
| Tetrachloroethene | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Toluene | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 1,1,2,2-Tetrachloroethane | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 2-Chloroethyl vinyl ether | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Vinyl acetate | 4 | 10 | 20 | 40 | 100 | 200 | 400 |
| Chlorobenzene | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Ethylbenzene | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Styrene | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| t-1,4-Dichloro-2-butene | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| m and p Xylenes | 4 | 10 | 20 | 40 | 100 | 200 | 400 |
| o-xylene | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 1,3-Dichlorobenzene | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 1,4-Dichlorobenzene | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 1,2-Dichlorobenzene | 2 | 5 | 10 | 20 | 50 | 100 | 200 |

Table 5. TestAmerica Appendix IX List Calibration Levels, 5-gram Purge, µg/kg

| Compound | Level 1 | Level 2 | Level 3 | Level 4 | Level 5 | Level 6 |
|-----------------------------|---------|---------|---------|---------|---------|---------|
| Allyl Chloride | 5 | 10 | 20 | 50 | 100 | 200 |
| Acetonitrile | 50 | 100 | 200 | 500 | 1,000 | 2,000 |
| Dichlorofluoromethane | 5 | 10 | 20 | 50 | 100 | 200 |
| Isopropyl ether | 25 | 50 | 100 | 250 | 500 | 1,000 |
| Chloroprene | 5 | 10 | 20 | 50 | 100 | 200 |
| n-Butanol | 100 | 200 | 400 | 1,000 | 2,000 | 4,000 |
| Propionitrile | 50 | 100 | 200 | 500 | 1,000 | 2,000 |
| Methacrylonitrile | 50 | 100 | 200 | 500 | 1,000 | 2,000 |
| Isobutanol | 100 | 200 | 400 | 1,000 | 2,000 | 4,000 |
| Methyl methacrylate | 10 | 20 | 40 | 100 | 200 | 400 |
| 1,1,1,2-Tetrachloroethane | 5 | 10 | 20 | 50 | 100 | 200 |
| 1,2-Dibromo-3-chloropropane | 5 | 10 | 20 | 50 | 100 | 200 |
| Ethyl ether | 5 | 10 | 20 | 50 | 100 | 200 |
| Ethyl Acetate | 10 | 20 | 40 | 100 | 200 | 400 |
| 2-Nitropropane | 5 | 10 | 20 | 50 | 100 | 200 |
| Cyclohexanone | 200 | 400 | 800 | 2,000 | 4,000 | 8,000 |
| Isopropylbenzene | 5 | 10 | 20 | 50 | 100 | 200 |

Table 6. Water 8260 List Calibration Levels (µg/L)

| Compound | Level 1 | Level 2 | Level 3 | Level 4 | Level 5 | Level 6 | Level 7 |
|--------------------------|---------|---------|---------|---------|---------|---------|---------|
| Acetone | 2.0 | 4.0 | 8.0 | 20 | 40 | 120 | 240 |
| Acetonitrile | 5 | 10 | 20 | 50 | 100 | 300 | 600 |
| Acrolein | 5.0 | 10 | 20 | 50 | 100 | 300 | 600 |
| Acrylonitrile | 5 | 10 | 20 | 50 | 100 | 300 | 600 |
| Allyl chloride | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Benzene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Bromobenzene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Bromochloromethane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Bromodichloromethane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Bromoform | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Bromomethane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| n-Butanol | 15 | 30 | 60 | 150 | 300 | 900 | 1800 |
| 2-Butanone (MEK) | 2.0 | 4.0 | 8.0 | 20 | 40 | 120 | 240 |
| tert-Butyl alcohol | 10 | 20 | 40 | 100 | 200 | 600 | 1200 |
| n-Butylbenzene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| sec-Butylbenzene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| tert-Butylbenzene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Carbon disulfide | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Carbon tetrachloride | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Chlorobenzene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Chloroprene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 2-Chloro-1,3-butadiene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Chlorodibromomethane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Chloroethane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 2-Chloroethy vinyl ether | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Chloroform | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1-Chlorohexane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Chloromethane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 2-Chlorotoluene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |

Table 6. Water 8260 List Calibration Levels (µg/L) (cont.)

| Compound | Level 1 | Level 2 | Level 3 | Level 4 | Level 5 | Level 6 | Level 7 |
|------------------------------------|---------|---------|---------|---------|---------|---------|---------|
| 4-Chlorotoluene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Cyclohexane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Cyclohexanone | 20 | 40 | 80 | 200 | 400 | 1200 | 2400 |
| 1,2-Dibromo-3-chloropropane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,2-Dibromoethane (EDB) | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Dibromomethane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,2-Dichlorobenzene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,3-Dichlorobenzene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,4-Dichlorobenzene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| cis-1,4-dichloro-2-butene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| trans-1,4-dichloro-2-butene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Dichlorodifluoromethane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,1-Dichloroethane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,2-Dichloroethane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| cis-1,2-Dichloroethene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| trans-1,2-Dichloroethene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,1-Dichloroethene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Dichlorofluoromethane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,2-Dichloropropane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,3-Dichloropropane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 2,2-Dichloropropane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| cis-1,3-Dichloropropene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| trans-1,3-Dichloropropene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,1-Dichloropropene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,2-Dichloro-1,1,2-trichloroethane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,2-Dichloro-1,1,1-trichloroethane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,4-Dioxane | 25 | 50 | 100 | 250 | 500 | 1500 | 3000 |
| Ethanol | 25 | 50 | 100 | 250 | 500 | 1500 | 3000 |
| Ethyl acetate | 1.0 | 2.0 | 4.0 | 10 | 20 | 60 | 120 |
| Ethylbenzene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |

Table 6. Water 8260 List Calibration Levels (µg/L) (cont.)

| Compound | Level 1 | Level 2 | Level 3 | Level 4 | Level 5 | Level 6 | Level 7 |
|--|---------|---------|---------|---------|---------|---------|---------|
| Ethylene oxide | 62.5 | 125 | 250 | 625 | 1250 | 3750 | 7500 |
| Ethyl ether | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Ethyl methacrylate | 1.0 | 2.0 | 4.0 | 10 | 20 | 60 | 120 |
| Hexachlorobutadiene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Hexane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 2-Hexanone | 2.0 | 4.0 | 8.0 | 20 | 40 | 120 | 240 |
| Iodomethane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Isobutyl alcohol | 10 | 20 | 40 | 100 | 200 | 600 | 1200 |
| Isopropylbenzene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Isopropyl ether | 2.5 | 5.0 | 10 | 25 | 50 | 150 | 300 |
| 4-Isopropyltoluene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Methacrylonitrile | 5.0 | 10 | 20 | 50 | 100 | 300 | 600 |
| Methylene chloride | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Methyl methacrylate | 1.0 | 2.0 | 4.0 | 8.0 | 20 | 60 | 120 |
| 4-Methyl-2-pentanone | 2.0 | 4.0 | 8.0 | 20 | 40 | 120 | 240 |
| Methyl <i>tert</i> -butyl ether (MTBE) | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Naphthalene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 2-Nitropropane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 2-Pentanone | 2.0 | 4.0 | 8.0 | 20 | 40 | 120 | 240 |
| Propionitrile | 5.0 | 10 | 20 | 50 | 100 | 300 | 600 |
| n-Propylbenzene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Styrene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,1,1,2-Tetrachloroethane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,1,2,2-Tetrachloroethane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Tetrachloroethene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Tetrahydrofuran | 1.0 | 2.0 | 4.0 | 10 | 20 | 60 | 120 |
| Toluene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,2,3-Trichlorobenzene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,2,4-Trichlorobenzene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,1,1-Trichloroethane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,1,2-Trichloroethane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |

Table 6. Water 8260 List Calibration Levels (µg/L) (cont.)

| Compound | Level 1 | Level 2 | Level 3 | Level 4 | Level 5 | Level 6 | Level 7 |
|------------------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Trichloroethene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Trichlorofluoromethane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,2,3-Trichloropropane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,1,1-Trichloro-2,2-dichloroethane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,1,2-Trichloro-2,2-dichloroethane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Trichlorotrifluoroethane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 2,2-Dichloro-1,1,1-trifluoroethane | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,2,4-Trimethylbenzene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,3,5-Trimethylbenzene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Vinyl acetate | 1.0 | 2.0 | 4.0 | 10 | 20 | 60 | 120 |
| Vinyl chloride | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| m and p Xylenes | 1.0 | 2.0 | 4.0 | 10 | 20 | 60 | 120 |
| o-xylene | 0.5 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |

Table 7. Low-Level Soil AFCEE 8260 List Calibration Levels (µg/kg)

| Compound | Level 1 | Level 2 | Level 3 | Level 4 | Level 5 | Level 6 | Level 7 | Level 8 |
|------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|
| Acetone | 4 | 8 | 20 | 40 | 80 | 200 | 400 | 800 |
| Benzene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Bromobenzene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Bromochloromethane | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Bromodichloromethane | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Bromoform | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Bromomethane | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 2-Butanone (MEK) | 4 | 8 | 20 | 40 | 80 | 200 | 400 | 800 |
| n-Butylbenzene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| sec-Butylbenzene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| tert-Butylbenzene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Carbon disulfide | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Carbon tetrachloride | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Chlorobenzene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Chlorodibromomethane | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Chloroethane | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 2-Chloroethyl vinyl ether | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Chloroform | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 1-Chlorohexane | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Chloromethane | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 2-Chlorotoluene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 4-Chlorotoluene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 1,2-Dibromo-3-chloropropane (DBCP) | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 1,2-Dibromoethane (EDB) | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Dibromomethane | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 1,2-Dichlorobenzene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 1,3-Dichlorobenzene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 1,4-Dichlorobenzene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Dichlorodifluoromethane | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |

Table 7. Low-Level Soil AFCEE 8260 List Calibration Levels (µg/kg) (cont.)

| Compound | Level 1 | Level 2 | Level 3 | Level 4 | Level 5 | Level 6 | Level 7 | Level 8 |
|--------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|
| 1,1-Dichloroethane | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 1,2-Dichloroethane | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| cis-1,2-Dichloroethene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| trans-1,2-Dichloroethene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 1,1-Dichloroethene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 1,2-Dichloropropane | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 1,3-Dichloropropane | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 2,2-Dichloropropane | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| cis-1,3-Dichloropropene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| trans-1,3-Dichloropropene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 1,1-Dichloropropene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Ethylbenzene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Hexachlorobutadiene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 2-Hexanone | 4 | 8 | 20 | 40 | 80 | 200 | 400 | 800 |
| Isopropylbenzene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 4-Isopropyltoluene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Methylene chloride | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 4-Methyl-2-pentanone | 4 | 8 | 20 | 40 | 80 | 200 | 400 | 800 |
| Methyl tert-butyl ether (MTBE) | 2 | 4 | 10 | 20 | 40 | 100 | 200 | 400 |
| Naphthalene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| n-Propylbenzene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Styrene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 1,1,1,2-Tetrachloroethane | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 1,1,2,2-Tetrachloroethane | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Tetrachloroethene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Toluene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 1,2,3-Trichlorobenzene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 1,2,4-Trichlorobenzene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 1,1,1-Trichloroethane | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |

| Table 7. Low-Level Soil AFCEE 8260 List Calibration Levels (µg/kg) (cont.) | | | | | | | | |
|---|---|---|----|----|----|-----|-----|-----|
| 1,1,2-Trichloroethane | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Trichloroethene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Trichlorofluoromethane | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 1,2,3-Trichloropropane | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 1,2,4-Trimethylbenzene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 1,3,5-Trimethylbenzene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Vinyl acetate | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| Vinyl chloride | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| m and p Xylenes | 2 | 4 | 10 | 20 | 40 | 100 | 200 | 400 |
| o-xylene | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |

Table 8. Water AFCEE 8260 List Calibration Levels (µg/L)

| Compound | Level 1 | Level 2 | Level 3 | Level 4 | Level 5 | Level 6 | Level 7 |
|------------------------------------|---------|---------|---------|---------|---------|---------|---------|
| Acetone | 0.6 | 2.0 | 4.0 | 10.0 | 20 | 60 | 120 |
| Benzene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Bromobenzene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Bromochloromethane | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Bromodichloromethane | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Bromoform | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Bromomethane | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 2-Butanone (MEK) | 0.6 | 2.0 | 4.0 | 10.0 | 20 | 60 | 120 |
| n-Butylbenzene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| sec-Butylbenzene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| tert-Butylbenzene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Carbon disulfide | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Carbon tetrachloride | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Chlorobenzene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Chlorodibromomethane | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Chloroethane | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 2-Chloroethyl vinyl ether | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Chloroform | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1-Chlorohexane | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Chloromethane | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 2-Chlorotoluene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 4-Chlorotoluene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,2-Dibromo-3-chloropropane (DBCP) | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,2-Dibromoethane (EDB) | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Dibromomethane | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,2-Dichlorobenzene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,3-Dichlorobenzene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,4-Dichlorobenzene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Dichlorodifluoromethane | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |

Table 8. Water AFCEE 8260 List Calibration Levels (µg/L) (cont.)

| Compound | Level 1 | Level 2 | Level 3 | Level 4 | Level 5 | Level 6 | Level 7 |
|--|---------|---------|---------|---------|---------|---------|---------|
| 1,1-Dichloroethane | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,2-Dichloroethane | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| cis-1,2-Dichloroethene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| trans-1,2-Dichloroethene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,1-Dichloroethene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,2-Dichloropropane | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,3-Dichloropropane | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 2,2-Dichloropropane | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| cis-1,3-Dichloropropene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| trans-1,3-Dichloropropene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,1-Dichloropropene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Ethylbenzene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Hexachlorobutadiene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 2-Hexanone | 0.6 | 2.0 | 4.0 | 10.0 | 20 | 60 | 120 |
| Isopropylbenzene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 4-Isopropyltoluene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Methylene chloride | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 4-Methyl-2-pentanone | 0.6 | 2.0 | 4.0 | 10.0 | 20 | 60 | 120 |
| Methyl <i>tert</i> -butyl ether (MTBE) | 0.6 | 2.0 | 4.0 | 10.0 | 20 | 60 | 120 |
| Naphthalene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| n-Propylbenzene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Styrene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,1,1,2-Tetrachloroethane | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,1,2,2-Tetrachloroethane | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Tetrachloroethene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Toluene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,2,3-Trichlorobenzene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,2,4-Trichlorobenzene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,1,1-Trichloroethane | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,1,2-Trichloroethane | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Trichloroethene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |

Table 8. Water AFCEE 8260 List Calibration Levels (µg/L) (cont.)

| Compound | Level 1 | Level 2 | Level 3 | Level 4 | Level 5 | Level 6 | Level 7 |
|------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Trichlorofluoromethane | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,2,3-Trichloropropane | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,2,4-Trimethylbenzene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| 1,3,5-Trimethylbenzene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Vinyl acetate | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| Vinyl chloride | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |
| m and p Xylenes | 0.6 | 2.0 | 4.0 | 10.0 | 20 | 60 | 120 |
| o-xylene | 0.3 | 1.0 | 2.0 | 5.0 | 10 | 30 | 60 |

Table 9. Manually added Internal Standards

| Internal Standard | Standard Concentration (µg/mL) | Quantitation Ion |
|------------------------------------|--------------------------------|------------------|
| Fluorobenzene | 20 | 96 |
| Chlorobenzene-d ₅ | 20 | 119 |
| 1,4-Dichlorobenzene-d ₄ | 20 | 152 |

NOTES:

- 1) 10 µL of the internal standard is added to the sample. This results in a concentration of each internal standard in the sample at 10 µg/L for a 20 mL purge.
- 2) Except for high-level soils, the surrogate and internal standards may be combined in one solution.

Table 9A. Automatically added Internal Standards

| Internal Standard | Standard Concentration (µg/mL) | Quantitation Ion |
|------------------------------------|--------------------------------|------------------|
| Fluorobenzene | 250 | 96 |
| Chlorobenzene-d ₅ | 250 | 119 |
| 1,4-Dichlorobenzene-d ₄ | 250 | 152 |

NOTES:

- 1) 1 µL of the internal standard is added to the sample. This results in a concentration of each internal standard in the sample at 10 µg/L for a 20 mL purge.
- 2) There may be some variability in the size of the internal standard loop from one instrument to the next. This is compensated for on the day of initial calibration by comparing the manually added and automatically added internal standard concentrations.

Table 10. Manually added Surrogate Standards

| Surrogate Compounds | Standard Concentration (µg/mL) |
|-----------------------------------|--------------------------------|
| 1,2-Dichloroethane-d ₄ | 20 |
| Dibromofluoromethane | 20 |
| Toluene-d ₈ | 20 |
| 4-Bromofluorobenzene | 20 |

NOTES:

- 1) 10 µL of the surrogate standard is added to the sample. This results in a concentration of each surrogate in the sample at 10 µg/L for a 20 mL purge.
- 2) Except for high-level soils, the surrogate and internal standards may be combined in one solution.
- 3) Recovery limits for surrogates are generated from historical data and are maintained by the QA department.

Table 10A. Surrogate Standards

| Surrogate Compounds | Standard Concentration (µg/mL) |
|-----------------------------------|--------------------------------|
| 1,2-Dichloroethane-d ₄ | 250 |
| Dibromofluoromethane | 250 |
| Toluene-d ₈ | 250 |
| 4-Bromofluorobenzene | 250 |

NOTES:

- 1) 1 µL of the surrogate standard is added to the sample. This results in a concentration of each surrogate in the sample at 10 µg/L for a 20 mL purge.
- 2) There may be some variability in the size of the surrogate standard loop from one instrument to the next. This is compensated for on the day of initial calibration by comparing the manually added and automatically added surrogate standard concentrations.
- 3) Recovery limits for surrogates are generated from historical data and are maintained by the QA department.

Table 11. Matrix Spike and LCS Standard

| Compound | Standard Concentration µg /mL |
|--------------------------|-------------------------------|
| 1,1-Dichloroethene | 40 |
| Methylene Chloride | 40 |
| Trans-1,2-Dichloroethene | 40 |
| 1,1-Dichloroethane | 40 |
| 1111-Trichloroethane | 40 |
| Carbon Tetrachloride | 40 |
| Benzene | 40 |
| Trichloroethene | 40 |
| 1,2-Dichloropropane | 40 |
| Bromodichloromethane | 40 |
| Toluene | 40 |
| Tetrachloroethene | 40 |
| Chlorobenzene | 40 |
| Ethylbenzene | 40 |
| 1,4-Dichlorobenzene | 40 |
| 1,3-Dichlorobenzene | 40 |

NOTES:

- 1) 2.5 µL of the standard is added to the LCS or matrix spike sample. This results in a concentration of each spike analyte in the sample of 5 µg/L for a 20 mL purge.
- 2) Recovery and precision limits for the LCS, MS, and MSD are generated from historical data and are maintained by the QA department.
- 3) Full analyte spikes or different compounds may also be used at the laboratory's option or at client request.

Table 12. BFB Key Ion Abundance Criteria

| Mass | Ion Abundance Criteria |
|------|--|
| 50 | 15 to 40 % of Mass 95 |
| 75 | 30 to 60 % of Mass 95 |
| 95 | Base Peak, 100 % Relative Abundance |
| 96 | 5 to 9 % of Mass 95 |
| 173 | Less than 2 % of Mass 174 |
| 174 | Greater than 50 % of Mass 95 |
| 175 | 5 to 9 % of Mass 174 |
| 176 | Greater than 95 %, but less than 101 % of Mass 174 |
| 177 | 5 to 9 % of Mass 176 |

Table 13. SPCC Compounds and Minimum Response Factors

| Compound | 8260B Min. RF |
|---------------------------|---------------|
| Chloromethane | 0.100 |
| 1,1-Dichloroethane | 0.100 |
| Bromoform | > 0.100 |
| 1,1,2,2-Tetrachloroethane | 0.300 |
| Chlorobenzene | 0.300 |

Table 14. CCC Compounds

| Compound | Max. %RSD from Initial Calibration | Max. %D for continuing calibration |
|---------------------|------------------------------------|------------------------------------|
| Vinyl Chloride | ≤ 30.0 | ≤ 20.0 |
| 1,1-Dichloroethene | ≤ 30.0 | ≤ 20.0 |
| Chloroform | ≤ 30.0 | ≤ 20.0 |
| 1,2-Dichloropropane | ≤ 30.0 | ≤ 20.0 |
| Toluene | ≤ 30.0 | ≤ 20.0 |
| Ethylbenzene | ≤ 30.0 | ≤ 20.0 |

Table 15. Characteristic Ions

| Compound | Primary* | Secondary | Tertiary |
|---|----------|-----------|--------------|
| 1,2-Dichloroethane-d ₄ (Surrogate) | 65 | 102 | -- |
| Dichlorodifluoromethane | 85 | 87 | 50, 101, 103 |
| Dibromofluoromethane | 111 | 113 | -- |
| Chloromethane | 50 | 52 | 49 |
| Vinyl chloride | 62 | 64 | 61 |
| Bromomethane | 94 | 96 | 79 |
| Chloroethane | 64 | 66 | 49 |
| Trichlorofluoromethane | 101 | 103 | 66 |
| 1,1-Dichloroethene | 96 | 61 | 98 |
| Acrolein | 56 | 55 | 58 |
| Iodomethane | 142 | 127 | 141 |
| Carbon disulfide | 76 | 78 | -- |
| Trichlorotrifluoroethane | 151 | 101 | 153 |
| Ethanol | 45 | 46 | -- |
| Acetone | 43 | 58 | -- |
| Methylene chloride | 84 | 49 | 51, 86 |
| Tert-Butyl alcohol | 59 | 74 | -- |
| Trans-1,2-Dichloroethene | 96 | 61 | 98 |
| Acrylonitrile | 53 | 52 | 51 |
| Methyl <i>tert</i> butyl ether | 73 | | -- |
| Hexane | 57 | 43 | -- |
| 1,1-Dichloroethane | 63 | 65 | 83 |
| cis-1,2-Dichloroethene | 96 | 61 | 98 |
| 2-Butanone | 43 | 72** | -- |
| Tetrahydrofuran | 42 | 71 | -- |
| Chloroform | 83 | 85 | 47 |
| 1,2-Dichloroethane | 62 | 64 | 98 |
| Dibromomethane | 93 | 174 | 95, 172, 176 |
| 1,4-Dioxane | 88 | 58 | -- |
| Vinyl acetate | 43 | 86 | -- |
| 1,1,1-Trichloroethane | 97 | 99 | 117 |
| Carbon tetrachloride | 117 | 119 | 121 |

Table 15. Characteristic Ions (cont.)

| Compound | Primary* | Secondary | Tertiary |
|------------------------------------|----------|-----------|-------------|
| Benzene | 78 | 52 | 77 |
| Trichloroethene | 95 | 130*** | 97, 132 |
| 1,2-Dichloropropane | 63 | 65 | 41 |
| Bromodichloromethane | 83 | 85 | 129 |
| 2-Chloroethyl vinyl ether | 63 | 65 | 106 |
| cis-1,3-Dichloropropene | 75 | 77 | 39 |
| trans-1,3-Dichloropropene | 75 | 77 | 39 |
| 1,1,2-Trichloroethane | 97 | 83 | 85, 99 |
| Chlorodibromomethane | 129 | 127 | 131 |
| Bromoform | 173 | 171 | 175, 252 |
| 1,2,3-Trichloropropane | 75 | 110 | 77, 112, 97 |
| Toluene-d ₈ (Surrogate) | 98 | 70 | 100 |
| 4-Bromofluorobenzene (Surrogate) | 95 | 174 | 176 |
| Toluene | 91 | 92 | 65 |
| 4-Methyl-2-pentanone | 43 | 58 | 57, 100 |
| Tetrachloroethene | 164 | 166 | 131 |
| Ethyl methacrylate | 69 | 41 | 99, 86, 114 |
| 2-Hexanone | 43 | 58 | 57, 100 |
| Chlorobenzene | 112 | 114 | 77 |
| Ethylbenzene | 106 | 91 | -- |
| Xylenes | 106 | 91 | -- |
| Styrene | 104 | 103 | 78, 51, 77 |
| Dichlorobenzene (all isomers) | 146 | 148 | 111 |
| Trans 1,4-Dichloro-2-butene | 53 | 75 | 89, 77, 124 |
| 1,1,2,2-Tetrachloroethane | 83 | 85 | 131, 133 |
| Allyl Chloride | 41 | 76 | 78 |
| Acetonitrile | 41 | 40 | -- |
| Dichlorofluoromethane | 67 | 69 | -- |
| Isopropyl ether | 87 | 59 | 45 |
| Chloroprene | 53 | 88 | 90 |
| n-Butanol | 56 | 41 | 42 |
| Propionitrile | 54 | 52 | 55 |
| Methacrylonitrile | 41 | 67 | 52 |
| Isobutanol | 41 | 43 | 74 |

Table 15. Characteristic Ions (cont.)

| Compound | Primary* | Secondary | Tertiary |
|-----------------------------|----------|-----------|----------|
| Methyl methacrylate | 41 | 69 | 100 |
| 1,1,1,2-Tetrachloroethane | 131 | 133 | 119 |
| 1,2-Dibromo-3-chloropropane | 157 | 155 | 75 |
| Ethyl ether | 59 | 74 | -- |
| Ethyl Acetate | 43 | 88 | 61 |
| 2-Nitropropane | 41 | 43 | 46 |
| Cyclohexanone | 55 | 42 | 98 |
| Isopropylbenzene | 105 | 120 | -- |
| 2,2-Dichloropropane | 77 | 97 | -- |
| Bromochloromethane | 128 | 49 | 130 |
| 1,1-Dichloropropene | 75 | 39 | 110 |
| 1,3-Dichloropropane | 76 | 41 | 78 |
| 1-Chlorohexane | 91 | 55 | 41 |
| 1,1,1,2-Tetrachloroethane | 131 | 133 | -- |
| Bromobenzene | 156 | 158 | 77 |
| n-Propylbenzene | 120 | 91 | 65 |
| 2-Chlorotoluene | 126 | 91 | 65 |
| 1,3,5-Trimethylbenzene | 105 | 120 | 77 |
| 4-Chlorobenzene | 126 | 91 | 89 |
| t-Butylbenzene | 119 | 134 | 91 |
| sec-Butylbenzene | 134 | 105 | -- |
| 4-Isopropyltoluene | 119 | 134 | 91 |
| n-Butylbenzene | 91 | 92 | 134 |
| 1,2,4-Trichlorobenzene | 180 | 182 | -- |
| Hexachlorobutadiene | 225 | 227 | 223 |
| Naphthalene | 128 | 127 | -- |
| 1,2,3-Trichlorobenzene | 180 | 182 | -- |

- * The primary ion should be used for quantitation unless interferences are present, in which case a secondary ion may be used.
- ** m/z 43 may be used for quantitation of 2-butanone, but m/z 72 must be present for positive identification.
- *** Used as quantitation ion for method 624.

Table 16. State of Arizona ICV/CCV Quality Control Limits

| QC Limits not specified in method | Default QC (method specified or laboratory historical if not specified) |
|--|--|
| CCV Non-CCC compounds | CCC limits ($\leq 30\%$) |
| ICV | Same as CCV ($\leq 30\%$) |
| Reporting Limit | Must be supported by low level initial calibration standard |
| LCS/LCSD | Lab historical |
| MS/MSD | Lab historical |

NOTES:

- 1) Based on ADHS Rule A.A.C.R9-14-615.C.8. Director approved on June 29, 2005 for the labs to use default limits as an alternative to developing statistically derived limits.

Table 17. List 1 Poorly Performing Compounds

| | |
|---|---------------------------------------|
| Acetone | Ethanol |
| Acetonitrile | Ethyl acetate |
| Acrolein | Ethylene oxide |
| Acrylonitrile | 2-Hexanone |
| n-Butanol | Isobutyl alcohol |
| 2-Butanone (MEK) | Isopropanol |
| tert-Butyl alcohol | Methacrylonitrile |
| Carbon disulfide | Methyl acetate |
| 2-Chloroethyl vinyl ether | 4-Methyl-2-pentanone |
| cis-1,4-Dichloro-2-butene | 2-Nitropropane |
| trans-1,4-Dichloro-2-butene | 2-Pentanone |
| Dichlorodifluoromethane | 2-Propanol |
| Dichlorofluoromethane | Propionitrile |
| 1,2-Dibromo-3-chloropropane (DBCP) | Tetrahydrofuran |
| 1,2-Dichlorotetrafluoroethane | Tetrahydrothiophene |
| 1,2-Dichloro-1,1,2-trifluoroethane (Freon 123a) | 1,1,2-Trichloro-1,2,2-trifluoroethane |
| 2,2-Dichloro-1,1,1-trifluoroethane | Trichlorofluoromethane |
| 1,4-Dioxane | Vinyl acetate |
| 1,2-Dichloro-1,1,2,2-tetrafluoroethane | |

The laboratory's GC/MS group identified this list of compounds based on current and historical performance. The recovery performance was reviewed against full spike recovery data and method performance data, where available , to validate each compound as a "poor performer."

Table A-1. Method 624 Analytes and Reporting Limits, 5-mL Purge

| Analytes | µg/L |
|---------------------------|------|
| Benzene | 5 |
| Bromodichloromethane | 5 |
| Bromoform | 5 |
| Bromomethane | 5 |
| Carbon tetrachloride | 5 |
| Chlorobenzene | 5 |
| Chloroethane | 5 |
| 2-Chloroethyl vinyl ether | 5 |
| Chloroform | 5 |
| Chloromethane | 5 |
| Dibromochloromethane | 5 |
| 1,2-Dichlorobenzene | 5 |
| 1,3-Dichlorobenzene | 5 |
| 1,4-Dichlorobenzene | 5 |
| 1,1-Dichloroethane | 5 |
| 1,2-Dichloroethane | 5 |
| 1,1-Dichloroethene | 5 |
| trans-1,2-Dichloroethene | 5 |
| 1,2-Dichloropropane | 5 |
| cis-1,3-Dichloropropene | 5 |
| trans-1,3-Dichloropropene | 5 |
| Ethylbenzene | 5 |
| Methylene chloride | 5 |
| 1,1,2,2-Tetrachloroethane | 5 |
| Tetrachloroethene | 5 |
| Toluene | 5 |
| 1,1,1-Trichloroethane | 5 |
| 1,1,2-Trichloroethane | 5 |
| Trichloroethene | 5 |
| Trichlorofluoromethane | 5 |
| Vinyl chloride | 5 |

Table A-2. Method 624 QC Acceptance Criteria

| Analytes | Daily QC Check (CCV) Acceptance Criteria (20 µg/L spike) | Mean Recovery, Initial Demonstration Acceptance Criteria (IDOC) (20 µg/L spike) | Std Dev, Initial Demonstration Acceptance Criteria (IDOC) (20 µg/L spike) | Matrix Spike and LCS Acceptance Criteria (% Recovery) |
|---------------------------|---|--|--|--|
| Benzene | 12.8 - 27.2 | 15.2 - 26.0 | 6.9 | 37 - 151 |
| Bromodichloromethane | 13.1 - 26.9 | 10.1 - 28.0 | 6.4 | 35 - 155 |
| Bromoform | 14.2 - 25.8 | 11.4 - 31.1 | 5.4 | 45 - 169 |
| Bromomethane | 2.8 - 37.2 | D - 41.2 | 17.9 | D - 242 |
| Carbon tetrachloride | 14.6 - 25.4 | 17.2 - 23.5 | 5.2 | 70 - 140 |
| Chlorobenzene | 13.2 - 26.8 | 16.4 - 27.4 | 6.3 | 37 - 160 |
| Chloroethane | 7.6 - 32.4 | 8.4 - 40.4 | 11.4 | 14 - 230 |
| 2-Chloroethyl vinyl ether | D - 44.8 | D - 50.4 | 25.9 | D - 305 |
| Chloroform | 13.5 - 26.5 | 13.7 - 24.2 | 6.1 | 51 - 138 |
| Chloromethane | D - 40.8 | D - 45.9 | 19.8 | D - 273 |
| Dibromochloromethane | 13.5 - 26.5 | 13.8 - 26.6 | 6.1 | 53 - 149 |
| 1,2-Dichlorobenzene | 12.6 - 27.4 | 11.8 - 34.7 | 7.1 | 18 - 190 |
| 1,3-Dichlorobenzene | 14.6 - 25.4 | 17.0 - 28.8 | 5.5 | 59 - 156 |
| 1,4-Dichlorobenzene | 12.6 - 27.4 | 11.8 - 34.7 | 7.1 | 18 - 190 |
| 1,1-Dichloroethane | 14.5 - 25.5 | 14.2 - 28.5 | 5.1 | 59 - 155 |
| 1,2-Dichloroethane | 13.6 - 26.4 | 14.3 - 27.4 | 6.0 | 49 - 155 |
| 1,1-Dichloroethene | 10.1 - 29.9 | 3.7 - 42.3 | 9.1 | D - 234 |
| trans-1,2-Dichloroethene | 13.9 - 26.1 | 13.6 - 28.5 | 5.7 | 54 - 156 |
| 1,2-Dichloropropane | 6.8 - 33.2 | 3.8 - 36.2 | 13.8 | D - 210 |
| cis-1,3-Dichloropropene | 4.8 - 35.2 | 1.0 - 39.0 | 15.8 | D- 227 |
| trans-1,3-Dichloropropene | 10.0 - 30.0 | 7.6 - 32.4 | 10.4 | 17- 183 |
| Ethylbenzene | 11.8 - 28.2 | 17.4 - 26.7 | 7.5 | 37 - 162 |
| Methylene chloride | 12.1 - 27.9 | D - 41.0 | 7.4 | D - 221 |
| 1,1,2,2-Tetrachloroethane | 12.1 - 27.9 | 13.5 - 27.2 | 7.4 | 46 - 157 |
| Tetrachloroethene | 14.7 - 25.3 | 17.0 - 26.6 | 5.0 | 64 - 148 |
| Toluene | 14.9 - 25.1 | 16.6 - 26.7 | 4.8 | 47 - 150 |
| 1,1,1-Trichloroethane | 15.0 - 25.0 | 13.7 - 30.1 | 4.6 | 52 - 162 |
| 1,1,2-Trichloroethane | 14.2 - 25.8 | 14.3 - 27.1 | 5.5 | 52 - 150 |
| Trichloroethene | 13.3 - 26.7 | 18.6 - 27.6 | 6.6 | 71 - 157 |
| Trichlorofluoromethane | 9.6 - 30.4 | 8.9 - 31.5 | 10.0 | 17 - 181 |
| Vinyl chloride | 0.8 - 39.2 | D - 43.5 | 20.0 | D - 251 |

Analytes not listed on the table must meet a CCV drift criteria of $\pm 30\%$. Method 624 does not specify second source (ICV) criteria. The laboratory has adopted criteria of $\pm 30\%$ difference for the ICV.

Table A-3. Calibration Levels for 624, 5 mL Purge

| Compound | Level 1 | Level 2 | Level 3 | Level 4 |
|-----------------------------|---------|---------|---------|---------|
| Acetone | 10 | 40 | 100 | 400 |
| Acrolein | 5.0 | 20 | 50 | 200 |
| Acrylonitrile | 5.0 | 20 | 50 | 200 |
| Benzene | 5.0 | 20 | 50 | 200 |
| Bromodichloromethane | 5.0 | 20 | 50 | 200 |
| Bromoform | 5.0 | 20 | 50 | 200 |
| Bromomethane | 5.0 | 20 | 50 | 200 |
| 2-Butanone | 10 | 40 | 100 | 400 |
| Dichlorodifluoromethane | 5.0 | 20 | 50 | 200 |
| Carbon disulfide | 5.0 | 20 | 50 | 200 |
| Carbon tetrachloride | 5.0 | 20 | 50 | 200 |
| Chlorobenzene | 5.0 | 20 | 50 | 200 |
| Dibromochloromethane | 5.0 | 20 | 50 | 200 |
| Chloroethane | 5.0 | 20 | 50 | 200 |
| 2-Chloroethyl vinyl ether | 5.0 | 20 | 50 | 200 |
| Chloroform | 5.0 | 20 | 50 | 200 |
| Chloromethane | 5.0 | 20 | 50 | 200 |
| 1,2-Dibromo-3-chloropropane | 5.0 | 20 | 50 | 200 |
| 1,2-Dibromoethane (EDB) | 5.0 | 20 | 50 | 200 |
| Dibromomethane | 5.0 | 20 | 50 | 200 |
| 1,2-Dichlorobenzene | 5.0 | 20 | 50 | 200 |
| 1,3-Dichlorobenzene | 5.0 | 20 | 50 | 200 |
| 1,4-Dichlorobenzene | 5.0 | 20 | 50 | 200 |
| Dichlorodifluoromethane | 5.0 | 20 | 50 | 200 |
| 1,1-Dichloroethane | 5.0 | 20 | 50 | 200 |
| 1,2-Dichloroethane | 5.0 | 20 | 50 | 200 |
| cis-1,2-Dichloroethene | 5.0 | 20 | 50 | 200 |
| trans-1,2-Dichloroethene | 5.0 | 20 | 50 | 200 |
| 1,1-Dichloroethene | 5.0 | 20 | 50 | 200 |
| Dichlorofluoromethane | 5.0 | 20 | 50 | 200 |
| 1,2-Dichloropropane | 5.0 | 20 | 50 | 200 |
| cis-1,3-Dichloropropene | 5.0 | 20 | 50 | 200 |
| trans-1,3-Dichloropropene | 5.0 | 20 | 50 | 200 |

Table A-3. Calibration Levels for 624, 5 mL Purge (cont.)

| Compound | Level 1 | Level 2 | Level 3 | Level 4 |
|--|---------|---------|---------|---------|
| Ethylbenzene | 5.0 | 20 | 50 | 200 |
| Freon-113 | 10 | 40 | 100 | 400 |
| 2-Hexanone | 10 | 40 | 100 | 400 |
| Methylene chloride | 5.0 | 20 | 50 | 200 |
| 4-Methyl-2-pentanone | 10 | 40 | 100 | 400 |
| Methyl <i>tert</i> -butyl ether (MTBE) | 10 | 40 | 100 | 400 |
| Styrene | 5.0 | 20 | 50 | 200 |
| 1,1,1,2-Tetrachloroethane | 5.0 | 20 | 50 | 200 |
| 1,1,2,2-Tetrachloroethane | 5.0 | 20 | 50 | 200 |
| Tetrachloroethene | 5.0 | 20 | 50 | 200 |
| Tetrahydrofuran | 5.0 | 20 | 50 | 200 |
| Toluene | 5.0 | 20 | 50 | 200 |
| 1,1,1-Trichloroethane | 5.0 | 20 | 50 | 200 |
| 1,1,2-Trichloroethane | 5.0 | 20 | 50 | 200 |
| Trichloroethene | 5.0 | 20 | 50 | 200 |
| Trichlorofluoromethane | 5.0 | 20 | 50 | 200 |
| 1,2,3-Trichloropropane | 5.0 | 20 | 50 | 200 |
| Vinyl acetate | 5.0 | 20 | 50 | 200 |
| Vinyl chloride | 5.0 | 20 | 50 | 200 |
| 4-Methyl-2-pentanone | 10 | 40 | 100 | 400 |
| m and p Xylenes | 10 | 40 | 100 | 400 |
| o-xylene | 5.0 | 20 | 50 | 200 |

If the response factor (RF) is constant over the working range (<35% RSD), the average RF may be used for calculations. Alternatively, a calibration curve may be used if the correlation coefficient is ≥ 0.99 .

APPENDIX A

Modifications for analysis of 1,4-Dioxane by Selected Ion Monitoring

1.0 REQUIREMENTS FOR METHOD 8260 SELECTED ION MONITORING (SIM)

- The gas chromatograph/mass spectrometer (GCMS) is utilized in the SIM mode to obtain lower reporting limits. The standard analyte list and reporting limits are listed in Table Ap-1.
- This method can be applied to aqueous and solid matrices.
- The sample preparation is the same as defined in section 10.1.1 through 10.1.3 in this SOP, DV-MS-0010.
- The tune period for this method is defined as 12 hours. Instrument tuning is described in section 10.1.11.3 above.
- Initial calibration curve requirements are as follows:
 - Same as for 8260 detailed in Section 10.1.12 of this SOP.
 - The calibrations levels are shown in Table Ap-2.
- Continuing calibration verification requirements are as follows:
 - The %drift for 1,4-dioxane must be $\leq 25\%$ for the continuing calibration to be valid.
 - In addition, the %drift for the surrogate compounds should be $\leq 25\%$.
- Matrix Spike and LCS requirements are as follows:
 - The spike levels are listed in Table Ap-3.
- Internal Standards: The internal standard concentrations are listed in Table Ap-5.
- Surrogates: The surrogate concentrations are listed in Table Ap-4.
- Instrument Conditions are shown in Table Ap-7.

Table Ap-1.

TAL Method 8260SIM Standard Reporting Limits

| Analytes | CAS Number | Aqueous, µg/L | Solid, µg/Kg |
|-------------|------------|---------------|--------------|
| 1,4-Dioxane | 123-91-1 | 2.0 | 5.0 |

Table Ap-2.

Method 8260SIM Calibration Levels

| Calibration Level | Aqueous Calibration Concentration, µg/L | Solid Calibration Concentration, µg/Kg |
|-------------------|---|--|
| 1 | 2.0 | Na |
| 2 | 2.5 | 5 |
| 3 | 3.5 | 10 |
| 4 | 5.0 | 20 |
| 5 | 7.5 | 30 |
| 6 | 10.0 | 40 |
| 7 | 17.5 | 50 |
| SSV | 5.0 | 20 |

Table Ap-3.

Method 8260SIM LCS Spike Concentrations

| LCS Compounds | Aqueous Spiking Level, µg/L | Solid Spiking Level, µg/Kg |
|---------------|-----------------------------|----------------------------|
| 1,4-Dioxane | 5.0 | 20 |

Table Ap-4.

8260SIM Surrogate Compounds

| Surrogate Compounds | Aqueous Spiking Level, $\mu\text{g/L}^1$ | Solid Spiking Level, $\mu\text{g/Kg}^1$ |
|----------------------------------|---|--|
| Dibromofluoromethane | 12.5 | 50 |
| 1,2-Dichloroethane- d_4 | 12.5 | 50 |
| Toluene- d_8 | 12.5 | 50 |
| 4-Bromofluorobenzene | 12.5 | 50 |

¹ — Exact spike levels are dependent upon the calibration of the autosampler loop used for the addition of the surrogate spike solution.

Table Ap-5.

8260SIM Internal Standard Compounds

| Surrogate Compounds | Aqueous Spiking Level, $\mu\text{g/L}$ | Solid Spiking Level, $\mu\text{g/Kg}$ |
|-----------------------------------|---|--|
| Fluorobenzene | 12.5 | 50 |
| Chlorobenzene- d_5 | 12.5 | 50 |
| 1,4-Dichlorobenzene- d_4 | 12.5 | 50 |

Table Ap-6.

8260 Selected Masses

| Compound | Parent Ion | Daughter Ion |
|-----------------------------------|------------|--------------|
| 1,4-Dioxane | 88 | 58 |
| Fluorobenzene | 96 | 70 |
| Chlorobenzene- d_5 | 119 | 117 |
| 1,4-Dichlorobenzene- d_4 | 152 | 150 |
| Dibromofluoromethane | 111 | 113 |
| 1,2-Dichloroethane- d_4 | 65 | 102 |
| Toluene- d_8 | 98 | 70 |
| 4-Bromofluorobenzene | 95 | 174 |

Table Ap-7.

Suggested Instrument Conditions for 8260SIM

| | |
|---------------------------------------|--|
| Selected Masses: | See Table Ap-6 |
| Dwell Time: | ≥ 30 milliseconds |
| Initial Column Temperature/Hold Time: | 50 °C for 2 minutes |
| Column Temperature Program: | 50 - 160 °C at 30°C/min, 160 - 220 °C at 60°C/min . |
| Final Column Temperature/Hold Time: | 220 °C/4.3 min hold |
| Injector Temperature: | 220 °C |
| Transfer Line Temperature: | 260 °C |
| Source Temperature: | 240 °C |
| Trap Desorb Temperature: | 270 °C |
| Sample Volume: | 0.5 µl |
| Carrier Gas: | Helium at 1.3mL/min. |
| Column: | DB-624 Capillary 60m x 0.25mm x 1.8 um film thickness, or equivalent |

Attachment 1

Gas Standards Tracking Log

Gas Standards Tracking Log

SOP ID: DV-MS-0010

[illegible]

**LAB SOP-06 FOR TO-15 AND
SOP-08 FOR ASTM D-1946
CAN BE MADE AVAILABLE
UPON REQUEST**

APPENDIX D

***LABORATORY STANDARD OPERATING
PROCEDURES***



GREEN INVESTIGATION AND REMEDIATION BEST PRACTICES

The benefits of environmental investigations and remediation efforts are widely known, including management and reduction of risk to human health and the environment; reclamation of land and water resources; liability reduction; identification of better waste storage, handling, and disposal practices; aesthetic benefits; and economic improvements. However, during the course of environmental investigations and cleanups, energy and water are used and waste is generated, including greenhouse gases. Until recently, remedial decisions have typically not considered sustainability concepts. In accordance with NGB/A7O Memorandum 09-02 *Consideration of Green and Sustainable Remediation in Environmental Restoration*, ERM shall consider Green and Sustainable Remediation (GSR) in all phases of its environmental work. Sustainability concepts mostly apply to remedial activities, although some sustainability best practices can be incorporated into investigation phases of environmental work.

Elements of GSR

The EPA Office of Solid Waste and Emergency Response (EPA 2010) presents five elements of GSR that include the best practices listed below.

Minimize Total Energy Use and Maximize Use of Renewable Energy

- Minimize energy consumption (e.g. use energy efficient equipment)
- Power cleanup equipment through on-site renewable energy sources
- Purchase commercial energy from renewable resources

Minimize Air Pollutants and Greenhouse Gas Emissions

- Minimize the generation of greenhouse gases
- Minimize generation and transport of airborne contaminants and dust
- Use heavy equipment efficiently (e.g. diesel emission reduction plan)
- Maximize use of machinery equipped with advanced emission controls
- Use cleaner fuels to power machinery and auxiliary equipment
- Sequester carbon on site (e.g., soil amendments, revegetate)

Minimize Water Use and Impacts to Water Resources

- Minimize water use and depletion of natural water resources
- Capture, reclaim, and store water for reuse (e.g. recharge aquifer, drinking water irrigation)
- Minimize water demand for revegetation (e.g. native species)

- Employ best management practices for storm water

Reduce, Reuse, and Recycle Material and Waste

- Minimize consumption of virgin materials
- Minimize waste generation
- Use recycled products and local materials
- Beneficially reuse waste materials (e.g., concrete made with coal combustion products replacing a portion of the Portland cement)
- Segregate and reuse or recycle materials, products, and infrastructure (e.g. soil, construction and demolition debris, buildings)

Protect Land and Ecosystems

- Minimize areas requiring activity or use limitations (e.g., destroy or remove contaminant sources)
- Minimize unnecessary soil and habitat disturbance or destruction
- Minimize noise and lighting disturbance

AFCEE Sustainable Remediation Tool

The Air Force Center for Engineering and the Environment (AFCEE) and its partners have developed a tool to aid environmental professionals in incorporating sustainability concepts into remediation decision-making processes. This tool, called the Sustainable Remediation Tool (SRT), serves two general purposes:

- 1) planning for future implementation of remediation technologies at a particular site; and
- 2) a means to evaluate optimization of remediation technology systems already in place or to compare remediation approaches based on sustainability metrics.

The SRT allows users to estimate sustainability metrics for specific technologies. The technologies, selected by AFCEE for inclusion in the SRT, include the following:

- Excavation
- Soil Vapor Extraction
- Pump and Treat
- Enhanced In Situ Biodegradation
- Thermal Treatment
- In Situ Chemical Oxidation
- Permeable Reactive Barrier
- Long-term Monitoring / Monitored Natural Attenuation

The sustainability metrics calculated for the technologies above include the following:

- Carbon Dioxide Emissions
- Nitrogen Oxide Emissions
- Sulfur Oxide Emissions
- PM10
- Total Energy Consumed
- Change in Resource Service
- Technology Cost
- Safety / Accident Risk

The SRT is available for free to the public at:

<http://www.afcee.af.mil/resources/technologytransfer/programsandinitiatives/sustainableremediation/srt/index.asp>

AFCEE intends to add additional technology modules and metrics to the SRT in the future. Therefore, ERM personnel will check the AFCEE website to ensure that the current version of the SRT is used when evaluating remedial strategies on ANG sites.



SAMPLE CONTAINER IDENTIFICATION

Per the Uniform Federal Policy on *Quality Assurance Project Plan Manual* (EPA 2005), sample containers should be identified with the following minimum information:

- Site name/location
- Sample identification number
- Sample collection location (add depth/height when appropriate)
- Sample collection date and time (use military/24-hour time); ISO8601 date format (YYYY-MM-DD) is preferred, but not required
- Sample collection method (composite/grab) and device (e.g. split-spoon, low-flow)
- Sample preservation method (e.g. ice, acid); indicate if sample must be light protected
- Analysis requested
- Sample pH (if applicable to method)
- Sampler's signature or initials

Special Note for Air and Vapor Canisters:

Due to the nature of the matrix and sample collection method, air canisters typically require the following be included on the canister tag:

- Sample identification number
- Canister number
- Sample collection date and time (use military/24-hour time); ISO8601 date format (YYYY-MM-DD) is preferred but not required
- Analysis requested
- Initial and final vacuum readings



WASTE MANAGEMENT

Waste generated during the investigation of potentially contaminated or contaminated sites is classified as IDW. Waste generated during emergency responses and interim and final remedial actions is classified as RDW. These wastes include fluids from well development, purging, and pump tests; drill cuttings and soil from piezometer/monitoring well installation, test pits and soil removal excavations; residues from testing of treatment technologies; pump-and-treat effluent; personal protective equipment (PPE); decontamination solutions used to clean non-disposable equipment and protective clothing; and other materials or equipment that may be contaminated such that it cannot be sufficiently cleaned to allow its reuse.

Details regarding ANG Contractor responsibilities for management of IDW/RDW are specified in the most recent ANG policy, CEV Policy 05-1 for IDW/RDW (March 2, 2005).

Management of IDW/RDW also will follow protocols outlined under Section 3.10 of the base Environmental, Safety and Occupational Health Compliance Assessment and Management Program (ESOHCAMP). Additional ANG guidelines regarding management of these wastes are presented below:

- Management of IDW/RDW must be considered and discussed with the Base Environmental Manager (EM) and regulatory agencies before an investigation/remediation is initiated (e.g., during the kickoff meeting). For example, possible alternatives to storage of a large quantity of drums (which may be disruptive to some installations) should be identified, and concurrence obtained, before such wastes are generated.
- Sampling of IDW/RDW must comply with applicable state regulatory procedures and guidelines. Standard methods for collecting and compositing samples must be used when sampling soil from drums or soil piles. Typically no more than three to five drums or piles may be composited into one soil sample. Waste characterization samples collected from more than one site may not be composited. If sufficient quantities of wastewater are produced during the investigation or remediation, the wastewater may be collected in a large tank in lieu of individual drums. In these instances, representative samples of the mixture must be collected from the tank.
- Testing required to characterize IDW/RDW is specific to the site and regulatory agency. Typical analyses include Toxicity Characteristic

Leaching Procedure (TCLP) for soil samples and volatile organic compounds, semivolatile organic compounds, and metals for wastewater samples (e.g., Target Contaminant List/Target Analyte List (TCL/TAL)). However, testing for a different set of parameters may be appropriate based on the site history or based on requirements of the State or the selected treatment, storage, and disposal facility.

- The ANG contractor must ensure all applicable Federal, State, and local regulatory requirements are followed to manage the IDW/RDW. If untreated IDW/RDW is sent off base for disposal, the permitted disposal facility must provide a written Approval Letter to all appropriate parties, including the EM and the PM, before disposal proceeds.
- The management of IDW/RDW must be performed in an efficient and timely manner, using the most cost-effective method, while minimizing any adverse impacts on installation operations and in accordance with all applicable Federal, State, and local regulations.



WATER LEVEL MEASUREMENT

Guidance on measuring water levels for typical ANG investigations is presented below.

- Water levels must be measured in all newly installed piezometers and monitoring wells after the wells have been properly developed and the water levels have fully recovered.
- Water levels must be measured in all piezometers and monitoring wells using properly decontaminated equipment (e.g., water level indicators, electric sounders, or pressure transducers).
- Water levels must be measured before any groundwater samples are collected.
- The depth to groundwater must be measured from a consistent measuring point, which must be surveyed and permanently marked on each piezometer or monitoring well.
- Water level measurements in all piezometers and monitoring wells must be measured on the same day, and in as close a timeframe as possible.
- Water levels must be measured to the nearest 0.01 foot.
- A data table must be produced for each water level measurement event which includes, at a minimum, the following information: date, well identification number, well depth, screened interval, well diameter, installation date, depth to water measurements, measuring points, and the following elevations: groundwater surface, measuring point, total depth, top and bottom of screened interval and ground surface.
- A potentiometric surface map must be prepared for each water level measurement event which includes, at a minimum, the following information: groundwater elevation measurements, groundwater contour lines that follow standard contouring procedures, directional groundwater flow arrows, dates of water level measurements, and any pronounced features (e.g., groundwater divides, depressions, or moundings).



DECONTAMINATION

Equipment decontamination is an integral part of the data collection and quality assurance process. Implementation of proper decontamination practices and procedures will begin in the field prior to using sampling equipment.

All non-disposable groundwater sampling equipment will be decontaminated before initial use and between samples. Where disposable sampling equipment is used to collect samples, decontamination of sampling equipment is not necessary. Disposable groundwater sampling equipment will be discarded immediately after use.

Decontamination of groundwater sampling equipment will include the following (in order of performance):

- Liquinox (or equivalent) wash; and
- American Society for Testing and Materials (ASTM) Type II water rinse.

In cases where the State or Environmental Protection Agency (EPA) region require use of a final solvent rinse or at sites where free product exists (e.g., heavy oils or creosote), High Performance Liquid Chromatography (HPLC)-grade methanol (or isopropanol if specified by the State or EPA region) will be used for decontamination. When use of a solvent is deemed appropriate, the highest-grade solvent available must be used for equipment decontamination per *2009 ANG Investigation Guidance*.

In the event that submersible groundwater sampling pumps are not fitted with a check valve to prevent backflow, they will also be decontaminated internally by cycling wash and rinse water through the pump.

Whenever feasible, all sampling equipment will be kept off the ground (e.g., placed on polyethylene plastic sheeting) to prevent cross-contamination.

Drilling equipment must be decontaminated (e.g., steam-cleaned) before use and between each borehole or monitoring well location by moving the equipment to a site-specific decontamination area on a constructed decontamination pad.

Steam clean water and all other wastewater must be collected, contained, and handled as investigation-derived waste (IDW). Management of hazardous materials for equipment decontamination must be conducted in compliance with

ERM STANDARD OPERATING PROCEDURES

AIR NATIONAL GUARD PROJECTS



Environmental, Safety and Occupational Health Compliance and Management Program (ESOH CAMP) protocol.



DRILLING AND SOIL BORING

Drilling and soil boring includes any activity where a borehole is advanced below ground surface using hand-powered tools or drill rigs.

Prior to beginning any subsurface disturbance, a Subsurface Clearance Location Disturbance Permit will be obtained for each boring location, following ERM's subsurface disturbance procedures. All hazard mitigation identified in the permit will be followed before beginning any subsurface disturbance.

Hand tools commonly include hand augers, slide hammers, and electric or gasoline-powered rotary hammer drills.

The remainder of this SOP will provide detailed directions for the following:

- Hand-powered tool procedures, including:
 - Hand Augers;
- Drill rig procedures, including:
 - Sonic drilling procedures;
 - Hollow stem auger (HSA) procedures;
 - Direct-push drilling procedures; and
- Potential problems and solutions.

Hand-Powered Soil Boring Procedures:

Methods for a hand auger are provided below:

- Confirm that the hand auger is clean of any contaminants prior to augering. The blades should be pointed slightly inwards and should be slightly sharp, to allow for cutting through roots and other organic material. Wear eye protection, gloves and steel-toed shoes while operating a hand auger.
- Clear the drilling area of any large rocks or other surface debris.
- Push down on the top of the auger and then turn counter-clockwise. Twist from the hips and the shoulders, not from the back.



- Advance the hand auger until the bucket is full (approximately 6 to 9 inches) and then pull the auger from the hole. If the soil is to be logged, place the removed soil onto a plastic liner on the ground. If no logging is necessary, then place soil into a 5-gallon storage bucket, or equivalent. Soil can be removed from the auger bucket by tipping the auger upside down or by gently hitting the side of the bucket with a hammer.
- Repeat augering until target depth is reached.
- Hand augers are not suitable for removal of large rocks and gravel.

Drill Rig General Procedures:

There are multiple drill rigs used in soil/groundwater investigations and remediation activities. Each is useful for different site conditions and purposes. Care should be used when selecting an appropriate drill rig for the project (described below). Drill rigs will be operated by competent subcontractors that have all applicable State licenses for drilling boreholes. Drilling subcontractors must also be approved through ERM's Health and Safety Subcontractor Prequalification process.

The following general methods will be used for any drill rig:

- Generate a boring log for any drilling activity, following procedures provided in the Lithologic Logging SOP.
- For all drilling methods, confirm that the equipment is clean and free of dangerous wear prior to use.
- While drilling, periodically field-screen the borehole opening for potential airspace impacts from volatile compounds using a photoionization detector or equivalent.
- If soil sampling or logging is included in the project scope, the rig sampler will be brought to the surface periodically to bring soil samples to the ground surface.
- If grab groundwater sampling is included, then a slotted polyvinyl chloride screen will be installed in the boring, preferably inside the rod casing. The casing will then be pulled up to expose the zone of interest. Groundwater will be brought to the surface using a pump or bailer and discharged into pre-cleaned sampling containers provided by the analytical laboratory.



- Installation of monitoring wells will be addressed in a separate SOP.
- Once drilling has been completed at a particular location, the boring shall be properly abandoned in a way that complies with any state regulations. Borings will generally be abandoned using grout or bentonite chips. Grout will be composed of a mixture of Portland cement, bentonite, and water, and will be introduced into the borehole from the bottom up using a tremmie pipe.
- All equipment will be decontaminated following completion of borehole abandonment.
- Following completion of all drilling activities, ERM will ensure that the site is restored as closely as possible to its pre-investigation condition.
- All soil cuttings and decontamination liquids will be collected, analyzed for disposal characteristics, and disposed of in accordance with applicable State and Federal regulations.
- A borehole log will be produced for each borehole location and will include, at a minimum, the following information: date, borehole identification number, total depth of borehole, diameter of borehole, drilling company, driller, soil and groundwater sample depths, and ERM employee name.

Commonly used drill rigs include, but are not limited to:

- Sonic
- HSA
- Direct Push (GeoProbe™)
- Mud Rotary
- Air Rotary

Drilling methods differ depending on the drill rig. The remainder of this SOP addresses each drill rig separately. For all drilling methods, confirm that the equipment is clean and free of dangerous wear prior to use.

Sonic Drilling Procedures:

Sonic drilling works by generating a sonic vibration and rotating/pushing a steel casing into the ground. The sonic vibration allows the casing to “slice” through

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finer, sands, gravel, and cobbles. Sonic drill rigs may be truck-mounted or track-mounted. Common casing diameters are 4 to 10 inches and maximum boring depths can reach approximately 600 feet below ground surface (bgs). Sonic rigs are generally quicker than HSA, especially when collecting continuous soil samples for logging purposes. Sonic is also effective at sites with a high degree of cobbles and large gravels, as the sonic vibration tends to shear the rocks. Sonic rigs also generate a relatively small volume of soil cuttings compared to HSA or rotary methods.

Due to the tendency for fines to smear, sonic rigs are not recommended for installing pumping wells. If a sonic rig must be used, then extra care will be needed during well development. Sonic drilling is also not recommended for collecting soil samples for volatile compounds, as the heat generated during the sonic drilling process may drive off volatiles and give false negatives.

Methods for using a sonic drill rig include the following steps:

- A coring rod, usually 5 to 20 feet long, is attached to the sonic rotary head and advanced to the maximum depth of the rod.
- After the rod is advanced to its maximum depth, additional rods are added to the top of the coring rod to continue advancing the rod.
- At a depth determined by the driller, a sampler is advanced through the outer barrel and a soil sample is collected inside the sampler.
- The sampler is brought to the surface and the soil sample is vibrated out of the sampler into sausage-shaped bags that preserve the soil horizons.
- The ERM employee then splits open each sausage using a utility blade and conducts soil logging and sampling.
- The sampler is then used to remove all remaining soil from within the coring rod and then the driller continues to advance the coring rod.
- Once belowground tasks have been completed at that location, then the borehole can be abandoned.

Hollow Stem Auger Procedures:

HSA drilling involves advancing an auger containing helical or spiral flights surrounding a hollow core. As the auger is rotated, a bit at the bottom of the first auger cuts into the subsurface material and the spiral flights convey the material to the surface. The core of the first auger may be left open to allow for soil sampling, or a plug may be installed to prevent soil from entering the core.

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Common casing diameters range from 6 inch outer diameter (OD) to 15 inch OD and maximum boring depths can reach approximately 300 feet bgs. HSA rigs are generally cheaper than sonic and are more readily available. HSA is also ideal for collection of geotechnical information, such as SPT blow counts and Shelby tubes. Split spoon samplers attached to an HSA rig are an effective method of obtaining undisturbed soil samples. HSA is also useful for installing monitoring wells in areas with heave. Also, because most of the disturbed soil is removed by the flights, there is less potential problems with well development after installation of a monitoring well by HSA.

HSA is slow for collection of soil samples, and does not readily collect continuous soil samples. These rigs also generate a large volume of soil cuttings.

Methods for using a HSA drill rig include the following steps:

- Prior to beginning drilling, the ERM employee must determine the quality of soil sample needed. If only basic soil logging and no soil sampling is required, than soil for logging can be obtained from the cuttings pulled up by the flights. If soil samples are to be collected, or if logging must be conducted at specific depths, than the HSA must be fitted with a sampler, generally a split spoon, that is driven through the stem of the auger.
- An auger is first fitted with a coring bit. If soil samples or a specific log is needed, than the center of the coring bit is left open. If only basic soil logging is required, than the coring bit is plugged.
- Augers are generally 5 to 10 feet long. Each auger is driven into the ground using rotation.
- To collect soil for samples or for logging, a 1.5-foot long split spoon sampler is advanced through the stem of the augers. The sampler may be fitted with brass or steel tubes for collection of soil samples. The sampler is dropped from a known height and the number of "blows" required to advance the sampler 6 inches is recorded. The sampler is then brought to the surface and opened. Sample tubes are capped using Teflon sheets and plastic caps and then processed for shipping to a laboratory. Soil for logging is placed on a plastic liner. This sampling process can be repeated continuously or can be repeated for specific depths.
- Once belowground tasks have been completed at that location, than the borehole can be abandoned.



Direct-Push Drilling Procedures:

Direct-push drill rigs are smaller rigs that work by using hydraulic pressure and pounding to push a rod into the ground. Direct-push rigs are generally mounted on smaller trucks and may be track-mounted. The casing is generally 2 to 4 inches in diameter and maximum boring depths can reach approximately 100 feet bgs. Direct-push rigs are best for shorter borehole depths in areas with low proportions of gravel or cobble-sized materials. They are quick to use and are generally the cheapest option. Direct-push rigs are effective for collecting continuous soil samples for logging or sampling purposes. Direct-push rigs also generate a small volume of soil cuttings compared to other methods.

Because of the small casing size, direct-push rigs are only useful for installing monitoring wells up to 2 inches in diameter. They are also less powerful than other drilling methods and are more susceptible to refusal.

Methods for using a direct-push drill rig include the following steps:

- A drill rod, usually 4 to 5 feet long, is fitted with a hollow point (if logging soils or collecting samples), or a solid point (if no soil needed). If the hollow point is used, a clear, acetate liner is inserted inside of the drill rod.
- The drill rod is pushed into the ground to the maximum depth of the rod.
- If collecting soil for logging or sampling, the rod is then pulled out of the ground. The acetate liner is removed from the rod and placed aside for soil logging and sample processing.
- If soils are to be sampled for non-volatile materials, the acetate liner is cut into sections using a hacksaw, or equivalent. The ends are then capped with Teflon sheets and plastic end caps immediately. If the soils are to be logged or if the soils will be sampled for volatile compounds, the acetate liner is sliced open using a utility knife fitted with a hooked blade.
- The sample rod is fitted with a new acetate liner and pushed to the maximum depth again. Additional rods are added to the top of the coring rod to continue advancing the rod. The rod is pulled out of the borehole after each additional section is added so that the acetate liner can be removed.
- Once belowground tasks have been completed at that location, the borehole can be abandoned.

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Potential Problems and Solutions:

This section describes some of the most common problems encountered during injections and recommended solutions. This section will be amended as problem situations are encountered.



FIELD SCREENING FOR ORGANIC VAPORS

Soil Field Screening

This procedure describes the standard methods and equipment used to perform soil field screening of soil and/or sediment collected during field activities. This procedure is to be used along with visual and olfactory evidence of contamination for sample collection purposes during hollow stem auger advancement, geoprobe advancement, hand auger advancement, grab soil, concrete, debris and sediment sampling.

Equipment

- A MiniRae 2000 or equivalent photoionization detector (PID) equipped with a 10.6 eV lamp is to be used for the above-mentioned screening activities. HNUs or other non-digital PIDs are *NOT* to be used;
- One quart or gallon sized zip-lock freezer style bags;
- Paper Towels;
- 6-mil sheet plastic to be used as a cross contamination barrier between sample containers and the ground surface at each sampling location.
- Bowls, stainless steel trowels, shovels, spoons, and utility knives with hooked and strait blades etc. The site project manager must approve sampling equipment.
- Volume measurement devices such as scales or laboratory provided tools.
- 35-gallon trash bags for accumulation of sampling refuse.

Documentation

All records must be recorded in the log book. The log book must be comprised of a high-grade paper, have a water-resistant surface, and sewed with waterproof thread. Entries into the field logbook must be made with a waterproof, fade proof, permanent black pen, sharpie or equivalent.

Procedure

Use the polyethylene bag headspace method described below to characterize soil contamination at the project sites. The collapse of the polyethylene bag during analysis allows uniform flow of contaminant vapors into the field instrument, giving accurate readings.



1. Use a MiniRae 2000 (or equivalent) photoionization detector with a 10.6eV or greater lamp source. Perform PID calibration on site and at least daily to yield "total organic vapors" in volume parts per million (ppm) of a benzene equivalent, such as isobutylene. Follow the manufacturer's instructions for operation, maintenance and calibration of the instrument. Keep calibration records in the field log book.
2. Use a self-sealing quart-sized polyethylene freezer bag. Half-fill the bag with sample (the volume ratio of soil to air should be equal), then immediately seal it. Manually break up the soil clumps within the bag. Note: Immediately after opening a split spoon sampler or geoprobe plastic liner, transfer soil to field screening bags. Collect soil samples from excavations or soil piles from freshly exposed surfaces.
3. Allow headspace development for at least 10 minutes at approximate room temperature. Vigorously shake bags for 15 seconds at the beginning and end of the headspace development period. Headspace development decreases with temperature. When temperatures are below the operating range of the instrument, perform headspace development and analysis in a heated vehicle or building. Recorded the ambient temperature during headspace screening. Complete headspace analysis within approximately 20 minutes of sample collection.
4. After headspace development, introduce the instrument-sampling probe through a small opening in the bag to a point about on half of the headspace depth. Keep the probe free of water droplets and soil particles.
5. Record the highest meter concentration on boring log and/or field logbook. Maximum response usually occurs within about two seconds. If concentration continues to increase over time, allow the PID to equilibrate until the values stabilize for approximately 20 seconds (usually 1 to 5 minutes after the probe is initially inserted into the bag). Erratic meter response may occur if high organic vapor concentrations or moisture is present. Note any erratic headspace data in the sampling form and/or field log book. **Note: Do not collect analytical samples from the screened polyethylene bag.**



LITHOLOGIC LOGGING

Borings will be drilled by a State-licensed driller. An experienced geologist will be present at the drilling rig to monitor drilling and well installation operations, conduct air monitoring, record geologic and hydrogeologic information on boring logs, and document borehole advancement and monitoring well construction.

Documentation:

The following information will be recorded on the boring log for each location:

- Borehole/monitoring well identification number;
- Location and approximate ground surface elevation;
- Name of drilling company, driller, and attendant geologist;
- Method of drilling;
- Borehole diameter;
- Air monitoring results;
- Lithologic descriptions and PID readings for soils encountered, including soil moisture/saturation conditions and corresponding drilling depths;
- Any strong odors encountered while logging and corresponding depth;
- Depth at which saturated soil/groundwater is first encountered while drilling;
- Total depth of completed borehole;
- Reference elevation for all depth measurements;
- Monitoring well construction details (if applicable);
- Weather conditions; and
- Signature of attendant geologist.

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Soil Logging:

Lithologic descriptions recorded by the geologist on the boring logs will be based on visual inspection of the core and/or drill cuttings. Material will be classified using the Unified Soil Classification System and described according to American Society for Testing and Materials (ASTM) D2488, "Description of Soils (Visual Manual Procedure)." A copy of the ASTM D2488 is provided in [Attachment 1](#). When precise classification of soils for engineering purposes is required, the procedures prescribed in ASTM D2487 shall be used.

In addition to soil descriptions, the geologist will provide description related to visual or vapor assessment of potential chemical impacts.

Visual assessments of potential chemical impacts generally involves:

- Sheen: a glossy or "rainbow" colored sheen generally indicates non-aqueous phase liquids (NAPLs).
- Staining: red or black color that is NOT caused by natural redoximorphic conditions may indicate precipitation of a compound of concern.

Assessments of organic vapors can involve use of a photoionization detector (PID) or equivalent and/or an olfactory description of any strong odors. Additional discussion on measuring organic vapors is provided in the SOP on organic vapor screening.



LOW-FLOW GROUNDWATER SAMPLING

This SOP provides detailed directions on conducting low flow sampling using a bladder pump or a peristaltic pump.

The remainder of this SOP will provide detailed directions for the following:

- Documentation;
- Field Equipment Maintenance;
- Low-Flow Well Purging; and
- Potential Problems and Solutions.

1.0 Documentation:

Field activities will be documented in bound field notebooks and on sample collection forms using indelible ink. Notebook entries will be dated and signed by the person making them. The entries will be sufficiently detailed and descriptive to allow field events to be recalled without relying solely on the sampler's memory.

Deviations from the SOPs and any procedures described in the work plan will be documented in field notes.

In addition, a purge log will be generated for each monitoring well. The following information will be recorded on each purge log:

- Monitoring well identification;
- Date and time of setup at the monitoring well;
- Initial depth to water;
- Pump intake depth;
- Purge rate;
- Repeated measurements of groundwater quality during purging, including:
 - Volume purged in milliliters;

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- Depth to water in feet below ground surface;
- Water temperature;
- pH;
- Conductivity in milliSiems;
- Dissolved oxygen in milligrams per liter;
- Redox potential in millivolts; and
- Turbidity in nephelometric turbidity units;
- Sample bottles filled;
- Field-filtered samples;
- Any quality assurance samples collected;
- Weather conditions; and
- Signature of attendant ERM employee.

2.0 Field Equipment Maintenance

During well purging, the purge water temperature, pH, specific conductance, dissolved oxygen content, redox potential, and turbidity will be monitored using an in-line flow cell fitted with a water quality meter. This section describes proper care and maintenance of this equipment.

Water quality measurements will be collected using a YSI, Horiba, or equivalent water quality meter fitted with the appropriate probes for the constituents described above. The meter will be fitted to an in-line flow cell that may be in line with the pump.

2.1 Depth to Water Measurement

The depth to water will be measured using a digital water level meter, as described in the SOP for collecting water levels.

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2.2 *Temperature Measurement*

The water temperature will be measured using an electronic digital thermometer.

2.3 *pH Measurement*

The pH of the water will be measured using a pH meter. The meter will be calibrated daily using the 3-point calibration, using pH standards of 4, 7, and 10. If pH values appear to “drift” over the day, than the meter will be recalibrated.

2.4 *Specific Conductance Measurement*

The specific conductance of the water will be measured with a specific conductance meter. A standard solution will be used daily to calibrate the instrument. The meter may also be recalibrated periodically during periods of continued use.

2.5 *Dissolved Oxygen Measurement*

The dissolved oxygen content of the water will be measured with a dissolved oxygen meter. The meter will be calibrated daily using the saturated air method, as described in the equipment manual.

2.6 *Redox Potential Measurement*

The redox potential of the water will be measured with a redox meter. The meter will be calibrated weekly.

2.7 *Turbidity Measurement*

Turbidity of the water will be measured with a portable turbidity meter. A standard formazin solution will be used weekly to calibrate the instrument. The meter also will be recalibrated periodically during periods of continued use, as recommended by the manufacturer. The turbidity meter probe will be decontaminated prior to each use by rinsing with deionized water.



3.0 Low-Flow Well Purging

Low-flow purging and sampling methods will be used to obtain representative groundwater samples while minimizing the amount of purge water generated.

Monitoring wells will be purged and sampled according to the following field protocols:

1. Attach a fresh length of disposable polyethylene (or equivalent) tubing to the outlet of the decontaminated pump. If sampling for natural attenuation parameters, use a peristaltic pump or a bladder pump with no metal parts. Lower the pump slowly into the well to minimize the mixing of casing water and the suspension of any silt at the bottom of the well. Place the pump near the middle or slightly above the middle of the screened interval. (Note: these initial steps are only necessary if using a non-dedicated pump.) Purge at 100 to 500 milliliters per minute; the goal is to minimize drawdown in the well (ideally less than 10 centimeters drawdown).

To minimize delays in field parameter stabilization and potential bias in analytical testing results, any vents or other potential sources of air bubbles in the pump discharge tubing or in-line flow cell should be identified and sealed off (or otherwise isolated) prior to purging or as soon as possible after purging begins.

2. Monitor purge-water temperature, pH, specific conductance, dissolved oxygen, oxidation/reduction potential, and turbidity using an in-line flow cell. Take readings every 3 to 5 minutes.
3. Stop purging when the following parameters have stabilized for three successive readings or when at least one well casing volume has been purged:
 - Temperature: ± 1 degree Celsius;
 - pH: ± 0.1 unit;
 - Specific conductance: ± 10 percent; and
 - Dissolved oxygen or turbidity: ± 10 percent.
4. After well-purging criteria are satisfied, disconnect the in-line flow cell and collect samples in the following order: volatile natural attenuation samples first, followed by VOC/BTEX samples, and inorganic natural



attenuation samples, as applicable. For dissolved inorganics samples, place a 0.45-micron filter in line with the pump discharge tubing to remove particulates prior to collecting the samples in preserved sample containers.

5. If using a non-dedicated pump, remove pump from well, discard disposable tubing, and decontaminate the pump as described in the decontamination SOP.

4.0 Potential Problems and Solutions

4.1 Very Slow Recharge Rate

Peristaltic pumps and bladder pumps will not be operated at flow rates less than 100 ml/min. If continuous flow is lost during purging of low-yield wells, the pump will be turned off, and the well will be allowed to recover as much as possible (but not longer than 24 hours). After the water level in the well has recovered, the required samples will be collected with the pump placed near the middle of the screened interval. If a non-dedicated pump is used, it will be slowly lowered into the well to minimize disturbance of the water column.



SOIL GAS SAMPLING

The method for soil gas sampling involves the collection and analysis of a sample from an evacuated canister using the EPA TO-15 method (full-scan). Soil gas sampling point installations may be permanent or temporary. The following basic procedures should be included in any sampling protocol:

1. Advance the soil gas sampling point to the necessary depth using direct push technology, or manual probes if site conditions permit.
2. Required depth is 2 feet above the water table. Minimum depth of 3 feet. If water table or bedrock does not permit collection at minimum 3 feet, sample does not need to be collected.
3. An appropriate sealing material (e.g. bentonite slurry) should be placed around the probe rod at the ground surface to avoid sample short circuiting to the atmosphere.
4. Soil gas sampling points should be fitted with inert tubing (e.g., polyethylene, stainless steel, or Teflon®) of the appropriate size.
5. Prior to collecting the sample, a minimum of two volumes (i.e., total volume of the sampling point and tube) must be purged. This can be accurately completed using a graduated syringe. This process is to ensure samples collected are representative of sub-surface vapors.
6. An in-line moisture trap should be installed to prevent moisture from entering the sampling canister (e.g., Summa, Silco® canister).
7. Collect a sample by attaching the top end of the tubing to a sampling canister instrumented with a vacuum gauge.
8. Note and record the initial vacuum gauge reading, open the sampling canister valve, and monitor the vacuum gauge to check progress of canister filling.
9. Close the sampling canister valve after the required time has elapsed for an adequate volume of soil gas to be collected, or the vacuum gauge indicates that the canister is full. Record the time required for sampling and the final pressure onto the reporting form and chain of custody form. Sampling with a vacuum gauge is required for each sampling canister to ensure that an adequate volume of sample was collected. Without an adequate sample volume, the laboratory may not be able to meet the reporting limits needed to determine if the compound-specific action levels are being exceeded. If reporting limits prove to be consistently higher than the screening levels, a decision regarding vapor intrusion risk may not be possible and re-sampling may be required. Consult with the laboratory supplying the canisters to obtain the vacuum gauge readings corresponding to an acceptable canister volume.
10. Connect the inert tubing that was used to fill the canister to a field instrument and record the organic vapor measurement onto the laboratory chain-of-custody form and field sample log sheet, and submit the canisters for laboratory analysis.

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If the soil gas sampling point is a permanent installation, which may be the case where soil gas monitoring is included as part of a CAD, an above grade protective casing should be set around the point tubing and grouted in place to the surface to minimize infiltration of water or outdoor air, as well as to prevent accidental damage. The construction of any such permanent sampling point must also be such that the sampling interval is adequately sealed off from both the casing air and external surface a



SAMPLE HANDLING

Chain-of-Custody

A completed chain-of-custody (COC) will accompany all sample shipments to the laboratory. At a minimum, the COC will include the following:

- Full name, address and contact information of the client. The client in this case refers to the firm performing the remediation activities.
- Name of the site, and physical address of where the remediation is being performed.
- Who the laboratory should report to. In this case, the firm performing the remediation must include their full name, address and contact information.
- Requested laboratory analysis turn-around time.
- Sample identification, date collected, time collected, sample preservation methods, number of sampling containers and requested laboratory analysis and method.
- Company title, site manager's/supervisor's name, signature and date signed.
- Seal coolers with a COC seal.

Sample Custody

Sampling team personnel will perform all sampling and will retain sample custody until submitted for delivery. The field manager will be responsible for all on-site sample custody procedures. Sample custody includes sample collection, laboratory custody and final laboratory analysis deliverables.

New sampling containers necessary for completing field sampling and quality control requirements will be provided to the field personnel by the laboratory. The sample containers will be checked for cleanliness and integrity by the laboratory.

Immediately after sample collection, all samples will be processed using the following methods:

- Confirm that sample lids are screwed on tightly, but not overtightened.
- Confirm that all appropriate information has been included on the sample label, as described in the SOP for sample container identification.
- If the sample containers are glass, place container in 1 to 2 bubble-wrap bags. Use more bubble wrap if samples are to be shipped. Use less if samples will be hand-delivered to the laboratory.
- Place each sample container in a quart- or gallon-sized, freezer-weight self-sealing Ziploc bags (or equivalent) and seal.

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- Place at least one layer of bubble wrap at the base of a laboratory cooler.
- Place sample container in the bottom of a laboratory cooler and cover with ice. In standard conditions, ice may be packaged into “pillows” by pouring ice into large self-sealing bags. Pillows will then be applied around samples and over the top of samples. When ambient temperatures exceed 90 degrees Fahrenheit, ice must be poured around all edges and over the top of the sample bottles to reduce any pockets of air within the cooler.
- Complete all COC documents and record information in the field logbook.
- EXCEPTION: Air and vapor containers will be kept at room temperature. After sampling, containers will be placed in a laboratory-provided cardboard box or in a laboratory cooler that does not contain ice. The containers will be kept inside a vehicle or shed if ambient temperatures are cold and in a cooler, shady location if ambient temperatures are hot.

Shipping

After the samples have been documented and packaged, the samples must be placed on ice in a cooler, and shipped under chain-of-custody documentation to a certified laboratory for analysis. Samples should be packed as necessary to prevent breakage during transport, using packaging materials provided by the laboratory and/or sterile materials such as bubble rap to prevent sample shifting. A minimum of two 10-lb bags of ice or amount necessary to maintain a sample temperature between 0-4 degrees Celsius must be included with each cooler for shipment. All samples and ice must be contained to prevent external leakage from the shipping coolers. **Note: Ship samples immediately at the end of the day and according to their reported laboratory hold times!**

Subsurface Clearance

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1.0 INTRODUCTION

1.1 SCOPE

This Process provides Safe Work Practices for subsurface obstruction and utility clearance (collectively, Subsurface Clearance or SSC for short). This Process must be used to prevent injury to ERM employee and avoid contact with Subsurface Structures prior to any ERM project-related Ground Disturbance Activities.

1.2 LOCAL AMENDMENTS

This Process has been developed to be broadly applicable across all of the jurisdictions in which ERM operates. However, it may sometimes be necessary to augment portions of this Process by taking into account applicable legislative or regulatory requirements within the jurisdiction of the work. The provisions for doing so may be described within a project Health & Safety Plan, Job Hazard Analysis or other device. Compliance with such requirements is not optional.

1.3 DEFINITIONS

- **Contact Person** – a representative of the site where Ground Disturbance Activities will be conducted. The Contact Person may be a Client employee or the employee of a third party. The degree to which the Contact Person is “knowledgeable” about subsurface conditions at the site may be assessed by considering that individual’s time at the site, time in current job, and / or job-related duties.
- **Critical Zone** – 10 feet (3 meters) distance in all directions from the surface projection of all known or suspected underground pipes, cables, edges of tanks, pump islands, pump galleries, manifolds, electrical transformers, compressors, production wells, loading racks, or other process equipment with associated underground pipes and/or cables.
- **Detection Equipment** – technology used for the detection of Subsurface Structures including devices that utilize electromagnetic detection, ground penetrating radar, thermal detection and others.
- **Excavation Buffer** – a 2-foot (0.6-meter) distance in all directions from Subsurface Structures not otherwise prepared and designated for removal that will be exposed or partially exposed due to excavation-type Ground Disturbance Activities. The material within the Excavation Buffer will not be removed by means of mechanical digging.

- **Ground Disturbance Activities** – activities which require penetration of the ground surface deeper than 1 foot (0.3 meter) or the removal of surface pavement. Ground Disturbance Activities include, but not limited to: hand digging, drilling, hand auger, direct-push drilling, excavation, trenching, concrete coring, driving of posts, stakes, rods, or poles, and grading.
- **Non-Conductive Tools** – for purposes of use in a Physical Clearance Method, tools with fiberglass, composite or fully-insulated handles and potential contact surfaces (e.g., the T-handle and top flight of a hand auger).
- **Physical Clearance Methods** – methods used to identify the presence or absence of Subsurface Structures at a particular location by removal of overburden and direct observation and / or contact. Common Physical Clearance Methods include: hand digging, hand augering, probing, compressed air excavation or “air knifing,” pressurized water excavation, etc. Physical Clearance Methods should always be used in conjunction with Detection Equipment. Hand tools used with any Physical Clearance Method must have a non-conductive handle or a handle made non-conductive by proper insulation.
- **Site Services Model** – a depiction of the below ground utilities and services that are present, absent or unaccounted for at a site. The Site Services Model is revised in the field as additional information is derived from discussions with the Contact Person, observation of visual clues, utility markouts and other sources.
- **SSC Experienced Person** – an ERM employee who will ensure execution of the Subsurface Clearance process both in the office and in the field. Though not required, it is a best practice for the SSC Experienced person to be present on site through the completion of Ground Disturbance Activities.
- **Subsurface Structures** – man-made structures beneath the surface of the ground. Common Subsurface Structures include, but are not limited to: tanks, drums, pipelines (water, natural gas), electrical cables, fiber optic telecommunication cables, sewers, etc.
- **Useful Property** – a criteria for determining a “Property Damage”-type Incident. Useful property is a Subsurface Structure that, if broken, an ERM Client or other third party would pay to have repaired.

1.4 *MODEL TOOLS*

Model tools are available to facilitate the execution of the SSC Process. These tools, presented in Appendix A, include:

- **Subsurface Clearance Process Checklist (the “Checklist”)** – used to document the execution of the SSC Process broadly for all disturbance locations visited as part of a work mobilization.
- **Subsurface Clearance Location Disturbance Permit (the “Permit”)** – used to document the execution of the SSC Process at a specific ground disturbance location. The Permit is required at locations known or suspected to be in a Critical Zone. It is a recommended best practice to use the Permit at all disturbance locations.
- **Level 2 WARN Health & Safety Plan Template for Intrusive Work** – minimum HASP template used on projects where the SSC Process is utilized.

2.0 *SSC PROCESS REQUIREMENTS*

2.1 *PERSONNEL & TRAINING REQUIREMENTS*

1. SSC General Employees. ERM employees working on projects where Ground Disturbance Activities are performed must have fulfilled the following training requirements:
 - a. Classroom Subsurface Clearance training, and
 - b. Annual 1-hour Subsurface Clearance Refresher Training, as appropriate.
2. SSC Experienced Persons. At least one person in each ERM field team must be an SSC Experienced Person, having been designated as such by either:
 - a. Designation by an ERM Branch Manager at the time of hire or inception of the Subsurface Clearance Mentoring Process, or
 - b. Completion of SSC Mentoring, and, if applicable, the SSC Field Training Course (which is an optional requirement that may be instituted by local ERM businesses).

2.2 *EQUIPMENT REQUIREMENTS*

Equipment specific to Subsurface Clearance includes:

1. A hand auger – non-conductive or stainless steel with insulated handles and upper shaft
2. Probe – non-conductive or insulated upper shaft
3. Cable Avoidance Tools (Ground Penetrating Radar, C.A.T., etc.)

3.0

SSC SAFE WORK PRACTICES

The Safe Work Practices that comprise the SSC Process are presented below. They are summarized graphically in flowchart at the end of this Section.

3.1

PRE-PROJECT

1. Request that the Client identify a Contact Person knowledgeable of the subsurface at the work location. If available, the Contact Person should personally assist in identifying safe ground disturbance locations.
2. Ensure subcontractors that will be used (if any) meet ERM's minimum safety criteria and understand their role in the SSC Process.
3. The ERM Project Manager will assign a "SSC Experienced Person" who will fulfill the duties outlined above, and will:
 - a. Have current SSC Classroom / annual refresher training (as appropriate).
 - b. Lead the review of the SSC Process with all ERM personnel and subcontractors prior to initiating site work.
 - c. Mentor less experienced ERM employees at the jobsite.
4. Ensure that assigned ERM project staff have satisfied the Training Requirements defined herein.
5. As necessary, assess the potential for the presence of unexploded ordnance (UXO) or munitions of explosive concern (MEC).
 - a. If UXO/MEC is present or potentially present, specialist technical assistance must be obtained to assist with pre-planning and clearance.
 - b. Ensure that project field staff receive "Recognize, Retreat, Report" training customized for the situation at the site.

3.2

OFFICE ACTIVITIES

1. Health and Safety Planning.
 - a. At a minimum, a Level 2 WARN Health and Safety Plan (HASP) for Intrusive Work must be developed prior to initiating ground disturbance field activities.

- b. Other applicable ERM Safe Work Practices and / or policies must be appended to the HASP for field reference.
 - c. Any Client- and / or Site-specific excavation and safe work permit requirements must be understood and implemented.
 - d. If ERM personnel will operate Detection Equipment, attach a record of their latest Detection Equipment training to the HASP.
 - e. The HASP must be reviewed, approved and signed by the PIC and the PM prior to initiating activity on site.
 - f. ERM's HASP must be reviewed and signed by the field team, including ERM employees and ERM subcontractors.
2. Historical Information Review. The Project Manager or designee should:
- a. Obtain the most recent as-built drawings and/or site plans (including subsurface structures) as available.
 - b. Seek to obtain any additional site-related information such as easements, right-of-ways, historical plot plans, fire insurance plans, tank (dip) charts, previous site investigations, soil surveys, boring logs and aerial photographs, etc., as relevant to the planned ground disturbance activities.
 - c. Summarize available information sources in the Subsurface Clearance Information Summary in the HASP.
 - d. Site Services Model. Assemble information about Subsurface Obstructions, Utilities and Services into a preliminary Site Services Model.
 - i. Identify the presence / absence of known or suspected subsurface services at the work location in general (i.e., everything within the property boundary).
 - ii. Identify the routes and locations of known services.
 - iii. Identify the "gaps" – services suspected or not located based on currently available information.
 - iv. To the extent practicable, identify the locations of key isolation devices and shutoff valves.
3. Identify preliminary Critical Zones and / or Excavation Buffers on one or several site drawings or sketches.

4. Develop an initial disturbance location plan (boring location map, excavation plan, etc.) accounting for Critical Zones, Excavation Buffers, gaps in surface information and project objectives.
5. If any disturbance locations (or boundaries of disturbance areas) fall within a Critical Zone, the preferred course of action will be to move the location / boundary outside the Critical Zone.

3.3

FIELD ACTIVITIES: PRE-CLEARANCE

1. Site Walk. The SSC Experienced Person must personally oversee a visual survey of the disturbance locations and surrounding areas to identify signs of potential underground obstructions and utilities.
 - a. The findings and approvals received during the site walkover must be documented in one of the following (collectively, the Documentation):
 - i. Broadly for the site on the Subsurface Clearance Process Checklist (the Checklist),
 - ii. On the Location Disturbance Permit (the Permit), which has the level of detail required for locations known or suspected to be within a Critical Zone, or
 - iii. With equivalent notes and sketches (Field Notes) in a bound field log book.
 - b. If there is a Contact Person and he / she is available, he / she should *ideally* accompany the SSC Experienced Person on the site walk *and* will approve the disturbance locations.
 - i. Ideally, the Contact Person should indicate approval of the disturbance locations by providing his/ her signature on the Documentation.
 - ii. If verbal approval is given by the Contact Person, note the date and time at which such approval was given in the Documentation.
 - iii. Note any other information provided by the Contact Person or other site representatives in the Documentation.
 - c. Particular attention should be paid to confirming the routes / locations of services identified and those unaccounted for in the Site Service Model using visual clues, which include, but are not limited to the following:

- Utility poles with conduit leading to the ground
- Lights
- Signage
- Sewer drains/cleanouts
- Cable markers
- Utility boxes
- Manholes
- Pavement scarring
- Pipeline markers
- Remote buildings with no visible utilities
- Fire hydrants
- Sprinkler systems
- Water meters
- Natural gas meters
- Sewer manholes and drop inlets
- UST fill ports and vent pipes, and
- Steam lines

d. Confirm overhead clearances for safely deploying equipment to the location.

2. Utility Markouts. Utilities must be marked out using an available combination of Public Utility or Private (i.e., ERM subcontractor provided or ERM self performed) location services, except as allowed below.

a. Public Utility Markouts.

i. Where available and/or required by local legislative or regulatory requirements, the public utility locator must be called to mark utilities at the site.

ii. A site map including planned work areas should be made available to the public utility locator if possible.

iii. Waiving the need for Public Utility Markouts.

1. Only the PIC may waive this requirement, provided that he / she is:

a. Legally able to do so, and

b. Reasonably assured that it is safe to grant the Waiver, based on the guidance herein (see Section 4.1) and consultation with the SSC Experienced Person and project team.

2. The Waiver decision must be documented in the HASP and alternative measures must be taken and documented (also in the HASP) to ensure the safety of ERM employees.

3. In the absence of a Public Utility Markout or on private property, a Private Utility Markout must be performed to mark utilities at the site.

b. Private Utility Markouts.

- i. Hire a private utility locator to locate and mark utilities on the project site (this is the preferred course of action). The private utility locator must meet minimum ERM health & safety criteria.
 - ii. Where private utility locator services are not available for hire, utilize a trained ERM employee to conduct the utility location using a rented or ERM-owned locator tool. The locator tools utilized by ERM employees must:
 1. Be maintained according to manufacturer specifications with maintenance records available.
 2. Be calibrated according to manufacturer specifications. Calibrations must be documented.
 3. Be calibrated or tested at the start of each work day.
 - iii. Waive the need for Private Utility Markouts.
 1. Only the PIC may waive this requirement, provided that he / she is:
 - a. Legally able to do so, and
 - b. Reasonably assured that it is safe to grant the Waiver, based on the guidance herein (see Section 4.1) and consultation with the SSC Experienced Person and project team.
 2. The Waiver decision must be documented in the HASP and alternative measures must be taken and documented (also in the HASP) to ensure the safety of ERM employees.
 - c. Utilities should be marked with paint or other semi-permanent markings whose meaning is understood by the site team.
3. Final Critical Zone Determination and Location of Disturbance Points or Areas.
- a. Use the information gathered from the pre-planning work, site walk and utility markouts to determine the Critical Zones near each disturbance location.

- b. Though it is highly recommended for all ground disturbance locations, it is required to compile Critical Zone information using the Permit or with equivalent Documentation for locations known or suspected to be inside a Critical Zone.
- c. Critical Zone determination must be reviewed and approved by the SSC Experienced Person.
- d. If a disturbance location is confirmed inside a Critical Zone, then:
 - i. The preferred course of action will be to move the disturbance location to a safe location outside the Critical Zone.
 - ii. If Ground Disturbance Activity absolutely must proceed within the Critical Zone, then it must be explicitly authorized by the PIC provided that:
 - 1. He / she is reasonably assured that it is safe to allow that activity, based on the guidance herein (see See Section 4.1.1) and consultation with the SSC Experienced Person and project team,
 - 2. If possible, energized pipes or cables within the Critical Zone are de-energized via a formal Lockout/Tagout program, and
 - 3. Ground Disturbance Activities at that location do not present an unacceptable safety, environmental, or operational risk, either on-site or off-site.

3.4 ***FIELD ACTIVITIES: POINT DISTURBANCE CLEARANCE***

Note: Examples of Point Disturbances include soil borings, monitor wells, etc.

- 1. Re-verify overhead clearance at ground disturbance locations prior to initiating clearance activity.
- 2. In the case of sites where UXO / MEC risks are present, adhere to the clearance plan developed by the specialist provider, which will supersede item 3 below.
- 3. Physical Clearance.
 - a. Utilize a Physical Clearance Method to ensure the absence of Subsurface Structures at each ground disturbance location. Some jurisdictions require that Detection Equipment be used in conjunction

with Physical Clearance Methods (it is always a best practice to do so).

- b. Physical Clearance must be performed to the maximum of the following:
 - i. 2 feet (0.6 meters) beyond the bottom of the frost line at the site, or:
 - ii. Based on the location of the disturbance point:
 - 1. Inside Critical Zones:
 - a. To 7 feet (2.1 meters), or
 - b. To 20% deeper than the known or suspected invert elevation of the Subsurface Structure.
 - 2. Outside Critical Zones, to 4 feet (1.2 meters)
- c. Physical Clearance must also exceed the diameter of the largest tool (e.g. drilling auger, direct-push sampler, ream) to be advanced and be sufficiently large to allow obstructions to be inspected visually. (A best practice rule of thumb would be 10% - 20% larger than the largest tool.)
- d. Waiving the Physical Clearance requirement.
 - i. Only the PIC may waive this requirement, provided that he / she is:
 - 1. Legally able to do so, and
 - 2. Reasonably assured that it is safe to grant the Waiver, based on the guidance herein (see Section 4.1) and consultation with the SSC Experienced Person and project team.
 - ii. The Waiver decision must be documented in the HASP and alternative measures must be taken and documented (also in the HASP) to ensure the safety of the field team.

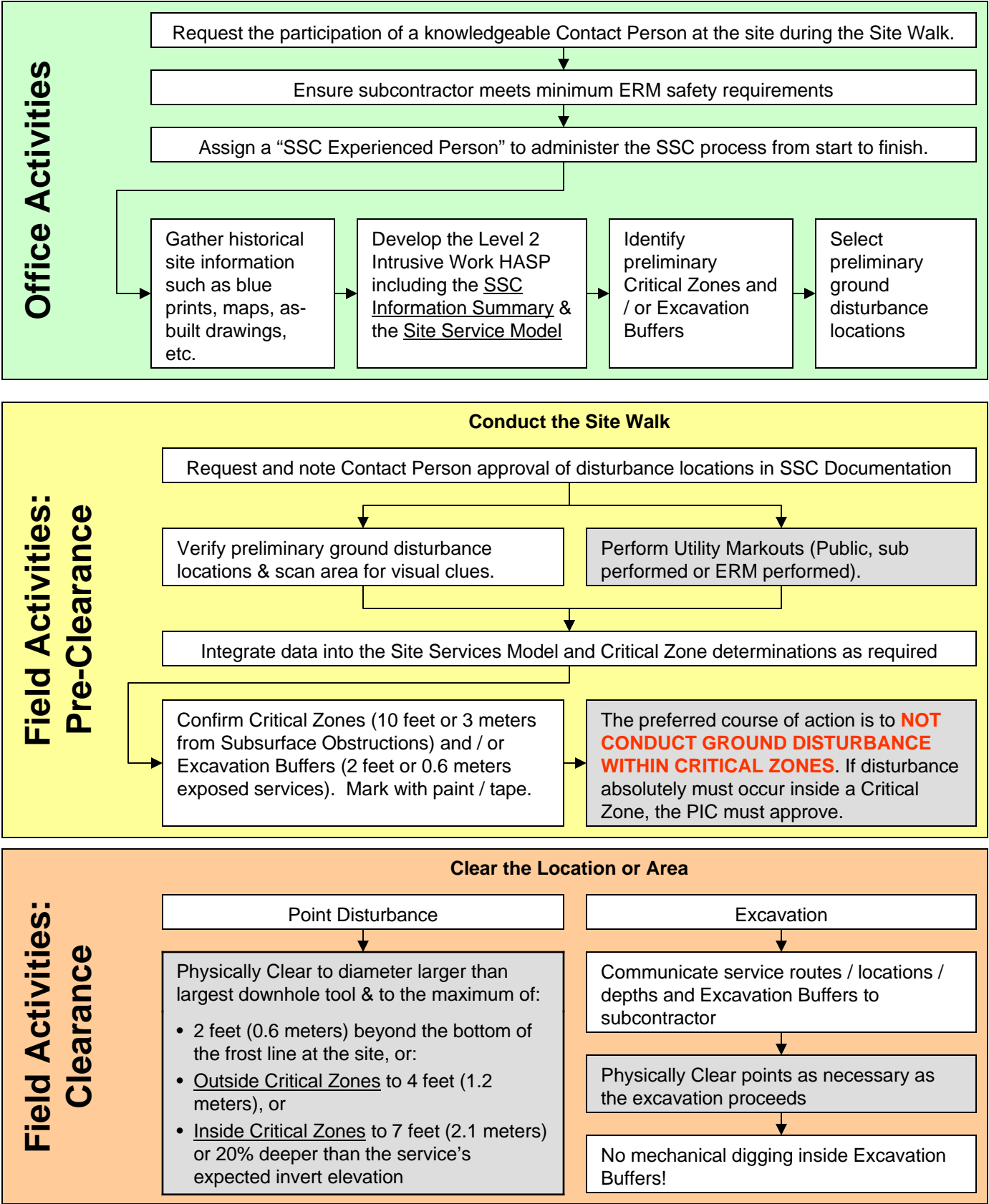
3.5

FIELD ACTIVITIES: EXCAVATION/TRENCHING CLEARANCE

- 1. Re-verify overhead clearance at ground disturbance locations prior to initiating clearance activity.

2. In the case of sites where UXO / MEC risks are present, adhere to the clearance plan developed by the specialist provider, which will supersede items 3-6 below.
3. Using the data from the HASP, Site Services Model and other information from the Site Walk and Utility Markouts, the SSC Experienced Person will identify in the Subsurface Clearance Checklist & Disturbance Permit or other equivalent notes in a bound field logbook:
 - a. The locations at which Subsurface Structures cross through or are located inside the excavation perimeter.
 - b. The routes of services crossing through the excavation perimeter and the expected excavation depths to the 2-foot (0.6-meter) Excavation Buffer around those services or other Subsurface Structures.
 - c. To the extent practicable, the SSC Experienced Person should work with the Contact Person to de-energize identified services prior to commencing excavation.
4. The SSC Experienced Person will inform the excavation subcontractor of information regarding the location of Subsurface Structures. Mechanical digging will be restricted in the Excavation Buffer.
5. Additional hand clearance by use of non-conductive tools / probe rods should be used as necessary to identify the presence / absence of Subsurface Structures as the excavation proceeds.
6. Removal of material inside the Excavation Buffer may only proceed by hand using non-conductive tools.

Subsurface Clearance (SSC) Process Flow Chart



REPORT ALL SAFETY EVENTS PROMPTLY PER HASP INSTRUCTIONS

SSC Process Requirement may be waived by the PIC

WAIVER GUIDANCE

There are four Waivers to the SSC Process that may potentially be issued by a PIC:

- Requirement for Public Utility Markouts,
- Requirement for Private Utility Markouts (performed by ERM Subcontractors or ERM employees),
- Requirement for Physical Clearance, and
- Restriction of Ground Disturbance Activities within Critical Zones.

PICs are expected to work with the SSC Experienced People and broader project teams to ensure the SSC Process is executed and to use available information to make safe decisions regarding Waivers to the SSC Process.

The guidance to issue waivers to components of the SSC process can be summarized as follows:

1. Waivers should only be issued when exceptional circumstances (e.g., rigid project requirements, technical infeasibility, etc.) limit the execution of parts of the SSC Process. Waivers cannot be issued solely for cost reasons.
2. Only PICs can issue Waivers, based on consultation with the SSC Experienced Person and others on the project team.
3. PICs cannot waive compliance with any legislative or regulatory requirement applicable within the jurisdiction of the work.
4. PICs cannot waive compliance to client-mandated requirements without prior discussion with and approval by the client.
5. PICs should integrate the following considerations into their decisions to issue a waiver:
 - a. Available lines of evidence about the services present in the subsurface.
 - b. Relative hazard of striking the services known or suspected (i.e., not confirmed as absent from the site).
 - c. Multiple / high-quality lines of evidence and low relative hazard support granting Waivers. Limited / low-quality lines of evidence and high relative hazard do not support granting Waivers, as shown in the Waiver Matrix (next page).

- d. For Ground Disturbance Activities within Critical Zones:
 - i. The default stance in ERM’s SSC Process is to NOT advance borings or proceed with excavations in a Critical Zone.
 - ii. If disturbance absolutely must occur in a Critical Zone, then the following factors must be considered:
 1. The ability to de-energize the lines of concern via a formal Lockout/Tagout program, and/or
 2. Safety, environmental, or operational concerns, either on-site or off-site, that arise from Ground Disturbance Activities in the Critical Zone.
6. All Waiver decisions must be recorded in the Health & Safety Plan.

The Waiver Matrix

| | | Lines of Evidence / Quality | |
|---|--------|-----------------------------|-----------|
| | | Less | More |
| Relative Hazard of Striking the Service | Higher | Likely Not | Caution |
| | Lower | Caution | Likely OK |

Additional guidance on issuing Waivers and illustrative examples of Waiver decisions are presented in Appendix B.

4.2 SSC-RELATED SAFETY EVENTS

1. For internal management purposes, ERM will classify Subsurface Clearance-related Safety Events with a “Subsurface Clearance “ classification as follows:

- a. Incident: Any injury, illness, damage to useful property or spill as the result of striking a Subsurface Structure sustained either during the clearance process or the Ground Disturbance Activity itself.
 - b. Near Miss: Any surprise contact with the following either during the clearance process or the Ground Disturbance Activity itself:
 - i. Useful property which is verified as not damaged.
 - ii. Any other verified Subsurface Structure.
 - iii. "Refusal" caused by rocks, difficult geology or other natural matter IS NOT a Near Miss. Step out locations should be in a safe direction and cleared consistent with the Subsurface Clearance process.
 - c. Unsafe Act: Any action, whether inadvertent or deliberate, that serves to contradict or reduce the protections to health and safety offered by this Subsurface Clearance Process.
 - d. Unsafe Condition: Any condition, whether inadvertently or deliberately created and / or permitted to exist, that serves to contradict or reduce the protections to health and safety offered by this Subsurface Clearance Process.
 - e. Remarkable Safe Behavior: Any action that serves to significantly enhance the protections to health and safety above and beyond those offered by this Subsurface Clearance Process.
2. In the case of an Incident or a Near Miss, the SSC Experienced person will:
- a. Suspend all related ERM and ERM Subcontractor action on site.
 - b. Work to stabilize or address the situation and gather initial facts.
 - c. Promptly report the Safety Event to the PIC and PM, who will ensure that such Events are noted in appropriate reporting systems and that appropriate parties are notified.
 - d. Restart work only with the concurrence of the PIC and PM.

5.0

SUBSURFACE CLEARANCE PROCESS MENTORING

Subsurface Clearance (SSC) Process Mentoring complements the Classroom, Refresher and Field Training components of the ERM SSC process and enables a framework to provide the real-world experience necessary to help make employees well-versed in SSC activities.

5.1

ERM PERSONNEL INVOLVED IN THE MENTORING PROGRAM

The main types of ERM employees involved in the SSC Mentoring Program are described below.

5.1.1

SSC General Employees

The label of “SSC General Employee” describes any ERM employee who is:

- Working on a project site that requires the use of ERM’s SSC process, and
- Not otherwise designated as “SSC Experienced Person” for the purposes of this program.

Upon the designation of an ERM employee as a SSC General Employee:

- He / she will be provided with a “SSC Mentorship Card”.
- The designation “SSC General Employee” will be added to the employee’s training database record.

SSC General Employees will potentially be mentored by different SSC Experienced Persons, depending on project assignments.

5.1.2

SSC Experienced Persons

The cornerstone of the SSC Mentoring Program is existing ERM “SSC Experienced Employees”, who serve as the mentors in the program.

SSC Experienced Persons are:

- Experienced in SSC-related issues,
- Identified in the safety training database with the designation “SSC Experienced Person”,
- Required to be involved in offsite planning for SSC projects and present on jobsites where SSC process are being performed.

It is during work on these jobsites that mentoring will occur, as described below.

5.1.3 *Branch Managing Partners*

Branch Managing Partners of General Employees will approve the “graduation” of General Employees from the SSC Mentoring Process to become SSC Experienced Persons, provided that training requirements are met.

5.2 *MENTORING CURRICULUM*

The SSC Experienced Person will mentor SSC General Employees in as many of the following topics that apply to his/her particular project.

5.2.1 *Pre-Project & Office Activity Mentoring*

Several important steps in effective planning for SSC projects occur prior to any activities in the field. SSC Experienced Persons will ensure SSC General Employees receive instruction in the following:

- Assessing knowledge of client contacts
- Assigning project personnel with appropriate experience
- Assigning project personnel with appropriate training
- Assess unexploded ordinance

Specific to SSC activities to occur on a project site, SSC Experienced Persons will ensure that SSC General Employees receive instruction in the following:

- WARN preparation for SSC projects
- Reviewing available historical information
- Developing a project-specific Site Services Model

5.2.2 *Field Activity Mentoring*

Once offsite planning has been completed and an ERM team mobilizes to a jobsite involving SSC hazards, the SSC Experienced Person shall ensure that SSC General Employees receive guidance in the following topics:

- Conducting the site walk, emphasizing visual identification of potential SSC locations
- Completing the SSC Checklist and Disturbance Permit
- Public and private utility location concerns
- Rational of choosing particular types of Cable Avoidance Tools for project-specific conditions
- Critical zone determinations
- Clearing single/multiple ground disturbance
- Clearing excavations/trenches
- Thorough discussion of rationale of PIC waivers directly associated with the project

- Proper reporting of SSC safety events

5.3 ***DOCUMENTATION OF MENTORING RECEIVED***

The SSC General Employee is responsible for asking the SSC Experienced Person to sign his / her SSC Mentorship Card at the completion of their involvement in the project.

The SSC Experienced Person's signature will denote:

- The SSC Experienced Person's satisfaction that a substantial subset of the above curriculum was successfully covered during the execution of the project assignment, and
- That the assignment completed without Injuries.

5.4 ***"GRADUATION" AND BECOMING A SSC EXPERIENCED PERSON***

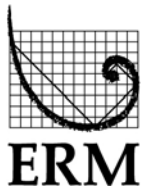
After obtaining 5 – 10 signatures on the SSC Mentorship Card, the SSC General Employee may request that his/her local Branch Managing Partner "graduate" them from the process.

The Branch Managing Partner will consider the request and will consult with the various SSC Experienced People and project Partners involved. The Branch Managing Partner may determine that:

- Sufficient mentoring has occurred and the SSC General Employee is prepared to exit or "graduate" from the mentoring program, or
- Additional project experience and mentoring is required, meaning that the SSC General Employee will remain in the mentoring program.

If the SSC General Employee has "graduated", then he / she will become an SSC Experienced Person. Such will be noted in the employee's safety training database record.

Appendix A
Model SSC Process Tools



Subsurface Clearance Field Process Checklist.

Site Name: _____

Client: _____

ERM Project No.: _____

SSC Exp. Person: _____

| Project Basics | Yes | No | N/A | Comments |
|---|-----|----|-----|----------|
| Contact Person requested and identified | | | | |
| Subcontractors meet ERM's minimum safety criteria | | | | |
| Subcontractors understand their role in the SSC Process | | | | |
| SSC Experienced Person with current SSC training assigned | | | | |
| Project staff with current SSC training assigned | | | | |
| UXO / MEC risks assessed: UXO / MEC IS NOT present | | | | |

| General Field Activity & Site Walk | | | | Yes | No | N/A | Comments | |
|--|--|-----|----|-----|--|-----|----------|----|
| HASP read, understood and signed by project team | | | | | | | | |
| Site walk Visual Clues / site features (below) integrated into Site Services Model | | | | | | | | |
| Identified Visual Clue | | Yes | No | | Identified Visual Clue | | Yes | No |
| Lights | | | | | Pipeline markers | | | |
| Signage | | | | | Fire hydrants | | | |
| Sewer drains / cleanouts | | | | | Sprinkler systems | | | |
| Cable markers | | | | | Water meters | | | |
| Utility poles with conduit leading to the ground | | | | | Natural gas meters | | | |
| Utility boxes | | | | | UST fill ports and vent pipes | | | |
| Manholes | | | | | Steam lines | | | |
| Pavement scarring | | | | | Remote buildings with no visible utilities | | | |
| Comments / Others: | | | | | | | | |

| Contact Person Approval of Ground Disturbance Locations (indicate verbal approval by printing "Verbal" in the signature space) | | | |
|--|---------|-------------|-------------|
| | | | |
| Name (Print) | Company | Name (Sign) | Date / Time |

| Pre-Clearance | Yes | No | N/A | Comments |
|---|-----|----|-----|----------|
| Public Utility Markout completed | | | | |
| Private Utility Markout completed | | | | |
| Final Critical Zone determinations made by the SSC Experienced Person | | | | |

| Critical Zones |
|--|
| <p>Are there any ground disturbance locations <u>known</u> or <u>suspected</u> to be inside Critical Zones?</p> <p><input type="checkbox"/> Yes. PIC must approve work within the Critical Zone. The SSC Location Disturbance Permit or equivalent is required for those locations.</p> <p><input type="checkbox"/> No. Physical Clearance will proceed to the deeper of: 0.6m / 2 feet below the frost line or 1.2m / 4 feet below ground level, whichever is deeper.</p> |

| Clearance for Point Disturbances | Yes | No | N/A | Comments |
|--|-----|----|-----|----------|
| Adequate overhead clearance at ground disturbance locations | | | | |
| There are disturbance locations known or suspected to be inside Critical Zones | | | | |
| Physical Clearance successfully completed at all locations | | | | |

| Clearance for Excavations | Yes | No | N/A | Comments |
|--|-----|----|-----|----------|
| Adequate overhead clearance at ground disturbance locations | | | | |
| Communicate excavation plan and Excavation Buffer location(s) to subcontractor | | | | |
| There are disturbance locations known or suspected to be inside Critical Zones | | | | |
| De-energize below ground services prior to beginning excavation | | | | |

| SSC Process Completed By (SSC Experienced Person) | | |
|---|-------------|-------------|
| | | |
| Name (Print) | Name (Sign) | Date / Time |



Subsurface Clearance Location Disturbance Permit

Disturbance
Location
Designation:

ERM Project No.:

SSC Exp. Person:

Contact Person Approval of Ground Disturbance Locations (indicate verbal approval by printing "Verbal" in the signature space)

| | | | |
|--------------|---------|-------------|-------------|
| | | | |
| Name (Print) | Company | Name (Sign) | Date / Time |

Critical Zone Determination and Clearance Depth (It is not preferred to initiate Ground Disturbance Activities within a Critical Zone)

If the Disturbance Location is known or suspected to fall within a Critical Zone, then a sketch (see reverse) or other map **must be** used to confirm proximal Critical Zones.

This Location Is:

☐

Inside a Critical Zone. Partner-in-Charge is aware & approved disturbance at this location. Physical Clearance will proceed to the deeper of: **0.6m / 2 feet below the frost line, 2.3m / 7 feet below ground level, or 20% deeper than the expected invert elevation of the service**

☐

Outside a Critical Zone.

Physical Clearance will proceed to the deeper of: **0.6m / 2 feet below the frost line or 1.2m / 4 feet below ground level.**

Physical Clearance Technique at This Location

☐

Cleared using the following technique:

☐

None. Waived by PIC. (Ensure documentation in the HASP.)

Reason:

Date / Time:

Physical Clearance Executed & Observed By:

| Company | Representative(s) | Date / Time Complete | Notes |
|---------|-------------------|----------------------|-------|
| | | | |

Was any Subsurface Structure discovered (damaged or undamaged) during Clearance?

☐

No
(Proceed)

☐

Yes

If Yes:

Discussed with PIC (Date / Time):

Agreed Action:

SSC Process Complete

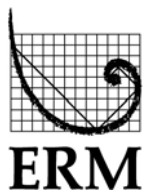
| | | |
|--|-------------|-------------|
| | | |
| Name of SSC Experienced Person (Print) | Name (Sign) | Date / Time |

(Optional) Critical Zone Determination Sketch

[illegible]

Instructions:

1. Create a sketch of the disturbance (in the space to left or attach) that contains the following information:
 - a. The disturbance location
 - b. Surface landmarks and overhead obstructions (buildings, roads, overhead lines, etc.)
 - c. Critical landmarks and Subsurface Structures (tanks, transformers, wells, racks, etc.)
 - d. Underground services:
 - i. Identified in the HASP Site Service Model
 - ii. Marked by Public or Private utility markouts
 - iii. As relayed by the Contact Person
 - iv. Nearest shutoff / isolation mechanism for each
 - e. Any surface clues as to potential underground services (junction boxes, drains, disturbed concrete, signage, etc.)
 - f. The site property boundary
2. Use your sketch to mark Critical Zones (3m or 10 feet) around critical landmarks and underground structures / services.
3. For Excavations, use your sketch to mark Excavation Buffers (0.6m or 2 feet) from Subsurface Structures.
4. If the disturbance location falls inside the Critical Zone, the preferred course of action is step out to a safe location outside a Critical Zone.
5. Disturbance within a Critical Zone can only proceed with PIC approval.



Level 2- Short Form

PROJECT HEALTH AND SAFETY PLAN FOR INTRUSIVE WORK

This form is intended to provide health and safety guidelines for project field activities where Ground Disturbance Activities (i.e., Intrusive Work) will be conducted, and where:

- The PIC and PM judge that the Short Form provides sufficient level of risk assessment and management
- A more detailed HASP is not required by law or the Client
- The work does not require complicated interactions with subcontractors
- The work is of relatively short duration such as 1-14 days
- The activities described below should be conducted using good work practices and judgments consistent with employee training.

The Project Manager and PIC must ensure that all project personnel review and sign this form, and document these activities in the project file. Their signatures indicate approval of methods and precautions in this plan.

Also attach Specific Task Hazard Assessment Sheet(s) and Subsurface Clearance Checklists as necessary

| | | |
|-----------------------------------|---------------------------------------|--|
| Administrative Information | Site Name, Owner and Location: | |
| | Client: | |
| | Project Name: | Project GMS Number: |
| | Health & Safety Plan Date: | Revision Number and Date: |
| | Project Field Work Start Date: | Anticipated Project Field Work End Date: |
| | Project Manager: | Partner-in-Charge: |
| | Project Manager (approval signature): | Partner-in-Charge (approval signature): |

| | |
|---|--|
| Site/Project General Information Develop a Task Hazard Analysis Sheet for each unique site task and attach to the HASP. Also Attach Generic Risk Assessment Tables | Scope of Work: |
| | Site History: |
| | Site Description: |
| | Site Hazard Assessment Summary (Summarize major bullet points from the attached Task Hazards Analysis sheet(s)): |
| | Precautions For Preventing Contractor-Equipment Related Incidents: |

| | | | | | |
|---|---|------------|-----------|------------|---|
| Subsurface Clearance Information Sources Summary Document the information sources that ERM used or will use to locate Subsurface Structures on site. | Information Source | Yes | No | N/A | Comment |
| | Facility-provided Map(s) of Utilities | | | | Date(s): |
| | Knowledgeable Contact Person | | | | Who: Time in Job: Time at Site: |
| | Public Utility Markouts | | | | Who: Tech. Used: Target Services: |
| | ERM [1] or ERM subcontractor performed geophysics / cable avoidance scans | | | | Who: Tech. Used: Target Services: |
| [1]: If ERM personnel will be performing any Private Utility Markouts, attach the operating employee's most recent equipment training record to the HASP. | | | | | |

| Site Services Model | Utility / Service | Present | Expect. Depth | Located? | | Absent | Unknown | Comment |
|---|-------------------|---------|---------------|----------|----|--------|---------|---------|
| | | | | Yes | No | | | |
| <p>List the utilities or other below ground services present on site.</p> <p>Do we know the locations of these services, their conveyance on site (to the site boundary, as appropriate) and the location of isolation switches or valves?</p> <p>If "Present" and not located or "Unknown", comment on how those gaps will be addressed.</p> | Electricity | | | | | | | |
| | Gas | | | | | | | |
| | Water | | | | | | | |
| | Sewer | | | | | | | |
| | Telephone / Data | | | | | | | |
| | Plant air / steam | | | | | | | |
| | Fuel / oil | | | | | | | |
| | Fire suppression | | | | | | | |
| | Others (List): | | | | | | | |
| | | | | | | | | |
| <p>Attach a figure / drawing showing the conveyance and isolation switches or valves for each located utility or service above.</p> | | | | | | | | |

| Subsurface Clearance Process Waivers | Waiver For... | Waived By (PIC) | Date | Reason |
|--------------------------------------|---|-----------------|------|--------|
| | Performance of Public Utility Markouts | | | |
| | Performance of Private Utility Markouts | | | |
| | Restricting ground disturbance inside a Critical Zone | | | |
| | Physical Clearance at Disturbance Locations (list) | | | |

| Chemicals of Concern | Chemical Name | PEL / TLV | Highest Reported Concentration | | | Site Location / Source |
|----------------------|---------------|-----------|--------------------------------|-------|------|------------------------|
| | | | Air | Water | Soil | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| Air Monitoring Action Levels | Constituent | Action Level (ppm) | Level of Protection | Monitoring Instrument |
|--|---------------------------|--------------------|---------------------|-----------------------|
| | Acute Chemical Issues | | | |
| If air monitoring is necessary to control acutely hazardous issues on site, document the short-term limit that requires response | Oxygen | | | |
| | H2S | | | |
| | C2S | | | |
| | Dusts | | | |
| | VOCs: | | | |
| | | | | |
| | | | | |
| | Others: | | | |
| If exposures to chronic chemical exposure concerns is necessary, document the levels at which actions are required | Long-Term Chemical Issues | | | |
| | Metals | | | |
| | Dusts | | | |
| | Others: | | | |
| | | | | |
| | | | | |
| | | | | |

| PPE Level of Protection Required by Work Task | Task Description | Level | | | | |
|---|------------------|-------|---|---|-------|---|
| | | A | B | C | Mod D | D |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| Personal Protective Equipment Components Required Req = Required Rec = Recommended NA = Not Applicable NOTE: Required PPE is built from a minimum base of Hard Hat, Safety Glasses and Leather Boots | Equipment | Req | Rec | NA | Equipment | Req | Rec | NA |
|---|--|-----|-----|----|---------------------------------------|-----|-----|----|
| | Steel Toe Boots | | | | Indirect Vented (Splashproof) Goggles | | | |
| | Outer Disposable Boots | | | | SCBA | | | |
| | Coveralls or Long Sleeve Shirt & Pants | | | | Full-face Airline Resp. | | | |
| | Tyvek Suit | | | | Full Face Negative Pressure Resp. | | | |
| | Poly-coated Tyvek / Saranex Suit | | | | Half Face Negative Pressure Resp | | | |
| | Fully Encapsulated Chemical Suit | | | | Powered Air Purifying Resp | | | |
| | Hearing Protection | | | | Other: | | | |
| | Leather Gloves | | | | | | | |
| | Outer Chemical Gloves | | | | | | | |
| | Inner Chemical Gloves | | | | | | | |

Some countries (U.S.) require documentation of the PPE needs assessment and certification of the selection process. If this applies, please complete below:

Name of PPE Assessor/ Certifier:

Date of Assessment/Certification:

| | |
|--|-------------------------------|
| Work Zones If exclusion zones are necessary because of chemical OR equipment hazards, describe the plan. | Exclusion Zone: |
| | Contamination Reduction Zone: |
| | Support Zone: |

| | |
|--|--|
| Site Access/Control How do we limit unauthorized entry to the site itself? | |
| Decontamination Procedures How will personnel and equipment be decontaminated prior to leaving the Site? | |

| | | | | |
|--|--|----------------|-----------------|---------------------|
| Safety Events | The occurrence of Safety Events will be reported per ERM procedures and Client requirements. At a minimum, Safety Events will receive follow-up per the ERM Event Communication System (ECS). Follow-up findings will be shared with the Client as required. | | | |
| Emergency Contacts Complete this section if medical and emergency response support is not KNOWN to be fully available through on-site client personnel | Name and Address of Nearest Hospital: | | | |
| | Hospital Phone Number: | | | |
| | Route To the Nearest Hospital: <i>(Write out / draw or attach map)</i> | | | |
| | Other Contact Information | | | |
| | Agency | Contact | Location | Phone Number |
| | Police Dept | | | |
| | Fire Dept/ Ambulance | | | |
| | Electric Utility | | | |
| | Plant Contact | | | |
| | Client Contact | | | |
| | Project Manager | | | |
| | Project H&S Officer | | | |
| | Site Safety Officer | | | |

| | | | | | | | | |
|--|---|--|---|--|----|--|----------------------------|--|
| Health & Safety Plan Evaluation Complete after the Field Work is done- place in the file and send suggested improvements to the H&S Leader | To evaluate the effectiveness of this health and safety plan and make future plans responsive to unexpected situations, the Project Manager or Site Safety Officer should complete the following and file a copy of this entire document with the OpCo Health and Safety Leader and others who would benefit. | | | | | | | |
| | Actual Dates of the Field Tasks: | | Was the H&S Plan followed as Presented? | | | | Was the H&S Plan Adequate? | |
| | | | Yes | | No | | Yes | |
| | Describe in detail any changes to the H&S Plan while on-site: | | | | | | | |
| | Reason For Change: | | | | | | | |
| What Changes Would You recommend: | | | | | | | | |
| Signatures | Project Manager (If other than the PM) | | | | | | Date: | |
| | Project Health and Safety Officer (If other than the PM) | | | | | | Date: | |
| | Site Safety Officer (If other than the PM) | | | | | | Date: | |

Appendix B
Additional Waiver Guidance and
Examples

APPENDIX B

Additional Waiver Guidance and Examples

Introduction

“Reasonably assured” denotes the standard that must be satisfied for PICs to grant Waivers to the execution of (or, more precisely, make an explicit decision to allow non-performance of) portions of the Subsurface Clearance (SSC) process, including:

- Private utility markouts;
- Public utility markouts (ERM- or subcontractor-performed);
- Physical clearance; and
- Restriction of Ground Disturbance Activities within a Critical Zone.

This guidance is intended to present a risk-based framework through which being “reasonably assured” may be assessed.

Definition and Two Factors to Consider

Being “reasonably assured” means that one would make the same decision as another PIC would concerning a Waiver based on the same set of factors. These factors include:

- The lines of evidence established (or not) about subsurface risks, and
- The relative hazard of striking the services known or suspected below ground.

Multiple / high-quality lines of evidence and low relative hazard support granting Waivers. Limited / low-quality lines of evidence and high relative hazard do not support granting Waivers, as shown in the Waiver Matrix, below.

The Waiver Matrix

| | | Lines of Evidence / Quality | |
|---|--------|-----------------------------|-----------|
| | | Less | More |
| Relative Hazard of Striking the Service | Higher | Likely Not | Caution |
| | Lower | Caution | Likely OK |

The way in which those factors are considered is illustrated by example below.

Example Project

An ERM team has been awarded a project to assess suspected impact at an idled manufacturing site. The Client previously demolished all surface structures, but did not fully address the process sewer. Some surface clues are present. They are assigned to go in and perform 25 soil borings along the run of the former process sewer (due to regulatory requirements, samples must be taken within 1 m of the sewer lines) looking for potential impact. The site is known to be constructed over made ground, and debris – both from historical operations and the recent demolition – is widespread over the site in the 0-1m interval.

The SSC Process first asks the project team to take stock of the project's information sources about subsurface risks. This is memorialized in the Subsurface Clearance Information Sources Summary (part of the Health & Safety Plan Template). Before mobilizing to the field for the drilling and sampling activity, the Information Summary is as follows.

Example Project SSC Information Sources Summary (Pre-Mobilization for Drilling Works)

| Subsurface Clearance Information Sources Summary Document the information sources that ERM used or will use to locate Subsurface Structures on site. | Information Source | Yes | No | N/A | Comment |
|---|---|-----|----|-----|--|
| | Facility-provided Map(s) of Utilities | x | | | Final as-built from 2005 prior to site demolition |
| | Knowledgeable Contact Person | | | x | Site is redundant. No client or site reps available. |
| | Public Utility Markouts | x | | | Marked out at the street only |
| | ERM [1] or ERM subcontractor performed geophysics / cable avoidance scans | | x | | None planned. Seeking waiver by PIC. |
| [1]: If ERM personnel will be performing any Private Utility Markouts, attach the operating employee's most recent equipment training record to the HASP. | | | | | |

The more information sources that are checked "Yes" indicates more lines of evidence potentially established. Comments regarding the quality or reliability of those lines of evidence should also be noted and weighed in subsequent decisions. Note that, at present, the project team intends to ask the PIC to waive the Private Utility markout.

Project teams are also asked to cycle through the potential underground services at a site. The goal is to ultimately confirm either their presence or absence of such services from the work area. The relative hazard of striking a service can be prioritized in terms of the potential severity of such a strike in terms of bodily harm, followed by potential cost implications of repair. All other things being equal, a prioritized list of common below ground services – from high hazard to low hazard – at a site might include:

1. High / medium voltage cables
2. Low voltage cables
3. Pressurized gas lines
4. Other pressurized pipelines
5. Fiber optic cables
6. Gravity drain process sewers
7. Gravity drain sanitary sewers
8. Gravity drain storm sewers

Of course, the particular circumstances of the site (e.g., active facility, idled facility, greenfield) and whether or not the routes of the services are known or would meet the definition of “Useful Property” may change the relative hazard ranking. The presence / absence and knowledge of the routes of below ground services on the Example Project site is noted in the Site Services Model, below.

Example Project Site Services Model (Pre-Mobilization for Drilling Works)

| Site Services Model | Utility / Service | Present | Expect. Depth | Located? | | Absent | Unknown | Comment |
|---|---------------------------------|---------|---------------|----------|----|--------|---------|---|
| | | | | Yes | No | | | |
| <p>List the utilities or other below ground services present on site.</p> <p>Do we know the locations of these services, their conveyance on site (to the site boundary, as appropriate) and the location of isolation switches or valves?</p> <p>If “Present” and not located or “Unknown”, comment on how those gaps will be addressed.</p> | (1) HV / MV Electricity | X | 2m | X | | | | De-energized from substation |
| | (2) LV Electricity | | | | | | X | But not anticipated outside of c. footprint |
| | (3) Pressurized Gas | X | 2m | X | | | | Present on site, but blinded at street |
| | (4) Other Pressurized Lines | X | 1m | | X | | | H ₂ pipeline crosses fmr. process area |
| | (5) Fiber Optic / communication | | | | | X | | Per phone company, none on-site |
| | (6) Process Sewer | X | 1-2 m | X | | | | Deactivated, but not abandoned |
| | (7) Sanitary Sewer | X | ? | | X | | | Deactivated, cut and blinded at street |
| | (8) Storm Sewer | | | | | X | | Previously abandoned by client |
| <p>Attach a figure / drawing showing the conveyance and isolation switches or valves for each located utility or service above.</p> | | | | | | | | |

Example Project Waiver Decisions

Decisions on granting Waivers should be based on considerations on what is known (or will be known, based on planned work activity) and what risks are present by virtue of the identified services at the site.

In this case, there are three potential Waiver decisions for the PIC to make:

- Waiving the private utility mark-out,
- Waiving the need for physical clearance, and
- Advancing within Critical Zones (within a 3m envelope of a sewer line).

The thought process includes weighing the lines of evidence against the relative hazard of the services known or suspected. In the end, the PIC must ask himself / herself if they are reasonably assured that the decision to grant a Waiver is a safe one. Consultation with the SSC Experienced Person and others project team may assist the PIC in making the decision. In the end, the PIC is the only one who may grant a Waiver.

What follows is an illustration of the decision making process, based on the situation presented in the Example Project.

Waiver Decision: Private Markouts

The SSC Information Summary suggests that the team has two of four possible lines of evidence in hand (a site plan and Public Utility markouts). The Site Services Model suggests that while those lines of evidence have provided us with a good idea about the locations and status of some high-hazard services and the former process sewer, they have not provided any sufficient detail about the hydrogen pipeline, which is known to be active and suspected to be running through the work area. That is, we have zero lines of evidence concerning the route of the hydrogen pipeline.

The Private Utility markout is the only available option for obtaining a line of evidence on the hydrogen pipeline. While that provider is on site, they may also be utilized to verify the route of the process sewer (as a second line of evidence) and the status of the de-energized conductors (i.e., that they are indeed de-energized). Additional lines of evidence never hurt!

The Private Utility Markout Waiver Decision

| | | Lines of Evidence / Quality | |
|---|--------|-----------------------------|-----------|
| | | Less | More |
| Relative Hazard of Striking the Service | Higher | Likely Not | Caution |
| | Lower | Caution | Likely OK |

To continue the example, the PIC was not reasonably assured that it would be safe to waive the Private Utility markout and thus decided not to grant the Waiver.

For purposes of the example, assume that the Private Utility markout was used to:

- Verify the route of the process sewer (which was found to align well with available surface clues and the site plan),
- Confirm that the electrical conductors are indeed de-energized, and
- Identify the route of the hydrogen pipeline (which was found to be distant from the process sewer).

Waiver Decision: Allowing Ground Disturbance within a Critical Zone

Recall from Section 3.3 (item 3.d.ii) that in addition to being “reasonably assured” about the safety of advancing within a Critical Zone, PICs are also required to factor the following into their decisions:

- If possible, energized pipes or cables within the Critical Zone should be de-energized via a formal Lockout/Tagout program.
- Ground Disturbance Activities within the Critical Zone do not present an unacceptable safety, environmental, or operational risk, either on-site or off-site.

In this case, with the process sewer, there is no need to de-energize it (it is inactive). If the sewer were to be struck, however, there is certainly an environmental risk – but there is some question as to it being an “unacceptable” risk. For the time being, assume that the PIC and project team believe the risk to not be “unacceptable”.

Even though the first position, of course, is to not advance within the Critical Zone unless absolutely necessary, the conditions of the Example Project engagement will tend to force the team to advance within the Critical Zone (i.e., close to the lines). Taking that into consideration, the PIC reviews the SSC Information Summary and the Site Services Model – both of which have evolved with the execution of the Private locator service. The PIC, SSC Experienced Person and project team ask, “Given what we know, are we reasonably assured that we will not strike the sewer line?”

By virtue of the Private Utility markout, the team now has an additional line of evidence about the route of the former process sewer and a high degree of confidence in it. The process sewer is not energized and is on the lower end of the relative hazard scale.

The Critical Zone Waiver Decision

| | | Lines of Evidence / Quality | |
|---|--------|-----------------------------|-----------|
| | | Less | More |
| Relative Hazard of Striking the Service | Higher | Likely Not | Caution |
| | Lower | Caution | Likely OK |

All things being equal, the PIC is reasonably assured that advancing within the Critical Zone would be a safe decision, and will allow the work inside the Critical Zone to proceed.

Waiver Decision: Physical Clearance

Recall that there is widespread subsurface debris at the site, mostly present in the 0-1m interval. Ground disturbance will occur inside a Critical Zone, which requires Physical Clearance to the deeper of:

- 7 feet / 2.1 meters;
- 2 feet / 0.6 meters below the frost line; or
- 20% past the expected invert elevation of the service (in this case, up to 2.4m given the depth of the process sewer);

In this example, the “20%” depth controls. Given the logistical and technical challenges, should the PIC allow Physical Clearance to be waived?

The Physical Clearance Waiver Decision

| | | Lines of Evidence / Quality | |
|---|--------|-----------------------------|-----------|
| | | Less | More |
| Relative Hazard of Striking the Service | Higher | Likely Not | Caution |
| | Lower | Caution | Likely OK |

There are multiple, good quality lines of evidence that confirm the routes of nearby services (as well as the absence of others), and the former process sewer ranks low in terms of relative hazard. In this case, the PIC is reasonably assured that waiving the Physical Clearance requirement is a safe decision.

Another Case to Consider

In the example above, circumstances led to fairly clear-cut decisions for granting Waivers to the SSC Process. Considerations of the lines of evidence and relative hazard tended to the regions of “likely not” and “likely OK” in the Wavier Matrix. Real world circumstances may lead to less clear-cut decisions and more ambiguity in being reasonably assured.

As an illustration, replace the former process sewer in the example above with an energized high voltage electrical cable. For the project, it is required to sample within 1 m of the cable. Assume that the Private Utility markout was performed, and that the route of the cable determined from that work matches well with what is shown on the site plan. Should the PIC allow advancing within the Critical Zone?

The High Voltage Cable Critical Zone Waiver Decision

| | | Lines of Evidence / Quality | |
|---|--------|-----------------------------|-----------|
| | | Less | More |
| Relative Hazard of Striking the Service | Higher | Likely Not | Caution |
| | Lower | Caution | Likely OK |

There are several quality lines of evidence that provide the route and location of the high voltage cable. Striking the cable would indeed be very hazardous. The Waiver Matrix indicates approaching the Waiver decision cautiously. Indeed, that is exactly what the PIC should do.

If the cable can be de-energized through a formal Lock Out / Tag Out program to eliminate the hazard, then a Waiver to advance inside the Critical Zone would be a safe decision.

But what if local utility says that the cable cannot be de-energized? The project requires advancing borings inside a Critical Zone. Even though the team believes that they have a very good understanding of the location of the service, the potential magnitude of the hazard is high, and presents a level of risk that would likely be unacceptable. In this case, not allowing the disturbance within the Critical Zone (i.e., not granting the Waiver) is the safe decision.

Additional considerations may be taken into account here. For example:

- Would it be possible (after discussion with the Client and discussing the risks) to advance farther away from the service (i.e., is it really necessary to get within 1m from the service)?
- Might another discussion with the utility be useful in terms of de-energizing the high voltage cable?
- Are there any additional safety precautions (e.g., grounding the drilling equipment) that might reduce the relative hazard?

Final Notes

Some Waiver decisions may affect other Waiver Decisions. For example, waiving the Private Utility markout eliminates a potential high-quality line of evidence. Not having this line of evidence may affect the ability to be reasonably assured that permitting work within a Critical Zone or waiving the Physical Clearance is a safe decision. Some illustrative guidance was presented above.

In the end, the PIC should err on the side of caution when it comes to taking any Waiver decision. PICs must ultimately be “reasonably assured” that a Waiver decision is a safe one for his / her project team, subcontractors and Client.

Appendix C
(Optional Process Component)
Field Training Course Outline

APPENDIX C

Field Training Course Outline (Optional Process Component)

Subsurface Clearance (SSC) Field Training is an OPTIONAL supplement to the ERM Subsurface Clearance 2.0 Classroom Training and Mentoring. ERM Businesses may elect, at their discretion, to make SSC Field Training a requirement for employees engaged in intrusive work activities.

This Section outlines a Field Training course, which is designed to provide employees an opportunity for practical use of the SSC Process and a clearer understanding of:

- The level of importance that ERM places on our SSC Process;
- The role that historical information plays in the SSC Process;
- The role that processing “Surface Clues” and other information in real time plays in the SSC Process;
- The field use of SSC Process tools; and
- The potential consequences of deviating from the SSC Process.

Material & Equipment Requirements

For each participant:

- Safety Glasses
- High Visibility Vest or Shirt
- Sturdy Work Shoes/Boots
- Site Drawing or Aerial Photograph of Site
- ERM SSC 2.0 Process Flowchart (for reference)
- ERM SSC Checklist & Disturbance Permit (several copies)

For the class session:

- Cable Avoidance Tools (assuming available equipment and trained staff)

Outline Design & Execution

1. A Subsurface Clearance Experienced Person, as defined in the ERM SSC Procedure, must lead the Field Training.
2. A Field Location will be indentified for the training. This may be a project site or a location proximal to an ERM Office.
3. The training will be conducted around a “fictitious project” created for purposes of this course. The “site” will be the selected Field Location.
4. For the fictitious project:

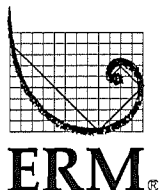
- a. Develop a “project back story “ (e.g., an M&A Phase II to support a property transaction)
 - b. Develop a “scope of work” for the project (e.g., 10 geoprobe borings to 6 meters)
 - c. Provide site maps, drawings, or at a minimum, an aerial photograph of the Field Location.
5. Before going to the field, ask participants to prepare their own Level 2 Intrusive Work WARN Health & Safety Plan (HASP), including the SSC Information Summary and Site Services Model. This may be structured as a group exercise among smaller numbers of participants if so desired.
6. Start the Field Training Course with a “Toolbox Safety Discussion” and making all participants sign a training Sign-In Sheet.
7. Review surface clues at the site that may indicate subsurface obstructions and utilities.
8. Conduct an exercise that incorporates the “gaps” identified in Site Services Model.
 - a. Emphasis should be placed on recognizing how the availability of information (or lack thereof) plays a role in the adequate preparation to safely conduct ground disturbance activities.
 - b. Participants might be asked if they would be comfortable commencing ground disturbance with the resources available.
9. Identify several hypothetical borehole (Point Disturbance) locations and one mass excavation location. Hypothetical locations should be chosen so that the following scenarios can be emphasized
 - a. Work within a critical zone;
 - b. Work beneath overhead obstructions or power lines; and
 - c. Work in the anticipated path of subsurface utility lines (i.e., between an electrical substation and building electrical supply).
10. Enable the use of a Cable Avoidance Tool at the Field Location. Use it to help close gaps in the Site Services Model.
11. A SSC Checklist & Disturbance Permit should be completed for each hypothetical ground disturbance location. Emphasis should be placed on the following aspects:
 - a. Critical Zone Determination and clearance depth requirements. ERM’s default position NOT TO ADVANCE in a Critical Zone should be discussed with emphasis on implications to safety and to the client.
 - b. Physical Clearance at the location – what must happen if requirement is waived by the PIC?

- c. Signature requirements with focus on refusal to sign or verbal approval only by the Client Contact
 - d. Critical Zone Determination Sketch – require sketches to be drawn for each of the hypothetical ground disturbance locations and consider reviewing each sketch as a group exercise highlighting positives and opportunities for improvement.
12. Hypothetical scenarios should be discussed in which a Subsurface Obstruction is contacted and the required actions as a result:
- a. A worker injury;
 - b. A damage to useful property;
 - c. A near miss (for example, the strike of a concrete subsurface structure causing no damage)
 - d. An unsafe act; and
 - e. An unsafe condition.
13. Consider a group discussion regarding UXO/MEC and what actions should be taken when UXO are uncovered on a project site. Emphasis should be placed on discussing the three R's – Recognize, Retreat, and Report.
14. Using the Sign-In Sheet, a member of the Local Safety Team will add the completion of the SSC Field Training Course to each participating employee's safety training database record.

APPENDIX B

SITE-SPECIFIC HEALTH AND SAFETY PLAN

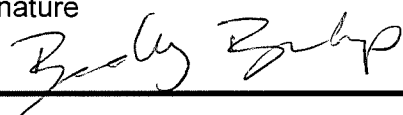
(INCLUDED ON CD IN APPENDIX A)



This Level 2 WARN HASP is intended to provide health and safety guidelines for project field work meeting the following criteria:

- Short-duration work not exceeding 30 consecutive days
- "Buddy System" in use
- Some likelihood of chemical and/or physical hazard exposure
- Limited number of job tasks (5 or less)
- No confined space entry or supplied-air respirator use
- Limited number of subcontractors involved (2 or less)

The Project Manager should review this Health and Safety Plan with all ERM project personnel and maintain the HASP in project files. H&S Team review is required for the Level 2 WARN and should be accomplished by sending the completed document to the "ERM NA Safety Leads" Outlook email group.

| | | |
|---|---|---|
| Administrative Information This document is valid for a maximum time period of one year after initial completion. A minimum of two persons with appropriate training and medical surveillance must be onsite. A mix of ERM and other personnel can satisfy this requirement. | Site Name and Location North Highlands, North Highlands CA | |
| | Client Contact and Phone CMSgt Warner Ratcliff - 916-569-2290 | |
| | Project Name ANG Western CRP | |
| | Health & Safety Plan Date 22 March 2013 | Revision Number and Date |
| | Field Work Start Date 25 March 2013 | Anticipated Field Work End Date September 2013 |
| | Project Manager (<i>responsible for implementing the site health and safety program on this project</i>) Mike Arnold | Partner In Charge (<i>responsible for overall site health and safety performance on this project</i>). Mark Bradford |
| H&S Team Review | Review Date 25 March 2013 | Signature  |

Project Background and Scope of Work

Include bullet list of tasks to be completed by ERM personnel during this project, and a separate list of tasks to be completed by any subcontractors at the site.

ERM Scope of Work: The scope of work involves site investigation activities at the Former Hydraulic Lift Area of Concern at the North Highlands Air National Guard site. During a previous investigation, a soil boring sample at a depth of 1 foot below ground surface (bgs) had a concentration of total petroleum hydrocarbons (TPH) as motor oil (TPH-MO) at 18 milligrams per kilogram (mg/kg). The scope of work includes:

- * Utility location;
- * Installing and sampling of soil borings using direct-push technology. Three direct-push borings will be advanced to approximately 30 feet bgs; and
- * Install a soil vapor sample and collect a soil vapor sample at a separate location, at a depth of 5 feet bgs.

Subcontractor Scope of Work:

Private Utility Clearance Subcontractor:

- * Use CAT to screen for underground utilities at monitoring well locations prior to intrusive activities.

Drilling Subcontractor:

- * Clear each boring location with a combination of air knife and vacuum truck to a minimum depth of 5 feet bgs.
- * Advance three direct-push borings; and
- * Advance one temporary soil vapor point.

Surveyor:

- * Survey the horizontal and vertical locations of borings and soil vapor sample locations.

Precautions For Preventing Contractor-Equipment Related Incidents:

- * Verbally confirm equipment safety with contractor as part of morning tailgate meeting;
- * Maintain good visual communication with equipment operators;
- * Ensure work area is clearly marked to prevent vehicle and pedestrian traffic from entering work area; and
- * Properly barricade work areas.

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|--|---|--|---|---|--|---|--|--|---|---|--|--|------------------------------------|---|--|---------------------------------------|--|---|---------------------------------------|---|--|---------------------------------------|--------------------------------------|--|---|--|---|---|--|--|
| <p>Site/Project General Information</p> <p>An asterisk (*) indicates that a completed Risk Assessment checklist must be completed and attached to this document.</p> <p>A double asterisk (**) indicates that a Risk Review must take place prior to beginning fieldwork on the project.</p> | <p>Site Type (check all applicable boxes)</p> <table border="0"> <tr> <td><input checked="" type="checkbox"/> Active Facility*</td> <td><input type="checkbox"/> Remote Facility*</td> <td><input type="checkbox"/> Inactive Facility*</td> <td><input type="checkbox"/> Inactive Facility*</td> </tr> <tr> <td><input type="checkbox"/> Mine</td> <td><input type="checkbox"/> Railroad</td> <td><input type="checkbox"/> Industrial</td> <td><input type="checkbox"/> Residential</td> </tr> <tr> <td><input type="checkbox"/> Secured</td> <td><input type="checkbox"/> Uncontrolled</td> <td><input type="checkbox"/> Chemical Mixing**</td> <td><input type="checkbox"/> Other (specify)</td> </tr> </table> | <input checked="" type="checkbox"/> Active Facility* | <input type="checkbox"/> Remote Facility* | <input type="checkbox"/> Inactive Facility* | <input type="checkbox"/> Inactive Facility* | <input type="checkbox"/> Mine | <input type="checkbox"/> Railroad | <input type="checkbox"/> Industrial | <input type="checkbox"/> Residential | <input type="checkbox"/> Secured | <input type="checkbox"/> Uncontrolled | <input type="checkbox"/> Chemical Mixing** | <input type="checkbox"/> Other (specify) | | | | | | | | | | | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> Active Facility* | <input type="checkbox"/> Remote Facility* | <input type="checkbox"/> Inactive Facility* | <input type="checkbox"/> Inactive Facility* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Mine | <input type="checkbox"/> Railroad | <input type="checkbox"/> Industrial | <input type="checkbox"/> Residential | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Secured | <input type="checkbox"/> Uncontrolled | <input type="checkbox"/> Chemical Mixing** | <input type="checkbox"/> Other (specify) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | <p>Main Site Hazards (check all applicable boxes)</p> <table border="0"> <tr> <td><input checked="" type="checkbox"/> Heat Stress</td> <td><input checked="" type="checkbox"/> Cold Stress</td> <td><input type="checkbox"/> Explosion/Fire</td> <td><input type="checkbox"/> Oxygen Deficiency</td> </tr> <tr> <td><input type="checkbox"/> Biological</td> <td><input type="checkbox"/> Organic Chemicals</td> <td><input type="checkbox"/> Inorganic Chemicals</td> <td><input type="checkbox"/> Heavy Equipment in Use</td> </tr> <tr> <td><input type="checkbox"/> Compressed Gas</td> <td><input type="checkbox"/> Asbestos</td> <td><input checked="" type="checkbox"/> High Noise</td> <td><input type="checkbox"/> Respirable Particles</td> </tr> <tr> <td><input type="checkbox"/> Work Over 6' High</td> <td><input type="checkbox"/> Extreme Weather</td> <td><input checked="" type="checkbox"/> Hand/Portable Power Tools</td> <td><input type="checkbox"/> Non-Ionizing Radiation</td> </tr> <tr> <td><input type="checkbox"/> Blasting Agents</td> <td><input type="checkbox"/> Confined Spaces</td> <td><input type="checkbox"/> ASTs/USTs</td> <td><input checked="" type="checkbox"/> Buried/Overhead Utilities</td> </tr> <tr> <td><input checked="" type="checkbox"/> Slip/Trip/Fall</td> <td><input type="checkbox"/> Forklift Use</td> <td><input type="checkbox"/> Manlift/Cherry Picker Use</td> <td><input checked="" type="checkbox"/> Heavy Equipment Use</td> </tr> <tr> <td><input type="checkbox"/> Scaffold Use</td> <td><input type="checkbox"/> Portable Ladders</td> <td><input type="checkbox"/> Welding or Hot Work</td> <td><input type="checkbox"/> Construction</td> </tr> <tr> <td><input type="checkbox"/> Excavations</td> <td><input type="checkbox"/> Extreme Weather</td> <td><input checked="" type="checkbox"/> Hand/Portable Power Tools</td> <td><input type="checkbox"/> Strip/Underground Mines</td> </tr> <tr> <td><input type="checkbox"/> Lockout/Tagout</td> <td><input type="checkbox"/> Commercial Vehicle</td> <td><input type="checkbox"/> Other (specify)</td> <td><input type="checkbox"/> Other (specify)</td> </tr> </table> | <input checked="" type="checkbox"/> Heat Stress | <input checked="" type="checkbox"/> Cold Stress | <input type="checkbox"/> Explosion/Fire | <input type="checkbox"/> Oxygen Deficiency | <input type="checkbox"/> Biological | <input type="checkbox"/> Organic Chemicals | <input type="checkbox"/> Inorganic Chemicals | <input type="checkbox"/> Heavy Equipment in Use | <input type="checkbox"/> Compressed Gas | <input type="checkbox"/> Asbestos | <input checked="" type="checkbox"/> High Noise | <input type="checkbox"/> Respirable Particles | <input type="checkbox"/> Work Over 6' High | <input type="checkbox"/> Extreme Weather | <input checked="" type="checkbox"/> Hand/Portable Power Tools | <input type="checkbox"/> Non-Ionizing Radiation | <input type="checkbox"/> Blasting Agents | <input type="checkbox"/> Confined Spaces | <input type="checkbox"/> ASTs/USTs | <input checked="" type="checkbox"/> Buried/Overhead Utilities | <input checked="" type="checkbox"/> Slip/Trip/Fall | <input type="checkbox"/> Forklift Use | <input type="checkbox"/> Manlift/Cherry Picker Use | <input checked="" type="checkbox"/> Heavy Equipment Use | <input type="checkbox"/> Scaffold Use | <input type="checkbox"/> Portable Ladders | <input type="checkbox"/> Welding or Hot Work | <input type="checkbox"/> Construction | <input type="checkbox"/> Excavations | <input type="checkbox"/> Extreme Weather | <input checked="" type="checkbox"/> Hand/Portable Power Tools | <input type="checkbox"/> Strip/Underground Mines | <input type="checkbox"/> Lockout/Tagout | <input type="checkbox"/> Commercial Vehicle | <input type="checkbox"/> Other (specify) | <input type="checkbox"/> Other (specify) |
| <input checked="" type="checkbox"/> Heat Stress | <input checked="" type="checkbox"/> Cold Stress | <input type="checkbox"/> Explosion/Fire | <input type="checkbox"/> Oxygen Deficiency | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Biological | <input type="checkbox"/> Organic Chemicals | <input type="checkbox"/> Inorganic Chemicals | <input type="checkbox"/> Heavy Equipment in Use | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Compressed Gas | <input type="checkbox"/> Asbestos | <input checked="" type="checkbox"/> High Noise | <input type="checkbox"/> Respirable Particles | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Work Over 6' High | <input type="checkbox"/> Extreme Weather | <input checked="" type="checkbox"/> Hand/Portable Power Tools | <input type="checkbox"/> Non-Ionizing Radiation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Blasting Agents | <input type="checkbox"/> Confined Spaces | <input type="checkbox"/> ASTs/USTs | <input checked="" type="checkbox"/> Buried/Overhead Utilities | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> Slip/Trip/Fall | <input type="checkbox"/> Forklift Use | <input type="checkbox"/> Manlift/Cherry Picker Use | <input checked="" type="checkbox"/> Heavy Equipment Use | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Scaffold Use | <input type="checkbox"/> Portable Ladders | <input type="checkbox"/> Welding or Hot Work | <input type="checkbox"/> Construction | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Excavations | <input type="checkbox"/> Extreme Weather | <input checked="" type="checkbox"/> Hand/Portable Power Tools | <input type="checkbox"/> Strip/Underground Mines | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Lockout/Tagout | <input type="checkbox"/> Commercial Vehicle | <input type="checkbox"/> Other (specify) | <input type="checkbox"/> Other (specify) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>Chemical Products ERM will Use or Store On Site</p> <p>For each chemical product identified, an MSDS must be attached to this WARN HASP</p> | <table border="0"> <tr> <td><input type="checkbox"/> Alconox or Liquinox</td> <td><input checked="" type="checkbox"/> Calibration gas (Methane)</td> <td><input checked="" type="checkbox"/> Isopropyl Alcohol</td> </tr> <tr> <td><input type="checkbox"/> Hydrochloric acid (HCl)*</td> <td><input checked="" type="checkbox"/> Calibration gas (Isobutylene)</td> <td><input type="checkbox"/> Household bleach (NaOCl)*</td> </tr> <tr> <td><input type="checkbox"/> Nitric acid (HNO₃)*</td> <td><input type="checkbox"/> Calibration gas (Pentane)</td> <td><input type="checkbox"/> Sulfuric acid (H₂SO₄)*</td> </tr> <tr> <td><input type="checkbox"/> Sodium hydroxide (NaOH)*</td> <td><input type="checkbox"/> Calibration gas (4-gas mixture)</td> <td><input type="checkbox"/> Hexane</td> </tr> <tr> <td></td> <td><input type="checkbox"/> Other (specify)</td> <td><input type="checkbox"/> Other (specify)</td> </tr> </table> <p>*NOTE: Eyewash solution shall be readily available on ALL projects where corrosive materials are used or stored, including sample preservatives.</p> | <input type="checkbox"/> Alconox or Liquinox | <input checked="" type="checkbox"/> Calibration gas (Methane) | <input checked="" type="checkbox"/> Isopropyl Alcohol | <input type="checkbox"/> Hydrochloric acid (HCl)* | <input checked="" type="checkbox"/> Calibration gas (Isobutylene) | <input type="checkbox"/> Household bleach (NaOCl)* | <input type="checkbox"/> Nitric acid (HNO ₃)* | <input type="checkbox"/> Calibration gas (Pentane) | <input type="checkbox"/> Sulfuric acid (H ₂ SO ₄)* | <input type="checkbox"/> Sodium hydroxide (NaOH)* | <input type="checkbox"/> Calibration gas (4-gas mixture) | <input type="checkbox"/> Hexane | | <input type="checkbox"/> Other (specify) | <input type="checkbox"/> Other (specify) | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Alconox or Liquinox | <input checked="" type="checkbox"/> Calibration gas (Methane) | <input checked="" type="checkbox"/> Isopropyl Alcohol | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Hydrochloric acid (HCl)* | <input checked="" type="checkbox"/> Calibration gas (Isobutylene) | <input type="checkbox"/> Household bleach (NaOCl)* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Nitric acid (HNO ₃)* | <input type="checkbox"/> Calibration gas (Pentane) | <input type="checkbox"/> Sulfuric acid (H ₂ SO ₄)* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Sodium hydroxide (NaOH)* | <input type="checkbox"/> Calibration gas (4-gas mixture) | <input type="checkbox"/> Hexane | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | <input type="checkbox"/> Other (specify) | <input type="checkbox"/> Other (specify) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Safe Work Practices | SWPs Applicable To This Project (check all applicable boxes) | | | |
|---------------------|---|--|--|--|
| | <p>Place a checkmark by applicable SWPs and attach to this document</p> <p>For hazards not covered by SWPs listed in this section, list the task name and complete a Job Hazard Analysis sheet (JHA) for each</p> | <input checked="" type="checkbox"/> 1-Hazard Communication | <input checked="" type="checkbox"/> 3-Medical Services and First Aid | <input type="checkbox"/> 4-Airborne Contaminants |
| | <input checked="" type="checkbox"/> 6-Cold Stress | <input checked="" type="checkbox"/> 7-Natural Hazards | <input checked="" type="checkbox"/> 8-Personal Protective Equipment | <input type="checkbox"/> 9-Respiratory Protection |
| | <input type="checkbox"/> 10-Confined Space Entry | <input checked="" type="checkbox"/> 11-Drum Handling | <input type="checkbox"/> 13-Excavation | <input type="checkbox"/> 14-Fall Protection and Prevention |
| | <input type="checkbox"/> 16-Forklift and Truck Operations | <input checked="" type="checkbox"/> 17-Hand Tools | <input type="checkbox"/> 19-Heavy and Material Handling Equipment | <input type="checkbox"/> 20-Ladder Safety |
| | <input checked="" type="checkbox"/> Other Task (specify) JHA-Operating Vehicles | <input checked="" type="checkbox"/> Other Task (specify)JHA-Engaging and Managing Subcontractors | <input checked="" type="checkbox"/> Other Task (specify) JHA-High Noise Environments | <input checked="" type="checkbox"/> Other Task (specify) JHA-Work at Active Facilities |
| | <input checked="" type="checkbox"/> Other Task (specify) JHA-Subsurface Clearance | <input type="checkbox"/> Other Task (specify) | <input type="checkbox"/> Other Task (specify) | <input type="checkbox"/> Other Task (specify) |

| Levels of Protection Required for each Task | Task Description | Level | | | |
|---|---|--------------------------|--------------------------|--------------------------|-------------------------------------|
| | | A | B | C | D |
| Signature of the H&S Team on page 1 of this document signifies certification of PPE Hazard Assessment | Utility location | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| | Utility clearance | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| | Installation and sampling of soil borings, soil vapor sampling. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| | Surveying | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

| | | | | | | | | |
|---|----------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-----------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| Personal Protective Equipment Req=Required Rec=Recommended | Equipment | Req | Rec | NA | Equipment | Req | Rec | NA |
| | Steel Toe Boots | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Hard Hat | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| | Long Sleeve Shirt & Pants | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Safety Glasses Shields | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| | Outer Disposable Boots | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | Indirect Vented Goggles | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| | Tyvek Suit | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | Poly-Coated Tyvek | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| | Fully Encapsulated Chemical Suit | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | Full-Face Respirator | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| | Hearing Protection | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Half-Face Respirator | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| | Leather Gloves | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Inner Chemical Gloves | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| | Outer Chemical Gloves | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | Other (specify) | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Training and Medical Surveillance Req=Required Rec=Recommended | Training | Req | Rec | NA | Medical Surveillance | Req | Rec | NA |
| | 40 Hour HAZWOPER | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Medical Clearance | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| | Current 8 Hour HAZWOPER | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Respirator Clearance | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| | 8 Hour HAZWOPER Supervisor* | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | Blood Lead and ZPP | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| | Current CPR and First Aid* | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Other (specify) | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| | 10 Hour Construction | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | Other (specify) | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| | ERM H&S Management System | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | | | | |
| | ERM Site Safety Officer* | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | | | | |
| | Other (specify) | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | | | | |
| Safety Supplies Req=Required Rec=Recommended | Supplies | Req | Rec | NA | Supplies | Req | Rec | NA |
| | First Aid Kit | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Fire Extinguisher | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| | Eyewash Solution | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Water/Sports Drink | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| | Air Horn | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | Oral Thermometer | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| | Noise Meter (Dosimeter) | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | Decontamination Supplies | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

| Subsurface Clearance Information Sources Summary Document the information sources that ERM used or will use to locate Subsurface Structures on site. | Information Source | Yes | No | N/A | Comment |
|--|--|-------------------------------------|--------------------------|--------------------------|--|
| | Facility-provided Map(s) of Utilities | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Date(s): Full review to be completed prior to intrusive work 3/15: Utility maps provided by base (included as attachment) CIPS data does not include utility information |
| | Knowledgeable Contact Person | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Who: CMsgt Warner Ratcliff Time in Job: Time at Site: |
| | Public Utility Markouts | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Who: To be completed prior to intrusive work Tech. Used: Target Services: |
| | ERM subcontractor performed geophysics / cable avoidance scans | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Who: To be completed prior to intrusive work Tech. Used: Target Services: |

| Site Services Model List the utilities or other below ground services present on site. Do we know the locations of these services, their conveyance on site (to the site boundary, as appropriate) and the location of isolation switches or valves? If “Present” and not located or “Unknown”, comment on how those gaps will be addressed. | Utility / Service | Present | Expected Depth | Located? | | Absent | Unknown | Comment |
|--|-------------------|--------------------------|----------------|--------------------------|--------------------------|--------------------------|--------------------------|--|
| | | | | Yes | No | | | |
| | Electricity | <input type="checkbox"/> | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Review Site Utility Drawings prior to intrusive work |
| | Gas | <input type="checkbox"/> | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Review Site Utility Drawings prior to intrusive work |
| | Water | <input type="checkbox"/> | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Review Site Utility Drawings prior to intrusive work |
| | Sewer | <input type="checkbox"/> | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Review Site Utility Drawings prior to intrusive work |
| | Telephone / Data | <input type="checkbox"/> | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Review Site Utility Drawings prior to intrusive work |
| | Plant air / steam | <input type="checkbox"/> | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Review Site Utility Drawings prior to intrusive work |
| | Fuel / oil | <input type="checkbox"/> | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Review Site Utility Drawings prior to intrusive work |
| | Fire suppression | <input type="checkbox"/> | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Review Site Utility Drawings prior to intrusive work |
| | Others (List): | <input type="checkbox"/> | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Review Site Utility Drawings prior to intrusive work |
| | | <input type="checkbox"/> | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |

Attach a figure / drawing showing the conveyance and isolation switches or valves for each located utility or service above.

| Subsurface Clearance Process Waivers Document any waivers to the process approved by the PIC. Legally required steps cannot be waived. | Waiver For... | Waived By (PIC) | Date | Reason |
|---|---|-----------------|------|--------|
| | Performance of Public Utility Markouts | | | |
| | Performance of Private Utility Markouts | | | |
| | Restricting ground disturbance inside a Critical Zone | | | |
| | Physical Clearance at Disturbance Locations (list) | | | |

| Overhead Clearance Document the steps that must be followed and justify any exceptions | Requirement | Yes | No | How will it be done? Why the exception? |
|---|---|--------------------------|--------------------------|--|
| | Are overhead utility lines in the general vicinity of ERM work onsite? | <input type="checkbox"/> | <input type="checkbox"/> | |
| | If overhead utilities are present, has nominal voltage been determined? If yes, list in comments section. | <input type="checkbox"/> | <input type="checkbox"/> | |
| | Before drill rig mast is raised in the vicinity of power lines, have we ensured that the minimum horizontal distance from any point on the drill rig to the nearest power line is greater than 25 ft? | <input type="checkbox"/> | <input type="checkbox"/> | |
| | If the drill rig is closer than 25 ft to the overhead utility, can the utility be de-energized? | <input type="checkbox"/> | <input type="checkbox"/> | |

**Subsurface and
Overhead Utility
Clearance Map**

**If a client-supplied
map is not used to
indicate location of
subsurface and/or
overhead utilities
draw a sketch in this
area indicating both
drilling locations and
locations of
subsurface and
overhead utilities**

To be completed prior to intrusive work activities.

| | |
|--|---|
| Work Zones If exclusion zones are necessary because of chemical OR equipment hazards, describe the plan | Exclusion Zone: Set exclusion zone to 15 foot (min.) radius of equipment using traffic cones and caution tape. Access will be monitored by site safety officer. |
| | Contamination Reduction Zone: The contamination reduction zone will be immediately outside of the Exclusion zone but within the closed work area as convenient and appropriate. |
| | Support Zone: The support zone will include the area outside of the exclusion zone. |

| | |
|---|--|
| <p>Site Access/Control</p> <p>How do we limit unauthorized entry to the site itself?</p> | <p>Access Control Procedures: The property is fenced and off limits to the general public. The work area will be barricaded with traffic cones and caution tape, if needed, to prevent access by unauthorized persons.</p> |
| <p>DECON Procedures</p> | <p>Decontamination Procedures:</p> <ul style="list-style-type: none"> • Place plastic sheeting on the ground or floor in the decontamination area. The sheeting should cover an area approximately 6 feet by 10 feet. • Fill two buckets with an appropriate amount of tap water (warm or hot water, if possible). • Place an appropriate amount of laboratory-grade detergent in a bucket containing tap water. • Place the second tap-water-containing bucket to the right of the bucket with the detergent. • Place the third, empty, bucket to the right of the second bucket. • Place equipment to be decontaminated to the left of the Tap + Detergent bucket. • Complete equipment wash and rinse using the following procedures: <ul style="list-style-type: none"> - Wash equipment in tap + detergent water, using brushes to remove soil and residue; - Rinse equipment in tap water in second bucket; and - Hold equipment over third bucket and pour distilled/deionized water over the equipment for a final rinse, taking care not to let the equipment contact the water collected in the bucket. • Place decontaminated equipment to the right of the third bucket. • Dispose used decontamination water to an approved container, such as a DOT-approved drum. Container should be labeled on the side (not lid) with date(s) of accumulation, contents, source of contents (e.g., "decontamination water"), and a unique number in sequence with other investigation-derived waste containers at the site. This information should be recorded in a drum log in the field notes. • Change wash and rinse water regularly, especially if water becomes turbid from soil. |

| Chemicals of Concern | |
|--|--|
| <p>In the section to the right, check any chemicals present on site in any media (air, soil water).</p> <p>In the table below, list chemicals suspected or confirmed to be on site, and provide requested information.</p> | <input type="checkbox"/> Friable Asbestos <input type="checkbox"/> 3,3'-Dichlorobenzidine <input type="checkbox"/> Benzidine <input type="checkbox"/> beta-Propiolactone <input type="checkbox"/> N-Nitrosomethylamine <input type="checkbox"/> Lead <input type="checkbox"/> Benzene <input type="checkbox"/> Acrylonitrile <input type="checkbox"/> Methylenedianiline |
| | <input type="checkbox"/> alpha-Naphthylamine <input type="checkbox"/> bis-Chloromethyl ether <input type="checkbox"/> 4-Aminodiphenyl <input type="checkbox"/> 2-Acetylaminoflourene <input type="checkbox"/> Vinyl chloride <input type="checkbox"/> Chromium (VI) <input type="checkbox"/> Coke oven emissions <input type="checkbox"/> Ethylene oxide <input type="checkbox"/> 1,3-Butadiene <input type="checkbox"/> No ERM exposure to these |
| | <input type="checkbox"/> Methyl chromoethyl ether <input type="checkbox"/> beta-Naphthylamine <input type="checkbox"/> Ethyleneimine <input type="checkbox"/> 4-Dimethylaminoazobenzene <input checked="" type="checkbox"/> Inorganic arsenic <input type="checkbox"/> Cadmium <input type="checkbox"/> 1,2-Dibromo-3-chloropropane <input type="checkbox"/> Formaldehyde <input type="checkbox"/> Methylene chloride |



| Materials Present or Suspected at Site | Highest Reported Concentration (specify units and sample medium) | Exposure Limit (specify ppm or mg/m ³) | IDLH Level (specify ppm or mg/m ³) | Primary Hazards of the Material (explosive, flammable, corrosive, toxic, volatile, radioactive, biohazard, oxidizer, or other) | Symptoms and Effects of Acute Exposure | Ionization Potential (eV) |
|--|--|--|--|--|--|---------------------------|
| TPH-MO | 18 mg/kg, soil | PEL = N/A REL = TLV = Skin Hazard <input checked="" type="checkbox"/> | N/A | Skin irritant | Heavy waste oils, including lubricants, grease, and used motor and hydraulic fluids, have been shown to cause skin cancer during prolonged dermal exposure in laboratory animals. Therefore, dermal protection must be provided when contact with used oil is suspected. Contaminated skin should be washed as soon as possible. | N/A |

PEL = OSHA Permissible Exposure Limit
 REL = NIOSH Recommended Exposure Limit
 TLV = ACGIH Threshold Limit Value
 IDLH = Immediately Dangerous to Life or Health

| Monitoring Equipment: All monitoring equipment on site must be calibrated before and after each use and results recorded | | | | |
|---|----------------------------|---|--|---|
| Instrument (Check all required) | Task | Instrument Reading | Action Guideline | Comments |
| <input type="checkbox"/> Combustible gas indicator model: | <input type="checkbox"/> 1 | 0 to 10% LEL | Monitor; evacuate if confined space | |
| | <input type="checkbox"/> 2 | 10 to 25% LEL | Potential explosion hazard | |
| | <input type="checkbox"/> 3 | >25% LEL | Explosion hazard; interrupt task; evacuate site | |
| | <input type="checkbox"/> 4 | | | |
| | <input type="checkbox"/> 5 | | | |
| <input type="checkbox"/> Oxygen meter model: | <input type="checkbox"/> 1 | >23.5% Oxygen | Potential fire hazard; evacuate site | |
| | <input type="checkbox"/> 2 | 23.5 to 19.5% Oxygen | Oxygen level normal | |
| | <input type="checkbox"/> 3 | <19.5% Oxygen | Oxygen deficiency; interrupt task; evacuate site | |
| | <input type="checkbox"/> 4 | | | |
| | <input type="checkbox"/> 5 | | | |
| <input type="checkbox"/> Radiation survey meter model: | <input type="checkbox"/> 1 | Normal background | Proceed | Annual exposure not to exceed 1,250 mrem per quarter Background reading must be taken in an area known to be free of radiation sources |
| | <input type="checkbox"/> 2 | Two to three times background | Notify SSC | |
| | <input type="checkbox"/> 3 | >Three times background | Radiological hazard; interrupt task; evacuate site | |
| | <input type="checkbox"/> 4 | | | |
| | <input type="checkbox"/> 5 | | | |
| <input checked="" type="checkbox"/> Photoionization detector model: <input type="checkbox"/> 11.7 eV <input checked="" type="checkbox"/> 10.6 eV <input type="checkbox"/> 10.2 eV <input type="checkbox"/> 9.8 eV <input type="checkbox"/> ____ eV | <input type="checkbox"/> 1 | Any response above background to 5 ppm above background | Level C is acceptable Level B is recommended | These action levels are for unknown gases or vapors. After the contaminants are identified, action levels should be based on the specific contaminants involved. |
| | <input type="checkbox"/> 2 | >5 to 500 ppm above background | Level B | |
| | <input type="checkbox"/> 3 | >500 ppm above background | Level A | |
| | <input type="checkbox"/> 4 | | | |
| | <input type="checkbox"/> 5 | | | |
| <input type="checkbox"/> Flame ionization detector model: | <input type="checkbox"/> 1 | Any response above background to 5 ppm above background | Level C is acceptable Level B is recommended | These action levels are for unknown gases or vapors. After the contaminants are identified, action levels should be based on the specific contaminants involved. |
| | <input type="checkbox"/> 2 | >5 to 500 ppm above background | Level B | |
| | <input type="checkbox"/> 3 | | | |
| | <input type="checkbox"/> 4 | >500 above background | Level A | |
| | <input type="checkbox"/> 5 | | | |
| <input type="checkbox"/> Detector tube models: | <input type="checkbox"/> 1 | Specify: <1.2 the PEL >1/2 the PEL | Specify: | The action level for upgrading the level of protection is one-half of the contaminant's PEL. If the PEL is reached, evacuate the site and notify a safety specialist. |
| | <input type="checkbox"/> 2 | | | |
| | <input type="checkbox"/> 3 | | | |
| | <input type="checkbox"/> 4 | | | |
| | <input type="checkbox"/> 5 | | | |
| <input type="checkbox"/> Other (specify): | <input type="checkbox"/> 1 | Specify: | Specify: | |
| | <input type="checkbox"/> 2 | | | |
| | <input type="checkbox"/> 3 | | | |
| | <input type="checkbox"/> 4 | | | |
| | <input type="checkbox"/> 5 | | | |

| | |
|--|---|
| <p>Emergency Response Planning</p> <p>In the pre-work briefing and daily tailgate safety meetings, all on-site employees will be trained in the provisions of emergency response planning, site communication systems, and site evacuation routes.</p> <p>Signal a site emergency or medical emergency with three blasts of a loud horn (car horn, fog horn, or similar device).</p> <p>To complete this section, attach a hospital route map to the HASP.</p> | <p>All work-related incidents must be reported. For all medical emergencies, call 911 or the local emergency number. For non-emergency incidents, you must:</p> <ul style="list-style-type: none"> • Give appropriate first aid care to the injured or ill individual and secure the scene. • Immediately call Incident Intervention at (888) 449-7787 (available 24 hours/7 days per week). • Notify the Project Manager and/or H&S Officer after calling Incident Intervention. • Enter the safety event into the ECS within 24 hours. <p>In the event of an emergency that necessitates evacuation of the work task area or the site as a whole, the following procedures shall occur:</p> <ul style="list-style-type: none"> • The ERM site safety contact will contact all nearby personnel using the on-site communications system to advise of the emergency. • Personnel will proceed along site roads to a safe distance upwind from the hazard source. • Personnel will remain in that area until the site safety contact or other authorized individual provides further instruction. <p>In the event of a severe spill or leak, site personnel will follow the procedures listed below:</p> <ul style="list-style-type: none"> • Evacuate the affected area and relocate personnel to an upwind location. • Inform the ERM site safety contact, an ERM office, and a site representative immediately. • Locate the source of the spill or leak, and stop the source if it is safe to do so and appropriately trained personnel are on site to do so. • Begin containment and recovery of spilled or leaked materials. • Notify appropriate local, state, and federal agencies after obtaining client consent to do so. <p>In the event of severe weather, site personnel will follow the procedures listed below:</p> <ul style="list-style-type: none"> • Site work shall not be conducted during severe weather, including high winds and lightning. • In the event of severe weather, stop work, lower any equipment (drill rigs), and evacuate the affected area. |
|--|---|

| Emergency Contacts | Name | Location | Phone | Cell Phone |
|----------------------------------|----------------------------------|---------------------|--------------|--------------|
| Hospital (attach map) | Kaiser Permanente Medical Center | North Highlands, CA | 916-973-6651 | N/A |
| Police | Sacramento PD | | 911 | |
| Fire | Sacramento Fire | | 911 | |
| Project Manager | Mike Arnold | Seattle, WA | 425-462-8591 | 425-761-2603 |
| Field Manager (if not PM) | Karyn Wong | Sacramento, CA | 916-924-9378 | 916-769-2777 |
| Field Safety Officer (if not PM) | Karyn Wong | Sacramento, CA | 916-924-9378 | 916-769-2777 |
| Division H&S Contact | Steven Perkins | Irvine, CA | 949-623-4669 | 916-675-2405 |
| Region H&S Contact | Rick Ecord | Atlanta, GA | 404-816-6606 | 404-769-4561 |
| Incident Intervention | WorkCare | N/A | 888-449-7787 | N/A |
| SSC Experienced Person | Mike Quillici | Sacramento, CA | 916-924-9378 | 530-304-7456 |
| Subcontractor Safety Contact | | | | |

| | | | |
|---|--|--------------|----------------------------|
| Acknowledgement | <p><i>I have read, understood, and agree with the information set forth in this Health & Safety Plan, and will follow guidance in the plan and in the ERM North America Health and Safety manual. I understand the training and medical monitoring requirements for conducting activities covered by this WARN and have met these requirements.</i></p> <p><i>ERM has prepared this plan solely for the purpose of protecting the health and safety of ERM employees. Subcontractors, visitors, and others at the site are required to follow provisions in this document at a minimum, but must refer to their organization's health and safety program for their protection.</i></p> | | |
| Printed Name | Signature | Organization | Date |
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| Approval Signatures Signatures in this section indicate the signing employee will comply with and enforce this WARN HASP, as well as procedures and guidelines established in the ERM NA H&S. Signatures in this section also indicate that any subcontractors performing work under contract to ERM have met the minimum safety standards in the ERM Subcontractor Prequalification Process. | Project Manager  | | Date: 25 March 2013 |
| (Continued from above) | Partner in Charge  | | Date: 25 March 2013 |

ACTIVE FACILITY CHECKLIST

RISK ASSESSMENT/MANAGEMENT CHECKLIST

Working in an Active Facility

| No. | Issues | These Issues Have Been Considered Before Work (Check each box considered) | What Additional Actions are Necessary Before Beginning Work? (State Them) |
|-----------------------------|---|--|--|
| Personnel Management | | | |
| 1 | Does the team have directions on where to park so that risk from truck and other traffic is lessened | X | ERM and Subcontractor to attend Site safety meeting with ANG prior to commencement of work |
| 2 | Does the team have instructions on where to enter the facility so that there is no likelihood of entering operating areas or upsetting facility security | X | ERM and Subcontractor to attend Site safety meeting with ANG prior to commencement of work |
| 3 | Do you know of, and will the team have access to all the necessary PPE for working on the site? | X | |
| 4 | Is there a plan to define the rules concerning unaccompanied movement within the facility? | X | ERM and Subcontractor to attend Site safety meeting with the ANG prior to commencement of work |
| 5 | Is there a plan in place to ensure that the team is aware of emergency response requirements while in the plant? | X | ERM and Subcontractor to discuss with ANG prior to commencement of work |
| 6 | Is there a plan in place to ensure that the team will be informed of chemical and process hazards that might be encountered during your site work? | X | Yes previous investigative reports available for the site. |
| 7 | Are you aware of any types of health conditions or status that could make it unsafe to work in specific areas of the plant (such as asthma, skin condition, allergies, or pregnancy)? | Not aware of any issues | |

ADDITIONAL ADVISORY INFORMATION

Working in an Active Industrial Facility

| Hazards | Control Measures | Risk Rating | Comments & Follow Up |
|---|---|-------------|--|
| Other moving vehicles including trucks | Visitor parking areas, walkways, designated vehicular gates | 1x3=3 | Park in designated areas, be alert to truck and other traffic while entering and leaving the plant. |
| Chemical contact and exposure | Facility engineering controls, plant boundaries and signs, use of required PPE | 1x4=4 | Know plant limits on touring alone, follow plant signs and rules, wear the required PPE |
| Walking and working surface hazards | Well-maintained walkways, aisles, stairs, railings, attention to work area | 2x2=4 | Do not venture into potentially unsafe areas, avoid badly cluttered, contaminated, and poorly lit areas |
| Plant emergencies from fire, explosion, or other | Facility engineering and operational controls, alarms, response plans and drills. | 1x5=5 | Ensure that emergency response to alarms is explained and follow plant rules on working alone in the plant |
| High Noise Levels | Engineering controls, use of hearing protection, normally limited time in high noise areas. | 1x2=2 | Wear hearing protection if the plant requires this or there is potential for your discomfort or distraction from the noise. |
| Moving plant vehicles | Be observant of all moving facility equipment and back-up alarms. | 1x5=5 | |
| Working at Elevated Heights | Railings | 1x5=5 | There should be no need to work at elevated heights in normal facility work. Do not take these risks. |
| Confined Spaces (pits, vessels, bag houses, sewers) | May be labeled with warning "Do Not Enter" signs and secured against inadvertent entry. | 1x4=4 | Do not enter confined spaces on any facility unless you have been formally trained on confined space entry and the plant's CSE program AND there is an undeniable project requirement. |
| Extreme Temperatures (hot or cold) | Pre-planning for anticipated weather conditions, planned breaks from extreme exposures | 3x2=6 | Consider facility tours and outside work during the most comfortable part of the day |

Working in an Active Industrial Facility

| Hazards | Control Measures | Risk Rating | Comments & Follow Up |
|--|---|-------------|---|
| Working Alone/ injured and unattended | Initial decisions on ERM's moving alone in the facility and property, determining sign-in and sign-out rules, and letting people know where you are going and anticipated length of time. | 1x2=2 | If working alone, then heightened awareness of potentially risky situations is essential. |
| Contact with moving production equipment and live electrical equipment | Machine guards, closed electrical cabinets, warning signs and barriers | 2x5=10 | DO NOT TOUCH any plant equipment unless it is reliably not under power and you have asked permission. |

The risk ratings concern the likelihood of an event and the potential severity of the outcome. Numbers range from 1-5 and the lower the number the less likelihood or potential severity is generally anticipated. Different sites could have different risk rankings. These are general opinions.

UTILITIES

| | | |
|---|----------------------------|--|
| BASE CIVIL ENGINEERING WORK CLEARANCE REQUEST (See Instructions on Reverse) | | DATE PREPARED 13 FEB2012 |
| 1. Clearance is requested to proceed with work at NORTH HIGHLANDS ANG STATION | | |
| on Work Order No. _____, Contract No. DAHA92-01-D0005 , involving excavation or utility disturbance per attached sketch. This area <input type="checkbox"/> has <input checked="" type="checkbox"/> has not been staked or clearly marked. | | |
| 2. TYPE OF FACILITY/WORK INVOLVED | | |
| <input type="checkbox"/> A. PAVEMENTS <input type="checkbox"/> D. FIRE DETECTION & PROTECTION SYSTEMS <input type="checkbox"/> G. AIRCRAFT OR VEHICULAR TRAFFIC FLOW <input type="checkbox"/> B. DRAINAGE SYSTEMS <input type="checkbox"/> E. UTILITY <input type="checkbox"/> OVERHEAD <input type="checkbox"/> UNDERGROUND <input type="checkbox"/> H. SECURITY <input type="checkbox"/> C. RAILROAD TRACKS <input type="checkbox"/> F. COMM <input type="checkbox"/> OVERHEAD <input type="checkbox"/> UNDERGROUND <input checked="" type="checkbox"/> I. OTHER SUBSURFACE INVESTIGATION | | |
| 3. DATE CLEARANCE REQUIRED 25 FEB2013 | | 4. DATE OF CLEARANCE 22 MAR 13 MB |
| 5. SIGNATURE OF REQUESTING OFFICIAL karyn.wong@erm.com <small>Digitally signed by karyn.wong@erm.com DN: cn=karyn.wong@erm.com Date: 2013.02.13 16:28:33 -0800</small> | | 6. TELEPHONE NO. 916.999.8919 7. ORGANIZATION ERM |
| | ORGANIZATION | REMARKS (Use Reverse for additional comments) |
| 8. B A S E C I V I L E N G I N E E R I N G | A. ELECTRICAL DISTRIBUTION | Exists in area, see pg 4 |
| | B. STEAM DISTRIBUTION | duct out of area |
| | C. WATER DISTRIBUTION | Exists in area, see pg 4 |
| | D. POL DISTRIBUTION | N/A |
| | E. SEWER DISTRIBUTION | out of area |
| | F. ENVIRONMENTAL | NO ENVIRONMENTAL concerns |
| | G. PAVEMENTS/ GROUNDS | Restore to usable state |
| | H. FIRE PROTECTION | out of area |
| | I. ZONE _____ | N/A |
| | J. OTHER (Specify) _____ | |
| 9. SECURITY POLICE | | N/A |
| 10. SAFETY | | Follow OSHA + AFOSH std |
| 11. COMMUNICATIONS | | Exists in area, see pg 4 |
| 12. BASE OPERATIONS | | Coordinate entry with Env |
| 13. CABLE TV | | N/A |
| 14. COMMERCIAL UTILITY COMPANY <input type="checkbox"/> TELEPHONE <input type="checkbox"/> GAS <input type="checkbox"/> ELECTRIC | | N/A |
| 15. OTHER (Specify) _____ | | |
| 16. REQUESTED CLEARANCE <input checked="" type="checkbox"/> APPROVED <input type="checkbox"/> DISAPPROVED | | |
| 17. TYPED NAME AND SIGNATURE OF APPROVING OFFICER (Chief of Operations Flight or Chief of Engineering Flight) CM Sgt. BORBA, MARK | | 17a. DATE SIGNED 22 MAR 13 |

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.

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

SEE ATTACHED FIGURE.

PURPLE POINTS OR A TRIANGLE ARE THE PROPOSED LOCATIONS FOR SUBSURFACE INVESTIGATION.

TO SAFELY EXECUTE THESE ACTIVITIES, I REQUEST IDENTIFICATION OF ANY KNOWN SUBSURFACE STRUCTURES WITHIN A 20-FOOT RADIUS OF THE PROPOSED LOCATION.

NOTE THAT TWO OF THE PROPOSED LOCATIONS ARE INSIDE THE BUILDING.

A PRIVATE UTILITY LOCATOR WILL FOLLOW-UP AND SWEEP THE AREA AT A LATER DATE.

THANKS IN ADVANCE FOR YOUR HELP.





Please see Page 4 provided by this office. Underground utilities exist that are not marked. Utilities as diagramed are approx. in location and not exact. Local representative should be on site at time of work to provide guidance and oversight. Follow safety standards per industry and restore area to usable condition.

CHSgt. BORBA

MR



Legend

-  Proposed Soil Boring Location
-  Proposed Soil Vapor Well Location
-  2009 One Clean Program Soil Boring Location
-  162nd CCG Property Boundary

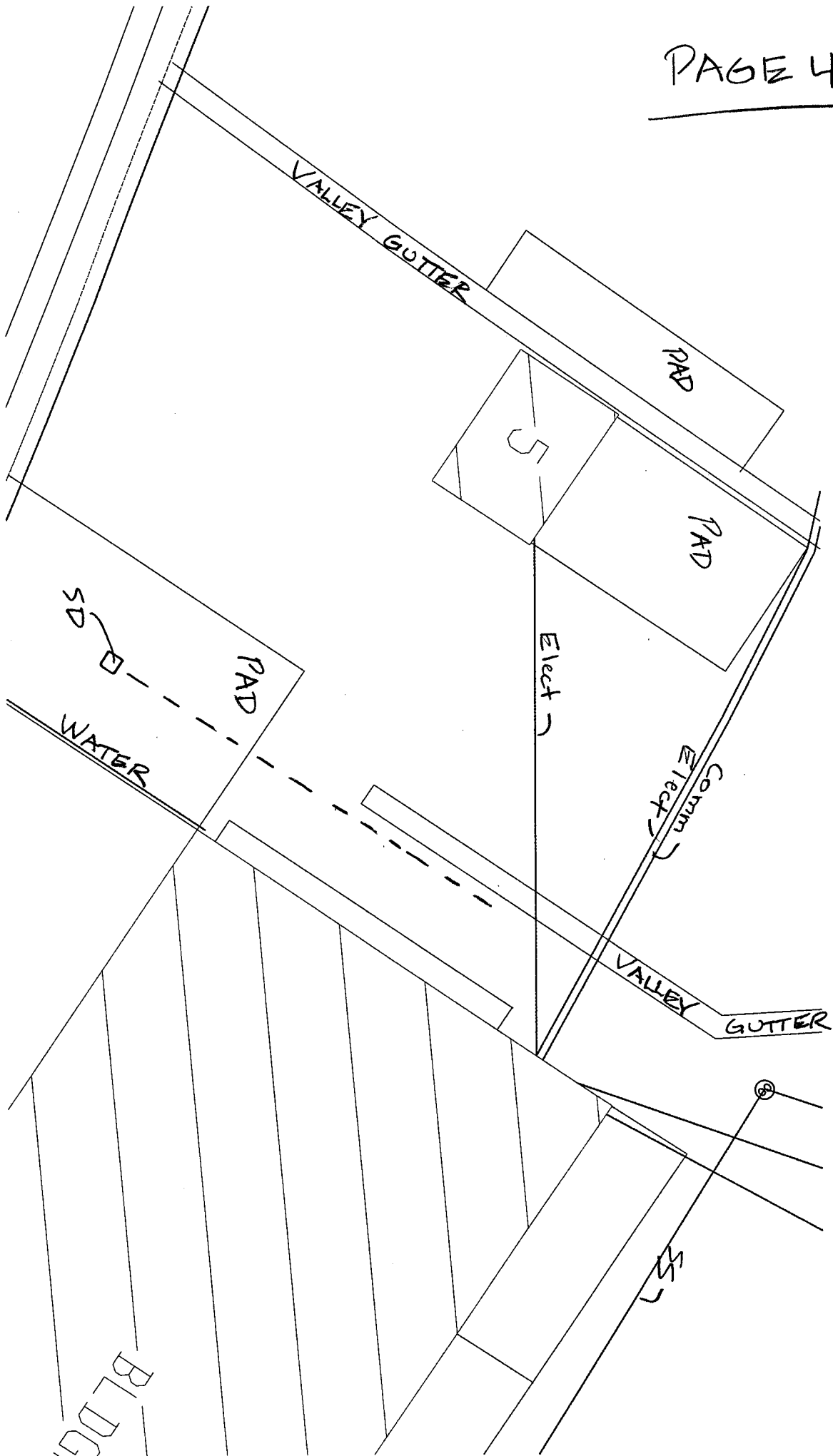


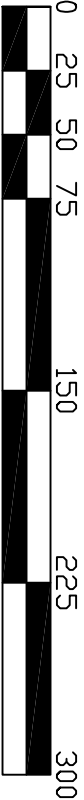
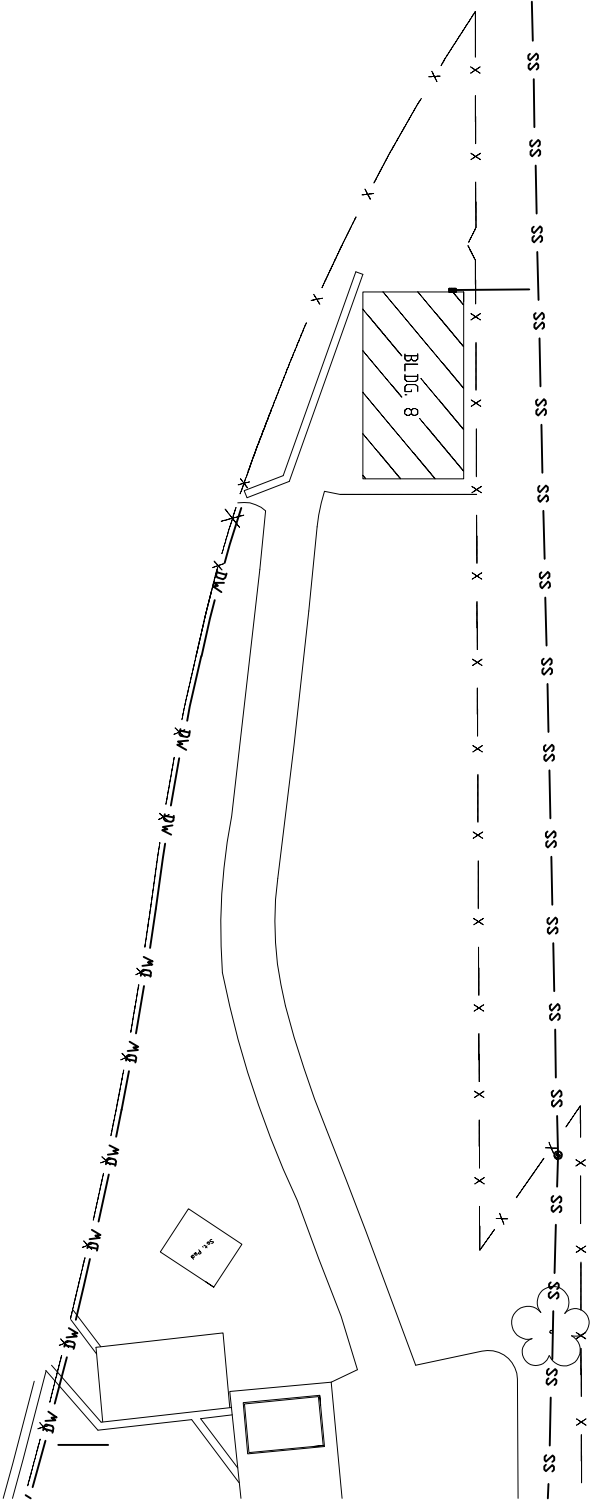
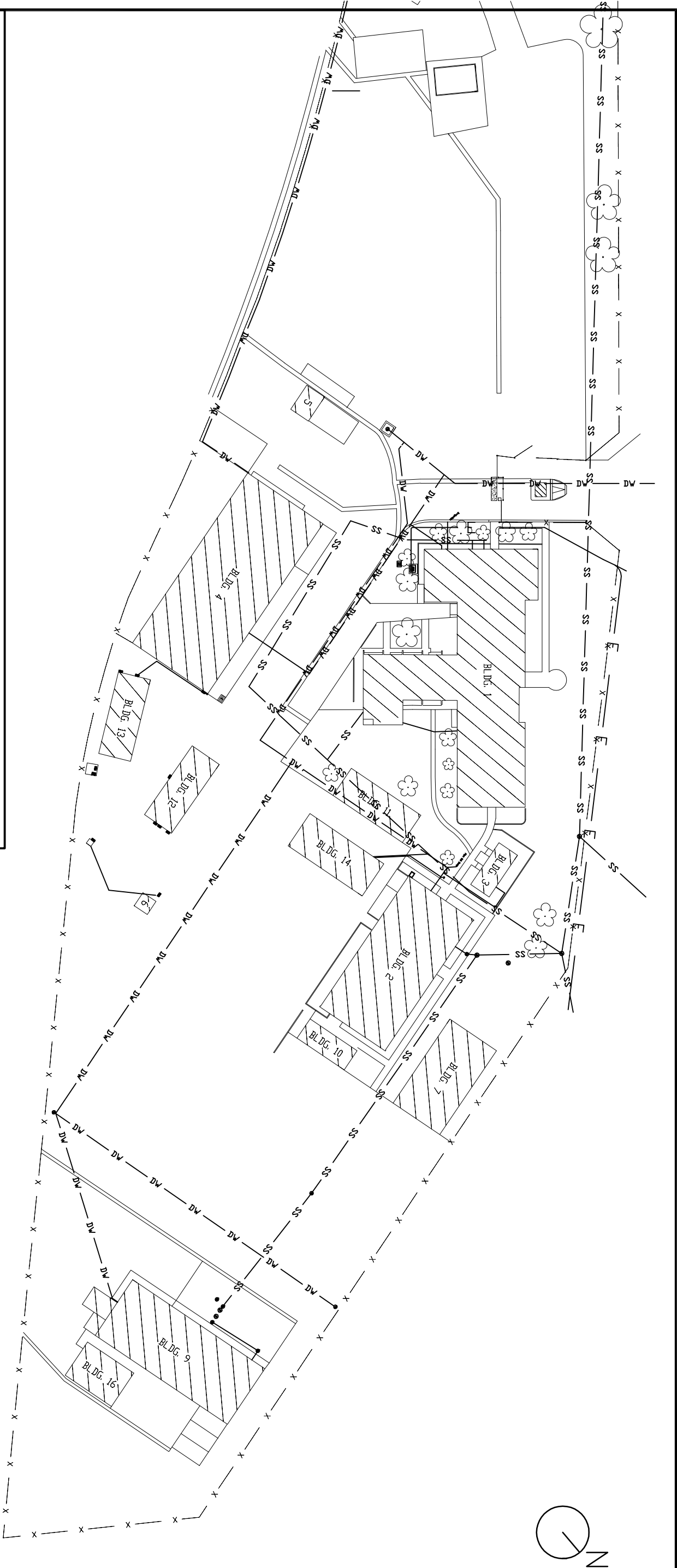
0 20 40 80 Feet

Aerial Photo: BING Aerial Image Web Service, March 2010

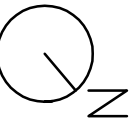
Figure 4-1

*Proposed Sample Locations
162nd Combat Communications Group
California Air National Guard
North Highlands, California*





SCALE: 1" = 75'

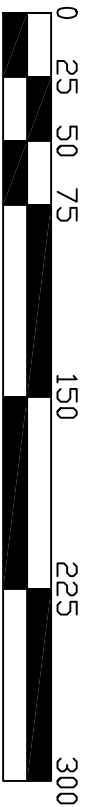
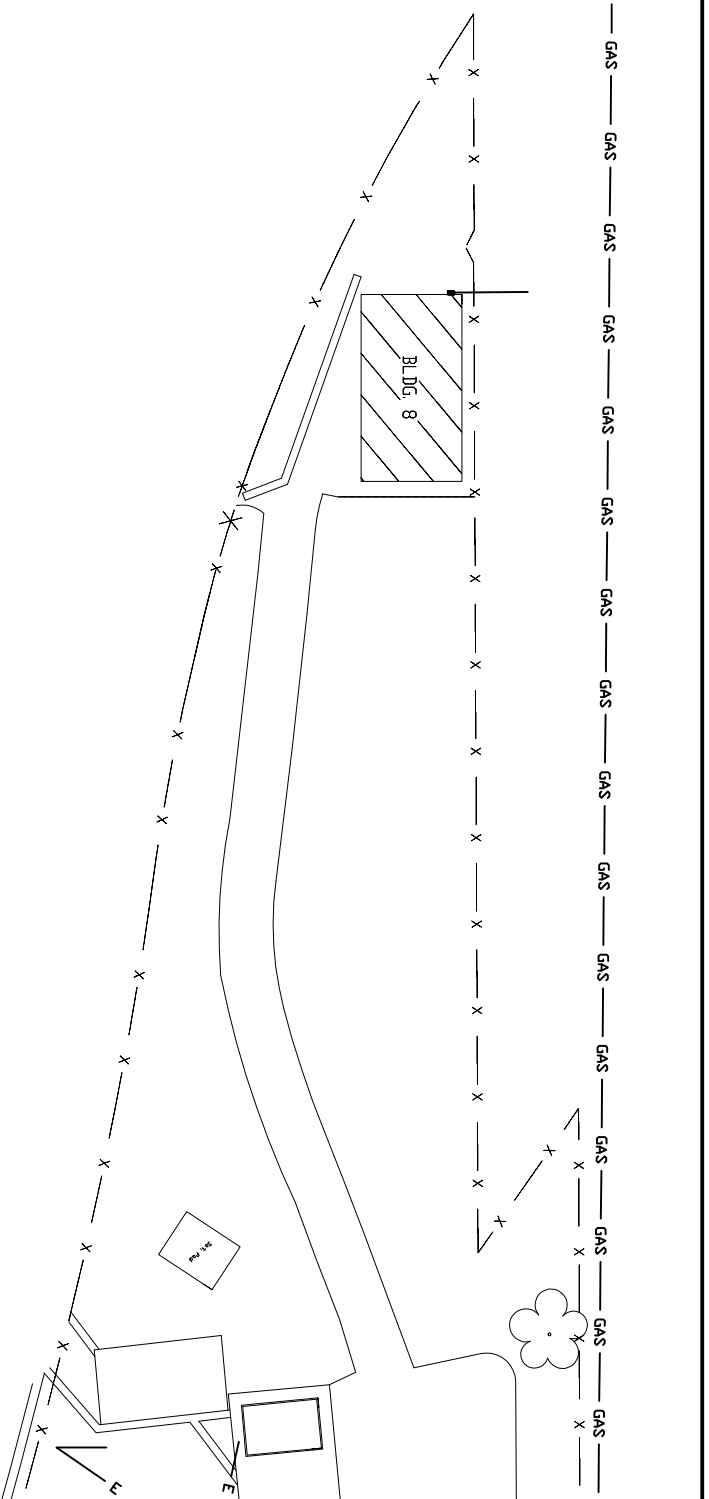
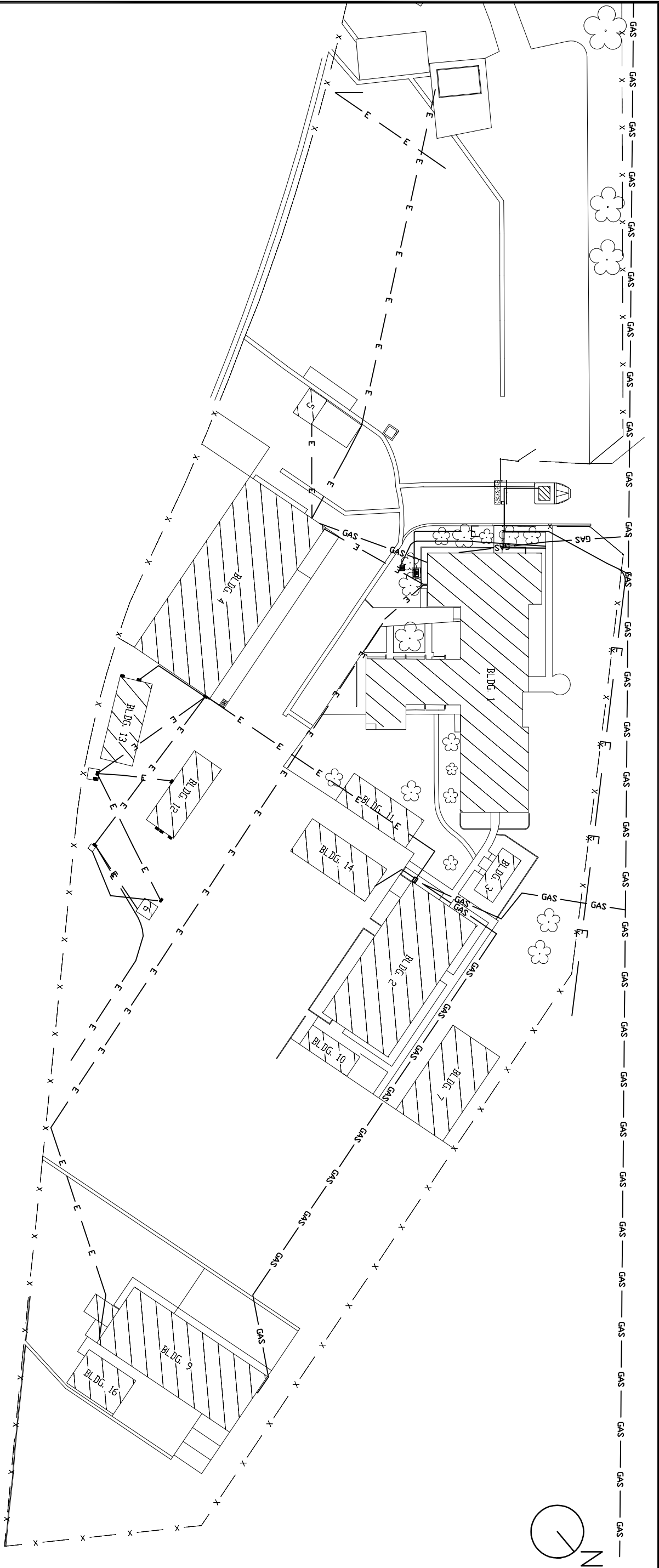


INSTALLATION UTILITY MAP
WATER AND SEWER DISTRIBUTION
3900 ROSEVILLE ROAD
NORTH HIGHLANDS AIR NATIONAL GUARD STATION CALIFORNIA



| ISSUE/REVISION | | | | | | | | | |
|----------------|--|--|--|--|--|--|--|--|--|
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DRAWN M. BORDA
JOB RZ10042998
DRAWING
C1.01



SCALE: 1" = 75'

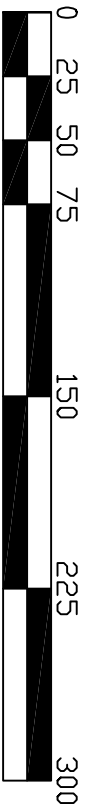
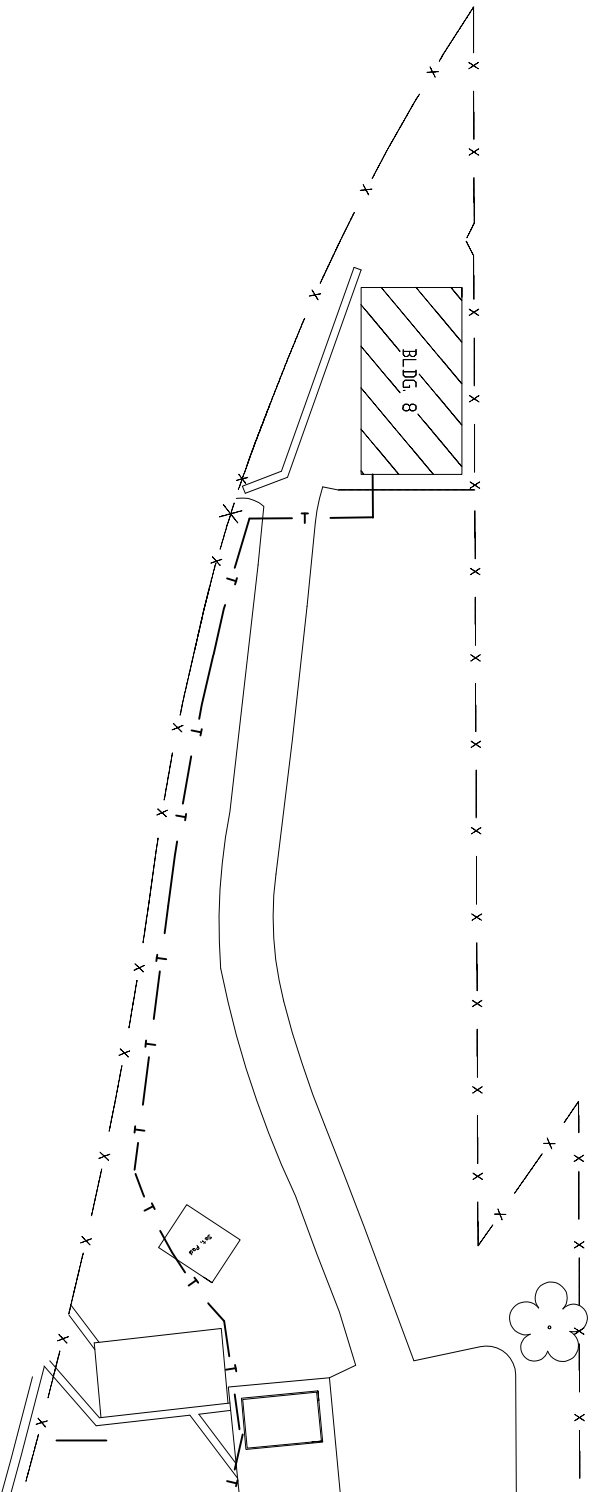
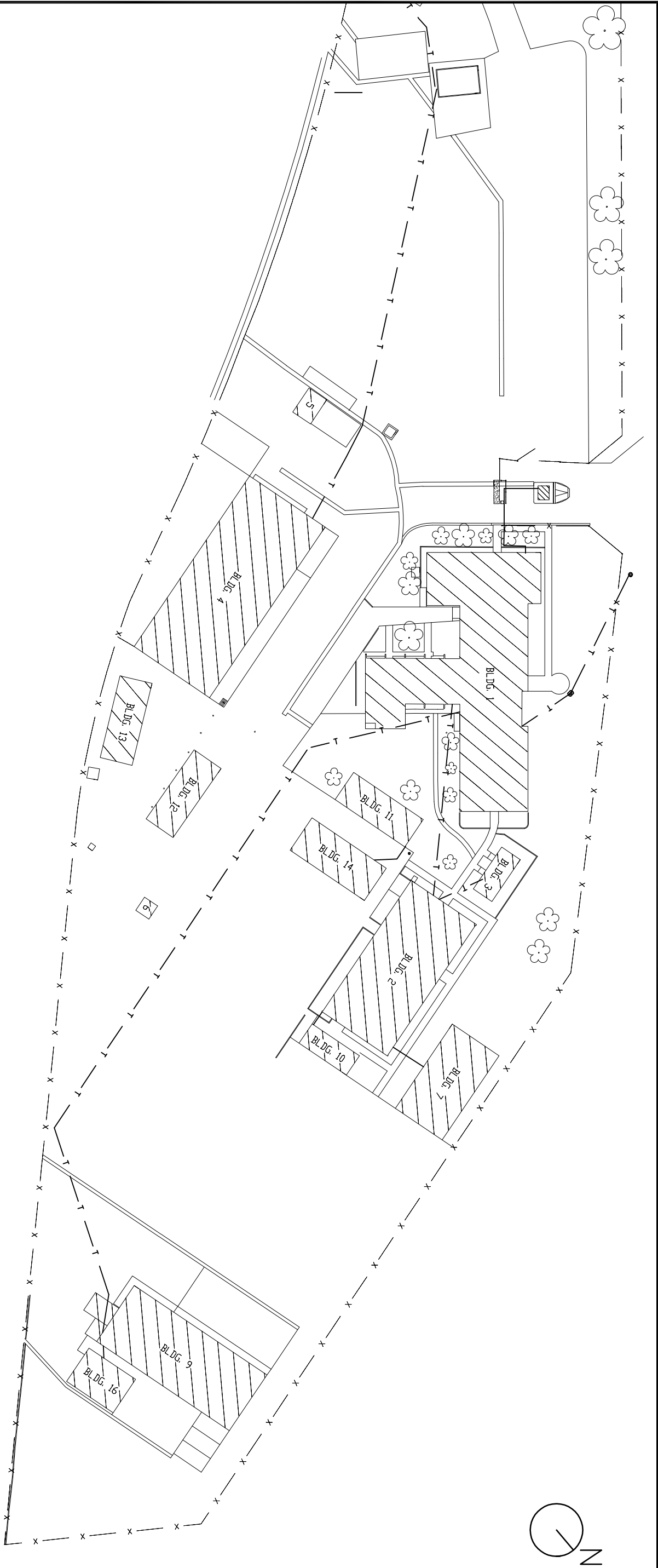


INSTALLATION UTILITY MAP
GAS AND ELECTRIC DISTRIBUTION
3900 ROSEVILLE ROAD
NORTH HIGHLANDS AIR NATIONAL GUARD STATION CALIFORNIA



| ISSUE /REVISION | |
|-----------------|-----|
| ORIGINAL | MMB |
| 24 APR 01 | |
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SCALE: 1" = 75'
DRAWN: M BORBA
JOB: 8210042998
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SCALE: 1" = 75'

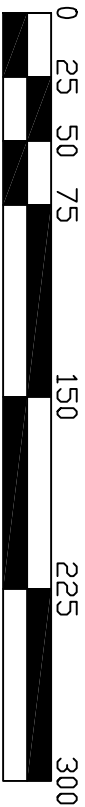
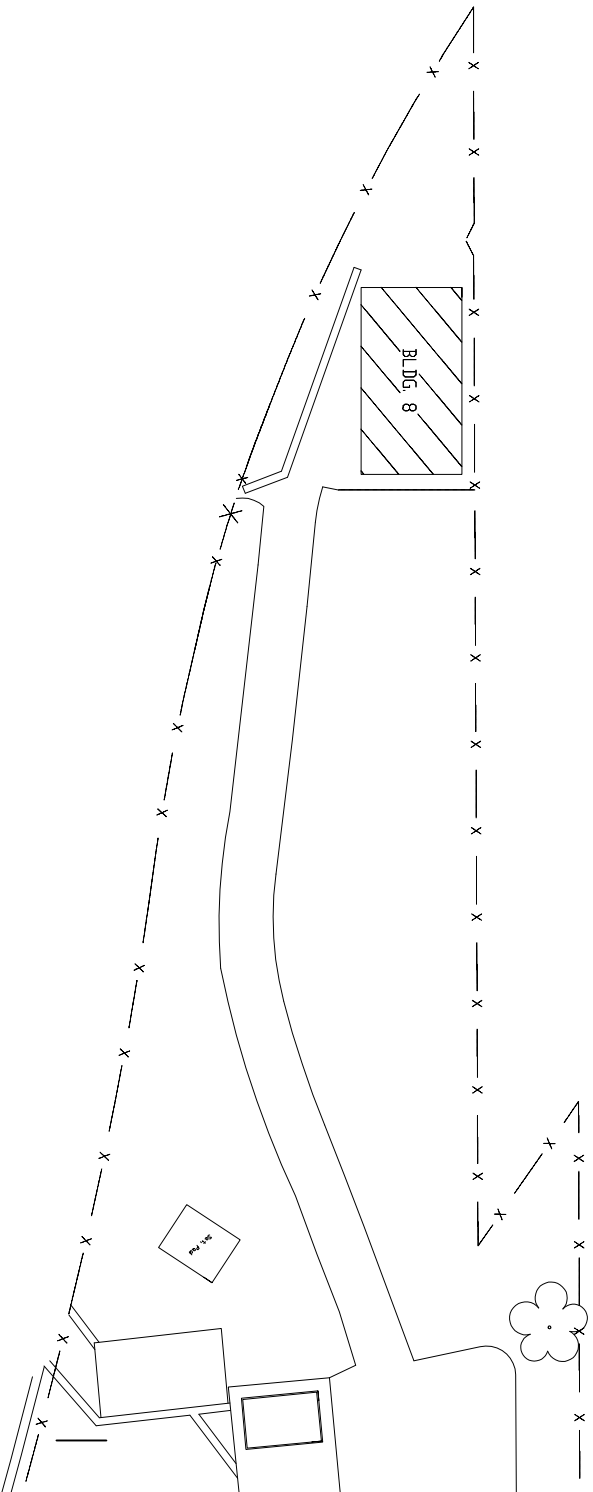
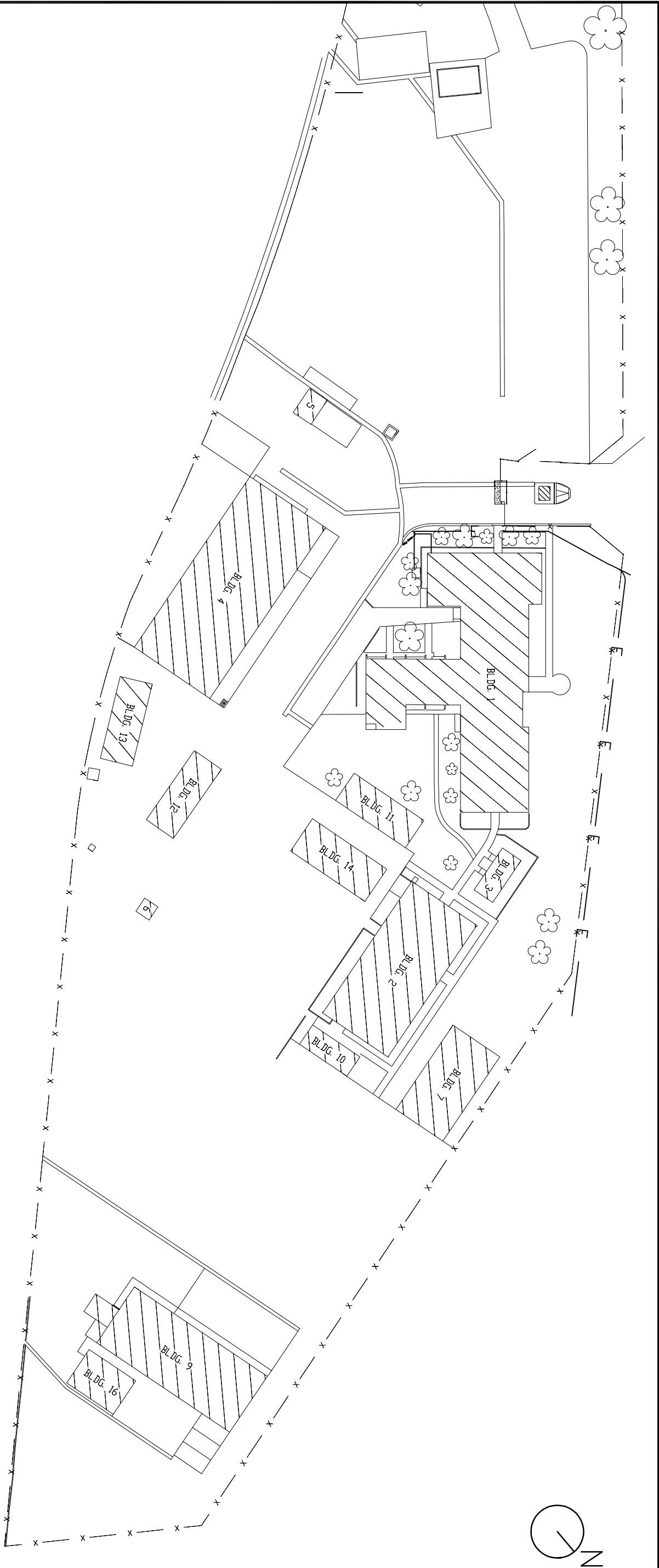


INSTALLATION UTILITY MAP
COMMUNICATIONS DISTRIBUTION
3900 ROSEVILLE ROAD
NORTH HIGHLANDS AIR NATIONAL GUARD STATION CALIFORNIA



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DATE 24 APR 01
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JOB 8210042998
DRAWING
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SCALE: 1" = 75'



INSTALLATION UTILITY MAP
STORM DRAIN DISTRIBUTION
3900 ROSEVILLE ROAD
NORTH HIGHLANDS AIR NATIONAL GUARD STATION CALIFORNIA



| ISSUE /REVISION | |
|-----------------|-----|
| ORIGINAL | MMB |
| 24 APR 01 | |
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DATE 24 APR 01

SCALE 1" = 75'

DRAWN M BORBA

JOB 8210042998

DRAWING

C4.01

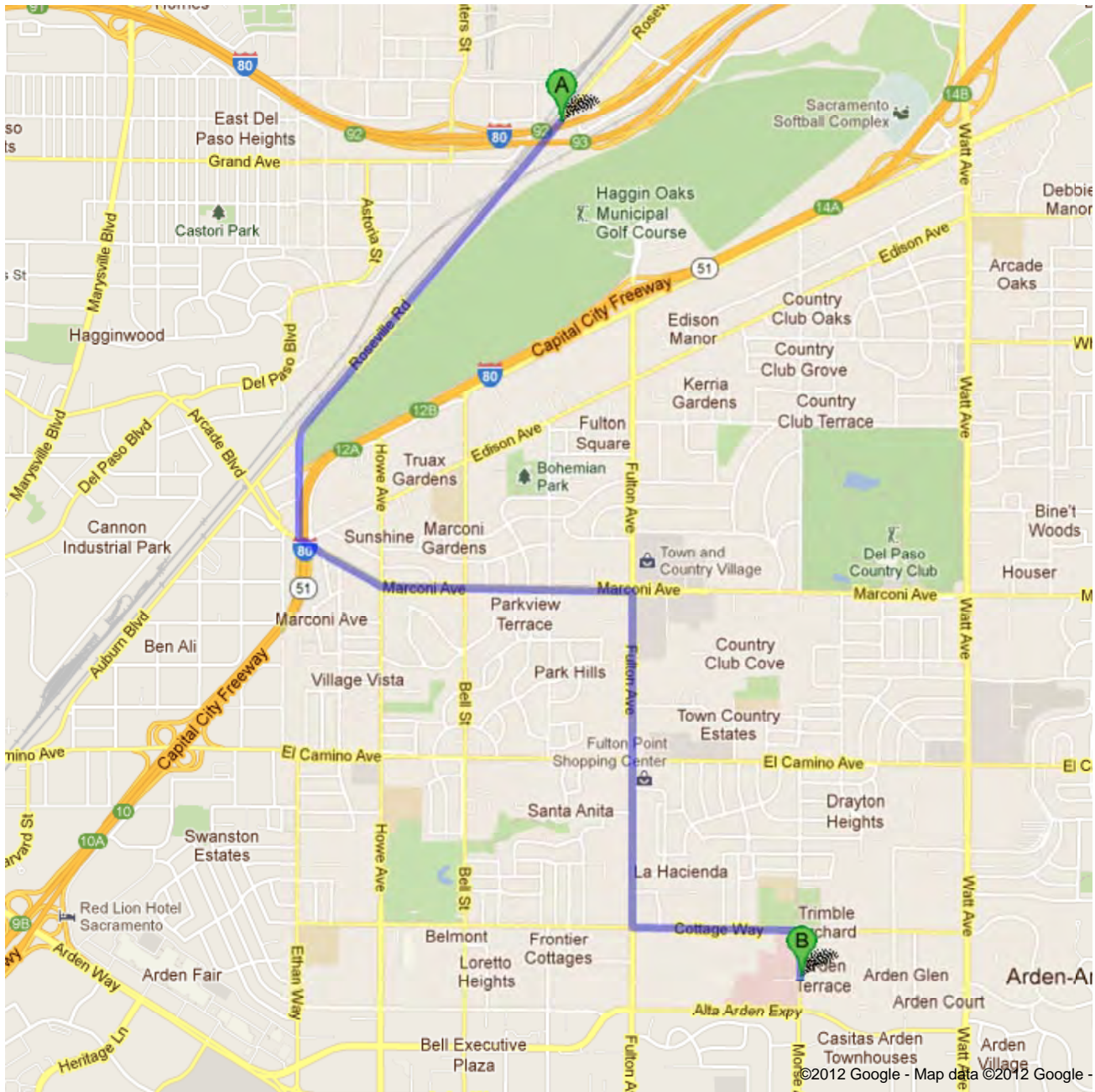
1 OF 1 SHEETS

HOSPITAL DIRECTIONS

**Directions to Kaiser Permanente Medical Center**

2025 Morse Ave # 3B, Sacramento, CA 95825 -

(916) 973-6651

4.2 mi – about 12 mins

**US Air National Guard Recruit**

3900 Roseville Rd, North Highlands, CA 95660

- | | |
|---|--------------|
| 1. Head southwest on Roseville Rd toward Connie Dr | go 1.2 mi |
| About 2 mins | total 1.2 mi |



- | | |
|--------------------------------------|--------------|
| 2. Slight left onto Connie Dr | go 0.3 mi |
| About 2 mins | total 1.5 mi |



- | | |
|--------------------------------------|--------------|
| 3. Turn left onto Marconi Ave | go 1.0 mi |
| About 4 mins | total 2.6 mi |



- | | |
|--------------------------------------|--------------|
| 4. Turn right onto Fulton Ave | go 1.0 mi |
| About 3 mins | total 3.6 mi |



- | | |
|--------------------------------------|--------------|
| 5. Turn left onto Cottage Way | go 0.5 mi |
| About 1 min | total 4.1 mi |



- | | |
|---|--------------|
| 6. Take the 2nd right onto Morse Ave | go 0.1 mi |
| Destination will be on the right | total 4.2 mi |

**Kaiser Permanente Medical Center**

2025 Morse Ave # 3B, Sacramento, CA 95825 - (916) 973-6651

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Map data ©2012 Google

Directions weren't right? Please find your route on maps.google.com and click "Report a problem" at the bottom left.

JOB HAZARD ANALYSIS



North America Job Hazard Analysis Operating Vehicles

Project Name: ANG Western CRP, North Highlands ANG
Project Number: 0160280.09
Job / Task Name: Supplemental SI
JHA No.: 5

| Document Routing | |
|------------------|---|
| FSO | Retain copy in site health & safety file, amend to HASP as necessary. |
| Project Manager | Retain copy in the office health & safety file, amend to HASP as necessary. |

| | |
|----------------------|---|
| Instructions: | This JHA has been developed and approved by the North America Safety Team. Prior to conducting fieldwork, site-specific hazards related to this task must be incorporated by the project team. Once completed, the JHA should be reviewed regularly with site personnel who will be performing this task. |
|----------------------|---|

| | |
|--------------------------|---|
| Task Description: | Operating vehicles for work, including personal vehicles, company-owned non-commercial small trucks, and rental vehicles. |
|--------------------------|---|

| Hazard Analysis: | |
|-------------------------------|--|
| Task Step | Hazard |
| Inspect the Vehicle | Tire pressure, brakes, steering, headlights and other vehicle equipment malfunction can contribute to vehicle accidents and property damage. Loose articles inside the vehicle and carried in truck beds or on trailers can shift and cause distractions or traffic accidents. |
| Get in and out of the Vehicle | Hands, hair, or loose clothing can be caught in doors, trunk covers, and other vehicle equipment, causing injury. |
| | Control Measures Use the "ERM Vehicle Safety Form" to document daily inspections of the vehicle. In certain cases, a client-required form may be used instead. Do not operate any vehicle if its safety is in question. During vehicle inspection make sure any loose articles either inside the vehicle or in truck beds/on trailers are well-secured. When entering or exiting a vehicle, pay attention to what you are doing. ERM has had incidents occur simply from being rushed and not paying attention during vehicle entry/exit. |



North America Job Hazard Analysis Operating Vehicles

Project Name: ANG Western CRP, North Highlands ANG

Project Number: 0160280.09

Job / Task Name: Supplemental SI

JHA No.: 5

| Task Step | Hazard | Control Measures |
|--------------------------|---|--|
| Drive the Vehicle | Operating a vehicle presents many different hazards to employees that must be simultaneously mitigated. | <p>Only allow ERM employees to drive motor vehicles (authorized employees with a current drivers license).</p> <p>Before moving vehicles always put your seat belt on, and stop using handheld electronics. Make sure any food or drink is secured and any electronics are programmed (GPS).</p> <p>When moving vehicles, follow all posted speed limits and posted signs. Do not pick up hitch-hikers, and never transport people in truck beds.</p> |
| Driving when Fatigued | Operating a vehicle after a full day of work or when you are fatigued drastically decreases focus and response time, and increasing the risk of being involved in a vehicle accident. | <p>Avoid driving more than 8 hours in one workday. If the number of hours driving to/from a jobsite combined with the number of hours to be worked on the site will equal more than 14 total hours, alternate arrangements should be arranged. Be aware of your fatigue level while driving and stop to rest if you feel overly tired.</p> |
| Stay Focused on the Road | Doing anything that distracts you from the road for more than 2 seconds highly increases the risk of being involved in a vehicle accident. In particular, driver inattention due to hand-held mobile phone use is currently thought to be responsible for approximately 80% of all vehicle accidents. | <p>Do not operate a hand-held mobile phone while driving. Use a hands-free mobile solution instead, such as a Bluetooth headset or hardwired earpiece. In some cases, all mobile phone use while driving (including answering and dialing), may be prohibited by our client.</p> <p>Do not perform activities while driving that will take your attention off the road for more than 2 seconds. A few of these types of activities could include programming GPS, applying makeup, changing the radio, or eating while driving. When these sorts of activities must be performed, pull to the side of the road and stop.</p> |



North America Job Hazard Analysis Operating Vehicles

Project Name: ANG Western CRP, North Highlands ANG

Project Number: 0160280.09

Job / Task Name: Supplemental SI

JHA No.: 5

| Task Step | Hazard | Control Measures |
|---|--|--|
| Pull a Trailer | Many drivers are unfamiliar or inexperienced with pulling trailers, increasing the risk of being involved in a vehicle accident. | <p>If you are uncomfortable pulling a trailer do not do so. Arrange for an alternate, experienced driver. Be aware that it takes longer to speed up and slow down when pulling a trailer, and that visibility may be reduced significantly.</p> <p>Make sure your vehicle is capable to pull the weight of the trailer and its contents. Inspect the trailer to ensure brake and turn signals work properly and in concert with the main vehicles signals, and that tire pressure is acceptable. Make sure trailer is attached securely to the main vehicle and the safety chain or other backup attachment device is in-place. Evenly distribute weight on any trailers pulled.</p> |
| Leaving the Vehicle | Leaving personal valuables and company equipment/ documents in abandoned vehicles may attract thieves. | Turn off the engine and lock any vehicle being left for even a short period of time when not on a secure jobsite. If the vehicle will be left for long periods or overnight, remove any company documents, computers, and equipment, personal valuables, or any items that would attract thieves. |
| Report and Document Vehicle Accidents and Property Damage | Improper documentation of vehicle accidents and property damage caused by vehicle operation place ERM at risk. | <p>No matter how minor a vehicle accident or property damage event is, report it as a safety event.</p> <p>If involved in a vehicle accident, always call the police so a report will be available, to protect your liability, and to protect ERM liability. Take as many pictures as you can of the accident scene if you can do so without placing yourself in further danger.</p> |



North America Job Hazard Analysis Operating Vehicles

Project Name: ANG Western CRP, North Highlands ANG

Project Number: 0160280.09

Job / Task Name: Supplemental SI

JHA No.: 5

| Task Step | Hazard | Control Measures |
|----------------------------|--|---|
| Drive a Commercial Vehicle | Driving vehicles alone or in combination (with a trailer, for example) with Gross Motor Vehicle Weight (GMVW) greater than 10,000 pounds carries additional regulatory requirements. Not addressing these requirements places ERM at risk. | Check the plaque on the inside of the driver-side door for the GMVW. If the weight is greater than 10,000 pounds contact a member of the North America Safety Team for further assistance. Do not operate the vehicle unless you have received proper training and have required supplies (such as logbooks). |
| Rent a Vehicle | Only certain car rental agencies have negotiated contracts, rates, and insurance coverage with ERM. Renting a vehicle from another agency exposes you and ERM to unnecessary liability and risk. | If possible, rent vehicles using the Cain Travel website, and from an ERM authorized car rental agency. If not possible to rent from one of these, you must purchase collision damage and personal accident insurance at the time of rental. Currently, authorized rental car agencies include: <ul style="list-style-type: none">• Enterprise Car Rental• Hertz Car Rental |

Personal Protective Equipment Required for this Task:

| Type | Description |
|---|---|
| Vehicle Safety Kit for Personal or Company-Owned Vehicles | Includes small fire extinguisher (ABC), first aid kit, spare tire/jack, jumper cables, flashlight, flares or lighted triangles, reflective vest, and disposable or digital camera (for documenting accidents) |

Training Required for this Task:

| Type | Description |
|------------------|--|
| ERM Safe Driving | E-learning course instructing employees on ERM vehicle safety policy and practice. |

Forms Associated with this Task:

| Type | Description |
|-------------------------|--|
| ERM Vehicle Safety Form | Includes items that should be inspected regularly on motorized vehicles. |



North America Job Hazard Analysis Operating Vehicles

Project Name: ANG Western CRP, North Highlands ANG
Project Number: 0160280.09
Job / Task Name: Supplemental SI
JHA No.: 5

Site-Specific Job Hazard Analysis Completed by:

| Name | Date |
|------|------|
| | |



North America Job Hazard Analysis Work in Active Facilities

Project Name: ANG Western CRP, North Highlands ANG
Project Number: 0160280.09
Job / Task Name: Supplemental SI
JHA No.: 3

| Document Routing | |
|------------------|---|
| FSO | Retain copy in site health & safety file, amend to HASP as necessary. |
| Project Manager | Retain copy in the office health & safety file, amend to HASP as necessary. |

| | |
|----------------------|---|
| Instructions: | This JHA has been developed and approved by the North America Safety Team. Prior to conducting fieldwork, site-specific hazards related to this task must be incorporated by the project team. Once completed, the JHA should be reviewed regularly with site personnel who will be performing this task. |
|----------------------|---|

Task Description:

| |
|---|
| General guidelines for working safely in facilities where active operations are occurring and other personnel are performing work |
|---|

Hazard Analysis:

| Task Step | Hazard | Control Measures |
|-------------------------------|---|--|
| Plan ahead for the site visit | Operational and safety items unplanned for prior to visiting the site can cause significant delay | Know ahead of time where any specific parking and entry locations are, as well as training or drug testing required prior to site entry. Ask your site contact/escort to explain any pre-entry requirements. Have the following personal protective equipment with you and wear it while working: <ul style="list-style-type: none">• Steel-toe boots• Long pants• Safety glasses• Hard hat• Safety goggles (if splash hazards exist)• Chemical resistant gloves (if needed) |



North America Job Hazard Analysis Work in Active Facilities

Project Name: ANG Western CRP, North Highlands ANG

Project Number: 0160280.09

Job / Task Name: Supplemental SI

JHA No.: 3

| Task Step | Hazard | Control Measures |
|-------------------|---|--|
| Perform Site Work | Employees may encounter moving vehicles/trucks/forklifts. Employees may be exposed to chemicals. There may be uneven terrain, unguarded holes or wall openings, and other slip, trip, and fall hazards. A site emergency may happen while you are working onsite. You may encounter confined spaces. High noise levels may be present. Highly mechanized equipment may be present in the area, posing electrical hazards and pinch hazards. | Be aware of traffic patterns on the site, including designated forklift lanes. Include chemicals known to pose health risks in your WARN HASP for the site, and determine their exposure limits. For any fieldwork, wear steel-toe boots with enough ankle support. If an area is overly cluttered, poorly lit, or posted signs indicate these hazards, avoid the area if possible. List the facility emergency planning information in the WARN HASP and have a copy of it with you at all times. Stay with your site escort at all times. If you encounter posted signs stating "DANGER - Confined Space - Do Not Enter", do not enter the space. Be alert to other areas where entry or exit appears to be limited. If a noise dosimeter is not available, use the following rule of thumb. If you are standing close to another person and have to raise your voice to be understood by them, hearing protection is needed. Do not touch plant equipment unless you verify it is not powered and permission has been given to you. |



North America Job Hazard Analysis Work in Active Facilities

Project Name: ANG Western CRP, North Highlands ANG

Project Number: 0160280.09

Job / Task Name: Supplemental SI

JHA No.: 3

| Task Step | Hazard | Control Measures |
|---------------|---|---|
| Working Alone | Any injury or illness that occurs to an employee working alone can become very serious if they are not able to reach another person for assistance. | <p>If a Level 2 or 3 WARN HASP has been prepared, do not work alone.</p> <p>If working alone is authorized, establish a communication plan in your WARN HASP and follow it completely. Also stay in close communication with your site contact/escort.</p> <p>If you become ill or injured when working alone, immediately call 911 for serious emergencies, or WorkCare's Incident Intervention service for other types of illnesses or injuries. The WorkCare Incident Intervention phone number is 1-800-IL-XPRTS. Know the contact information and route to the nearest medical facility.</p> |

Personal Protective Equipment Required for this Task:

| Type | Description |
|------|-------------|
| None | |

Training Required for this Task:

| Type | Description |
|------|-------------|
| None | |

Forms Associated with this Task:

| Type | Description |
|--|--|
| Work in Active Facilities Checklist | Checklist covering items associated with working in active facilities. The checklist may be used to perform pre-job risk assessment. |
| WorkCare Incident Intervention Wallet Card | Wallet-sized card to be carried by all ERM employees containing contact information for the Incident Intervention service. |



North America Job Hazard Analysis Work in Active Facilities

Project Name: ANG Western CRP, North Highlands ANG
Project Number: 0160280.09
Job / Task Name: Supplemental SI
JHA No.: 3

| | |
|---|--|
| WorkCare Incident Intervention Wall Poster | 11" x 17" poster containing contact information for the Incident Intervention service. This poster should be displayed in each permanent office location and in short-term field office locations. |
|---|--|

Site-Specific Job Hazard Analysis Completed by:

| Name | Date |
|------|------|
| | |



North America Job Hazard Analysis ERM Actions During Subsurface Clearance and Drilling

Project Name: ANG Western CRP, North Highlands ANG
Project Number: 0160280.09
Job / Task Name: Supplemental SI
JHA No.: 6

| Document Routing | |
|------------------|---|
| FSO | Retain copy in site health & safety file, amend to HASP as necessary. |
| Project Manager | Retain copy in the office health & safety file, amend to HASP as necessary. |

| | |
|----------------------|---|
| Instructions: | This JHA has been developed and approved by the North America Safety Team. Prior to conducting fieldwork, site-specific hazards related to this task must be incorporated by the project team. Once completed, the JHA should be reviewed regularly with site personnel who will be performing this task. |
|----------------------|---|

Task Description:

General guidelines for working safely when performing any ground penetrating activities (excluding surface soil sampling) and ERM personnel activities during overseeing drilling.

Hazard Analysis:

| Task Step | Hazard | Control Measures |
|---|---|---|
| Identify a Client Contact Person | Client contacts that are not familiar with the site layout could cause critical information to be missed during safety planning. | Determine degree of knowledge of our client contact by evaluating their current job duties at the site, length of time they have worked at the site, and time in their current job. If the ERM team does not feel comfortable with the level of experience of our client contact, take additional measures to ensure all pertinent subsurface utilities and services information is gathered. |
| Engage Subcontractors | Subcontractors who have not been evaluated against ERM minimum safety standards or who do not meet minimum safety standards may pose more risk. | Use only ERM subcontractors who are identified as having met our minimum safety standards. In cases where using an already-qualified subcontractor is not possible, ensure extra precautions are taken to provide safety oversight to the work. |
| Appoint an ERM Subsurface Clearance "Experienced Person" to the project | ERM employees who are not experienced with SSC issues may not recognize critical zones or clues to other site utilities/services. | Ensure a "SSC Experienced Person" is assigned to the project to provide oversight of ground penetrations and to mentor less experienced ERM employees. |



North America Job Hazard Analysis ERM Actions During Subsurface Clearance and Drilling

Project Name: ANG Western CRP, North Highlands ANG

Project Number: 0160280.09

Job / Task Name: Supplemental SI

JHA No.: 6

| Task Step | Hazard | Control Measures |
|---|--|--|
| Gather site-specific subsurface information | Incomplete or inaccurate site utility/service drawings may lead the ERM project team to incorrect conclusions regarding what utilities/services are onsite. | Obtain the most recent "as-built" drawings and additional site information such as easements, rights-of-way, historical plot plans, etc. to assist making decisions about other actions that will be required at the site. |
| Develop the HASP | Using incorrect documents in safety planning may lead to not considering all pertinent information. | A Level 2 WARN HASP for Intrusive Work (minimum) must be used when performing any ground penetrations, with the exception of surface soil sampling. The Level 2 HASP contains a "Site Services Model" that ERM uses to evaluate SSC hazards. |
| Develop the Site Services Model | Critical zones and a whole-site view of utilities and services at the site are more difficult to do if not put into the Site Services Model. | Use the Site Services Model to identify gaps in knowledge from all drawings and other verbal information from our client contact. Identify locations of key isolation and shutoffs closest to the work area for each type of utility/service. |
| Make Preliminary Determinations | Not recognizing or identifying critical zones poses great hazard to ERM employees in the field from contact with electricity or other utilities. | Establish critical zones and excavation buffers (if needed) for the work. Initial critical zone determinations may change in the field but are a good starting point in hazard identification. |
| Identify Preliminary Ground Disturbance Locations | Planning ground disturbance locations inside critical zones poses great hazard to ERM employees in the field from contact with electricity or other utilities. | Ensure critical zones have been identified using the Site Services Model and then identify locations outside those critical zones up-front, if possible. If a ground disturbance inside a critical zone is absolutely necessary, notify the site PIC and obtain guidance from him/her before proceeding. |
| Public and/or Private Utility Markout | Not having utilities marked may lead to a subsurface clearance strike. | Contact public and private utility markout services giving them enough time to respond. A minimum of 24-hour notification to utility locators is required in most states, and may vary higher in some states. |
| Conduct the Site Walk | Inexperienced people conducting the site walk may miss pertinent information regarding utilities and/or services. | The "SSC Experienced Person" must lead the site walk and should be accompanied by our client contact. Each ground disturbance location should be approved by our client contact (written approval preferred, verbal approval acceptable). |



North America Job Hazard Analysis ERM Actions During Subsurface Clearance and Drilling

Project Name: ANG Western CRP, North Highlands ANG

Project Number: 0160280.09

Job / Task Name: Supplemental SI

JHA No.: 6

| Task Step | Hazard | Control Measures |
|--|---|---|
| Inspect Each Ground Disturbance Location | Inexperienced people conducting inspection may miss pertinent information regarding utilities and/or services. | The "SSC Experienced Person" must lead inspection of each Ground Disturbance Location. Any visual clues of subsurface obstruction/utilities should be documented. Critical zones may have to be reassessed at this point. Use the SSC Checklist to document this inspection for each point inside a critical zone, at a minimum. |
| Finalize Critical Zone Determinations | Not performing this verification step in the field may lead to a SSC strike. | Use information gathered during pre-planning, utility markout, and site walk/inspection to verify critical zones that have been previously established. Revise critical zones as necessary. Use the SSC Checklist to document points inside critical zones. If points are confirmed inside critical zones, either step out and relocate the ground disturbance location, or contact the PIC for additional guidance. |
| Oversee setup of drilling equipment | Overhead electrical/other lines may come in contact with drill rigs. Materials stored in the vicinity of drill rigs may pose various hazards to employees. | Ensure drill rigs are set up in areas where they will not contact overhead lines when being positioned. The minimum distance for drill rig clearance is 25 feet unless special permission is granted by the utility company. When a drill rig must be maneuvered in tight quarters, the presence of a second person is required to ensure adequate clearance. If backing-up is required, two ground guides will be used: one in the direction the rig is moving and the other in the operator's normal field of vision. Move tools, materials, cords, hoses, and debris to prevent trip hazards and contact with moving drill rig parts. Secure tools and equipment subject to displacement or falling. Store any flammable materials away from ignition sources and in approved containers. |



North America Job Hazard Analysis ERM Actions During Subsurface Clearance and Drilling

Project Name: ANG Western CRP, North Highlands ANG

Project Number: 0160280.09

Job / Task Name: Supplemental SI

JHA No.: 6

| Task Step | Hazard | Control Measures |
|---|---|--|
| Physically Clear all Ground Disturbance Locations | <p>Employees performing physical clearance could contact underground utility/service lines.</p> <p>Drill rig could damage electrical/utility/service lines if not physically cleared first.</p> | <p>Use cable avoidance tools at each location that must be physically cleared (OSHA requirement). If using a hand-auger, ensure insulated handles are in-place before their use.</p> <p>Mechanical ground penetration should not commence until a ground disturbance location is physically cleared. In certain situations drilling may occur without physical clearance - consult with the project PIC prior to making this determination.</p> |
| Commence Drilling Operations | <p>Rotating equipment could pull employees into equipment.</p> <p>Poorly functioning drill-rig equipment could expose employees to hazardous conditions.</p> <p>Noisy environments may make it difficult to communicate by vocal means.</p> | <p>Do not wear loose or frayed clothing, loose long hair, or loose jewelry while working around rotating equipment. Tuck shirt-tails into pants. Never walk directly behind or beside drill rigs without the drill rig operator's knowledge. Keep all non-essential personnel out of the drill rig work area.</p> <p>Ensure drill rigs and other machinery used is inspected daily by competent, qualified individuals. Instruct drill rig operators to report any abnormalities such as equipment failure, oozing liquids or unusual odors so they can be dealt with before proceeding with work. Do not eat, drink, or smoke near the drill rig.</p> <p>Wear hearing protection at all times when in the vicinity of the drill rig, or when you must raise your voice to be heard by co-workers. Maintain visual contact with the drill rig operator at all times and establish hand-signal communications for use when verbal communication is difficult.</p> |



North America Job Hazard Analysis ERM Actions During Subsurface Clearance and Drilling

Project Name: ANG Western CRP, North Highlands ANG
Project Number: 0160280.09
Job / Task Name: Supplemental SI
JHA No.: 6

| Task Step | Hazard | Control Measures |
|------------------------------|---|---|
| Complete Drilling Operations | Equipment allowed to remain running poses pinch-point and potential explosion hazards to employees. | Shut down drill rigs before repairing or lubricating parts (except those that must be in motion for lubrication). Shut down mechanical equipment prior to and during fueling operations. When refueling or transferring fuel, containers and equipment must be bonded to prevent the buildup of static electricity. |

Personal Protective Equipment Required for this Task:

| Type | Description |
|-----------------------|---|
| Insulated hand-augers | Hand-augers fitted with rubber handles, or other non-conductive material. |

Training Required for this Task:

| Type | Description |
|------------------------|--|
| SSC Classroom Training | Initial classroom training detailing the ERM subsurface clearance process, tools, and forms. |
| SSC Experienced Person | At least one must be present on all sites involving SSC. The Experienced Person will both give SSC expertise in project execution and mentor less experienced employees. |

Forms Associated with this Task:

| Type | Description |
|---------------------------------|---|
| SSC Checklist | Checklist detailing the ERM SSC process, and providing tools to ensure critical zones and excavation buffers are properly identified and validated in the field. |
| SSC Mentorship Card | The SSC Mentorship Card provides Experienced Persons with topics to be covered with less experienced employees on SSC sites, and also documents mentoring of the less experienced employees. |
| Daily Drill Rig Inspection Form | Form required to be used by ERM subcontractors to document daily inspection of drill rigs. This form should be provided by the drill rig operating company. Completed forms should be kept with the |



North America Job Hazard Analysis

ERM Actions During Subsurface Clearance and Drilling

Project Name: ANG Western CRP, North Highlands ANG
Project Number: 0160280.09
Job / Task Name: Supplemental SI
JHA No.: 6

HASP and filed in project files.

Site-Specific Job Hazard Analysis Completed by:

| Name | Date |
|------|------|
| | |



North America Job Hazard Analysis Work in High Noise Environments

Project Name: ANG Western CRP, North Highlands ANG
Project Number: 0160280.09
Job / Task Name: Supplemental SI
JHA No.: 8

| Document Routing | |
|------------------|---|
| FSO | Retain copy in site health & safety file, amend to HASP as necessary. |
| Project Manager | Retain copy in the office health & safety file, amend to HASP as necessary. |

| | |
|----------------------|---|
| Instructions: | This JHA has been developed and approved by the North America Safety Team. Prior to conducting fieldwork, site-specific hazards related to this task must be incorporated by the project team. Once completed, the JHA should be reviewed regularly with site personnel who will be performing this task. |
|----------------------|---|

Task Description:

| |
|---|
| Guidelines for safe work in any environment with elevated noise levels. |
|---|

Hazard Analysis:

| Task Step | Hazard | Control Measures |
|------------------|---|--|
| Prepare for Work | Not having hearing protection or noise monitoring equipment could expose employees to unknown levels of elevated noise. | For work environments known or suspected to present elevated noise hazards, ensure hearing protection is procured and available at the jobsite. For any employee working on the site who has not attended hearing conservation training within the past year, review this JHA with them and document their training. Determine whether noise monitoring has been done on other projects with similar scopes of work by contacting your Safety Team representative. If work on the project will last 30 days or more, procure a noise dosimeter and perform personnel monitoring at the site to document noise levels. |
| Conduct the Work | Damage to hearing from sustained elevated noise or intermittent impact noise. | If noise dosimetry is not being conducted at the project, use the following rule of thumb to determine whether hearing protection is required: If you are standing within 3 feet of another person and have to raise your voice to be understood by them when talking, hearing protection must be worn. |



North America Job Hazard Analysis Work in High Noise Environments

Project Name: ANG Western CRP, North Highlands ANG

Project Number: 0160280.09

Job / Task Name: Supplemental SI

JHA No.: 8

| Task Step | Hazard | Control Measures |
|-------------------------------------|--|--|
| Report Dosimetry Monitoring Results | Lack of consolidated noise dosimetry monitoring results can result in other employees on different projects not being aware of typical noise levels. | OSHA allows noise dosimetry monitoring results collected when working with specific equipment to be used on any other project site where the same equipment is in-use. Report dosimetry monitoring results to your Safety Team representative so they can be included in a North America-wide listing of typical noise levels. |

Personal Protective Equipment Required for this Task:

| Type | Description |
|--------------------|-------------|
| Hearing Protection | |

Training Required for this Task:

| Type | Description |
|----------------------|-------------|
| Hearing Conservation | |

Forms Associated with this Task:

| Type | Description |
|------|-------------|
| None | |

Site-Specific Job Hazard Analysis Completed by:

| Name | Date |
|------|------|
| | |



North America Job Hazard Analysis Work in High Noise Environments

Project Name: ANG Western CRP, North Highlands ANG
Project Number: 0160280.09
Job / Task Name: Supplemental SI
JHA No.: 8

| Document Routing | |
|------------------|---|
| FSO | Retain copy in site health & safety file, amend to HASP as necessary. |
| Project Manager | Retain copy in the office health & safety file, amend to HASP as necessary. |

| | |
|----------------------|---|
| Instructions: | This JHA has been developed and approved by the North America Safety Team. Prior to conducting fieldwork, site-specific hazards related to this task must be incorporated by the project team. Once completed, the JHA should be reviewed regularly with site personnel who will be performing this task. |
|----------------------|---|

Task Description:

| |
|---|
| Guidelines for safe work in any environment with elevated noise levels. |
|---|

Hazard Analysis:

| Task Step | Hazard | Control Measures |
|------------------|---|--|
| Prepare for Work | Not having hearing protection or noise monitoring equipment could expose employees to unknown levels of elevated noise. | For work environments known or suspected to present elevated noise hazards, ensure hearing protection is procured and available at the jobsite. For any employee working on the site who has not attended hearing conservation training within the past year, review this JHA with them and document their training. Determine whether noise monitoring has been done on other projects with similar scopes of work by contacting your Safety Team representative. If work on the project will last 30 days or more, procure a noise dosimeter and perform personnel monitoring at the site to document noise levels. |
| Conduct the Work | Damage to hearing from sustained elevated noise or intermittent impact noise. | If noise dosimetry is not being conducted at the project, use the following rule of thumb to determine whether hearing protection is required: If you are standing within 3 feet of another person and have to raise your voice to be understood by them when talking, hearing protection must be worn. |



North America Job Hazard Analysis Work in High Noise Environments

Project Name: ANG Western CRP, North Highlands ANG
Project Number: 0160280.09
Job / Task Name: Supplemental SI
JHA No.: 8

| Task Step | Hazard | Control Measures |
|-------------------------------------|--|--|
| Report Dosimetry Monitoring Results | Lack of consolidated noise dosimetry monitoring results can result in other employees on different projects not being aware of typical noise levels. | OSHA allows noise dosimetry monitoring results collected when working with specific equipment to be used on any other project site where the same equipment is in-use. Report dosimetry monitoring results to your Safety Team representative so they can be included in a North America-wide listing of typical noise levels. |

Personal Protective Equipment Required for this Task:

| Type | Description |
|--------------------|-------------|
| Hearing Protection | |

Training Required for this Task:

| Type | Description |
|----------------------|-------------|
| Hearing Conservation | |

Forms Associated with this Task:

| Type | Description |
|------|-------------|
| None | |

Site-Specific Job Hazard Analysis Completed by:

| Name | Date |
|------|------|
| | |



North America Job Hazard Analysis Hazard Communication

| |
|--|
| Project Name: ANG Western CRP, North Highlands ANG |
| Project Number: 0160280.09 |
| Job / Task Name: Supplemental SI |
| JHA No.: 10 |

| Document Routing | |
|------------------|---|
| FSO | Retain copy in site health & safety file, amend to HASP as necessary. |
| Project Manager | Retain copy in the office health & safety file, amend to HASP as necessary. |

| | |
|----------------------|---|
| Instructions: | This JHA has been developed and approved by the North America Safety Team. Prior to conducting fieldwork, site-specific hazards related to this task must be incorporated by the project team. Once completed, the JHA should be reviewed regularly with site personnel who will be performing this task. |
|----------------------|---|

| |
|--|
| Task Description: |
| Guidelines for communicating hazards posed by the storage and/or use of chemicals. |

| Hazard Analysis: | |
|--|---|
| Task Step | Hazard |
| Storing Chemicals in the Office Setting | Chemicals stored in ERM offices or Field Project Offices may lead to employee chemical exposure, chemical spills, or fires from flammable materials. |
| | Control Measures If at all possible, do not store chemicals in the office environment. For each chemical product used by ERM employees or stored in an ERM field or office location, a MSDS sheet must be obtained and kept on-file. A chemical inventory list must be prepared and updated as new or different chemicals are procured. Chemical containers must be labeled in accordance with OSHA regulations. Train all employees who will use or be present in the general vicinity of chemicals annually about hazard communication. If new or updated chemicals are procured, hazard communication training must be given to affected employees prior to using or storing the chemical. |



North America Job Hazard Analysis Hazard Communication

Project Name: ANG Western CRP, North Highlands ANG

Project Number: 0160280.09

Job / Task Name: Supplemental SI

JHA No.: 10

| Task Step | Hazard | Control Measures |
|-----------------------|---|---|
| Using Chemicals | Employees may be exposed to chemical hazards via skin contact, ingestion, inhalation, or punctures in the skin. | Before using any chemical, make sure a jobsite WARN Health and Safety Plan (HASP) has been prepared and taken the chemical being used into account. Wear protective equipment as specified in the HASP. If chemicals are being used by subcontractors, ensure all employees on the jobsite have been told about the chemical in-use and are protected. If chemical exposure occurs, even if medical symptoms are not present, inform the Field Safety Office or Office H&S Contact. |
| Large Chemical Spills | Large chemicals spills may expose employees to significant health hazards. | For large chemical spills (generally anything larger than 1 gallon in size), HAZWOPER training is required to perform any action other than retreating from the area and contacting appropriately-trained personnel to mitigate the spill. Do not attempt to stop or clean-up a spill without current HAZWOPER training, current medical clearance, current respirator training, and a current respirator fit-test. |

Personal Protective Equipment Required for this Task:

| Type | Description |
|------|-------------|
| None | |

Training Required for this Task:

| Type | Description |
|----------------------|--|
| Hazard Communication | An annually-required training discussing general chemical hazards, MSDS sheets, and how to respond to general chemical emergency situations. |



North America Job Hazard Analysis Hazard Communication

Project Name: ANG Western CRP, North Highlands ANG
Project Number: 0160280.09
Job / Task Name: Supplemental SI
JHA No.: 10

Forms Associated with this Task:

| Type | Description |
|------------------------------------|---|
| Material Safety Data Sheet (MSDS) | An informational document containing information about chemical composition, hazardous properties, and steps to take in emergency situations involving chemicals. |
| International Chemical Safety Card | A chemical-specific document developed by the National Institute of Occupational Safety and Health providing abbreviated information similar to a MSDS. |

Site-Specific Job Hazard Analysis Completed by:

| Name | Date |
|------|------|
| | |



North America Job Hazard Analysis Personal Protective Equipment

Project Name: ANG Western CRP, North Highlands ANG
Project Number: 0160280.09
Job / Task Name: Supplemental SI
JHA No.: 13

| Document Routing | |
|------------------|---|
| FSO | Retain copy in site health & safety file, amend to HASP as necessary. |
| Project Manager | Retain copy in the office health & safety file, amend to HASP as necessary. |

| | |
|----------------------|---|
| Instructions: | This JHA has been developed and approved by the North America Safety Team. Prior to conducting fieldwork, site-specific hazards related to this task must be incorporated by the project team. Once completed, the JHA should be reviewed regularly with site personnel who will be performing this task. |
|----------------------|---|

Task Description:

Guidelines for selection and use of personal protective equipment (PPE). PPE is only to be used after engineering and administrative controls have been considered and found to be non-feasible. Guidance for respiratory protection and fall protection is included in separate JHAs

Hazard Analysis:

| Task Step | Hazard | Control Measures |
|-------------------|--|--|
| General fieldwork | A head injury could occur from a falling or flying object, or a head injury could be sustained from bumping into something. Wearing a "typical" hardhat around electrical equipment may result in electrical shock. | A hard hat meeting the American National Standards Institute (ANSI) Z-89.1 standard must be worn. These hardhats contain an inner suspension system that should be checked regularly to ensure straps are not worn and that space exists between the shell of the hardhat and the suspension straps. Electrical shock protection hardhats – Class A for low voltage (up to 2,000 volts), Class B for high voltage (up to 20,000 volts), and Class C for no electrical shock protection. |
| General fieldwork | A foot injury could occur from a falling or rolling object, or an object may pierce the sole of the shoe. Electrical shock may occur with steel-toe boots. | Steel toe protective footwear should be worn that meets or exceeds the American Society for Testing and Measurement (ASTM) F2413-05 standard. Footwear worn around electrical circuits should also be non-conductive. |



North America Job Hazard Analysis Personal Protective Equipment

Project Name: ANG Western CRP, North Highlands ANG
Project Number: 0160280.09
Job / Task Name: Supplemental SI
JHA No.: 13

| Task Step | Hazard | Control Measures |
|--|--|--|
| Cutting by hand | Hand injury could occur from handling an object with sharp edges of a fixed open-blade knife. | Fixed open-blade knives (such as pocket knives) may not be used on ERM jobsites, with few exceptions. If their use is required, cut-resistant gloves (such as Kevlar) must be worn and the PM or FSO must be informed prior to their use. Employees performing significant amounts of cutting tool use should wear high-visibility gloves to encourage awareness of where hands are being placed. |
| Handling chemicals by hand | Dermal exposure to hands from chemicals during soil and/or groundwater sampling. | Wear nitrile or latex protective gloves when handling sample media. Double-layering these gloves is a good idea for added protection. If acidic or caustic chemicals are present, wear outer neoprene or rubber gloves. |
| O&M or Subsurface Injection | Dermal exposure to body from chemicals during operations and maintenance activities or subsurface liquid injection activities. | When working with commercial, full-strength chemicals ensure splash protection is worn (such as a polyethylene coated suit) and that gloves and boots are taped to the suit to prevent liquid splash. |
| General fieldwork | Foreign object or liquid splash to the eye. | Safety glasses conforming to the ANSI Z-87 standard must be worn for field activities. Safety glasses are appropriate for use when general eye protection is needed. |
| Work around liquid splash and/or flying particle hazards | | For liquid splash hazards or hazards from flying particles, tight-fitting safety goggles should be worn. A faceshield should be considered for use when splash hazards from commercial, full-strength chemicals. |
| Work around active roadways | Struck by moving vehicles when working outside or along a roadway. | High-visibility safety vests should be worn when working in parking lots or by active roadways. Class I may be used when traffic is below 25 mph, Class II for 25-50 mph, and Class 3 for >50 mph. |



North America Job Hazard Analysis Personal Protective Equipment

| |
|--|
| Project Name: ANG Western CRP, North Highlands ANG |
| Project Number: 0160280.09 |
| Job / Task Name: Supplemental SI |
| JHA No.: 13 |

| Task Step | Hazard | Control Measures |
|---------------------------------|--|--|
| Work in high noise environments | Hearing damage from noise exposure greater than 85 decibels. | Attempt to perform work when elevated noise is not an issue. If work must be performed during high noise, wear hearing protection in the form of earplugs or earmuffs. Further details are given in the "Work in High Noise Environments" JHA. |
| O&M or Lockout/Tagout/Tryout | Electrical shock | Lockout/tagout/tryout should be performed by licensed electricians or others that have been specifically authorized by ERM to do so. PPE appropriate to this work includes a cotton t-shirt, Class II Electrical Arc Protection suit, Class O (low voltage) gloves, and non-conductive footwear. |

Training Required for this Task:

| Type | Description |
|-------------------------------|---|
| Personal Protective Equipment | PPE training, normally included in 8-hour refresher training, provides guidance on the selection, inspection, use, maintenance, and decontamination of different types of PPE |

Forms Associated with this Task:

| Type | Description |
|------|-------------|
| None | |

Site-Specific Job Hazard Analysis Completed by:

| Name | Date |
|------|------|
| | |



North America Job Hazard Analysis Work in Hot Environments

Project Name: ANG Western CRP, North Highlands ANG
Project Number: 0160280.09
Job / Task Name: Supplemental SI
JHA No.: 14

| Document Routing | |
|------------------|---|
| FSO | Retain copy in site health & safety file, amend to HASP as necessary. |
| Project Manager | Retain copy in the office health & safety file, amend to HASP as necessary. |

| | |
|----------------------|---|
| Instructions: | This JHA has been developed and approved by the North America Safety Team. Prior to conducting fieldwork, site-specific hazards related to this task must be incorporated by the project team. Once completed, the JHA should be reviewed regularly with site personnel who will be performing this task. |
|----------------------|---|

| |
|--|
| Task Description: |
| Guidelines for working in areas where heat stress may occur. |

| Hazard Analysis: | |
|---|---|
| Task Step | Hazard |
| Water Level Collection, Groundwater / Surface Water Sampling, Monitoring Well Installation and Development | Heat Disorders: 1. Sunburn 2. Heat cramps 3. Heat exhaustion 4. Heat stroke |
| Control Measures | |
| 1. Provide heat stress training to exposed employees 2. Provide potable water 3. Provide access to shade 4. Allow employees to gradually acclimate to hot environments 5. Take breaks in cool rest areas 6. Rotate physically demanding tasks 7. Save most demanding work for cooler times of the day 8. Utilize the heat index chart to determine exposure risk | |

| Personal Protective Equipment Required for this Task: Light colored clothing, hard hat, safety glasses, steel toed boots | |
|---|-------------|
| Type | Description |

| Training Required for this Task: | |
|---|-------------|
| Type | Description |
| None | |



North America Job Hazard Analysis Work in Hot Environments

Project Name: ANG Western CRP, North Highlands ANG
Project Number: 0160280.09
Job / Task Name: Supplemental SI
JHA No.: 14

Forms Associated with this Task:

| Type | Description |
|------------------|----------------------------------|
| Heat Index Chart | Chart to determine heat exposure |

Site-Specific Job Hazard Analysis Completed by:

| Name | Date |
|--------------|-----------|
| Cyrus Gorman | 3/22/2011 |



North America Job Hazard Analysis Work in Cold Environments

Project Name: ANG Western CRP, North Highlands ANG
Project Number: 0160280.09
Job / Task Name: Supplemental SI
JHA No.: 15

| Document Routing | |
|------------------|---|
| FSO | Retain copy in site health & safety file, amend to HASP as necessary. |
| Project Manager | Retain copy in the office health & safety file, amend to HASP as necessary. |

| | |
|---------------|---|
| Instructions: | This JHA has been developed and approved by the North America Safety Team. Prior to conducting fieldwork, site-specific hazards related to this task must be incorporated by the project team. Once completed, the JHA should be reviewed regularly with site personnel who will be performing this task. |
|---------------|---|

Task Description:

| |
|--|
| Guidelines for working in areas where cold stress may occur. |
|--|

Hazard Analysis:

| | | |
|-----------|--------|------------------|
| Task Step | Hazard | Control Measures |
|-----------|--------|------------------|



North America Job Hazard Analysis Work in Cold Environments

Project Name: ANG Western CRP, North Highlands ANG

Project Number: 0160280.09

Job / Task Name: Supplemental SI

JHA No.: 15

| Task Step | Hazard | Control Measures |
|------------------------------|--|--|
| 1. Work in cold environments | Cold-related disorders; cold stress, hypothermia, frostbite, trench foot, etc. | <ol style="list-style-type: none">1. Monitor ambient conditions and plan for cold weather extremes (suspend outdoor activities as necessary). Factors compounding cold temperature include:<ul style="list-style-type: none">• Wind velocity;• High humidity causing condensation;• Dampness;• Contact with cold water or surfaces.2. Know signs and symptoms of cold-related disorders and take action if symptoms persist (see training ppt – preventing cold weather disorders)3. In the event work must be performed in extremely cold temperatures, the recommended limits for properly clothed workers for periods of work at temperatures below freezing are found in Table 2. The recommended exposure times are based on the <i>wind chill factor</i> (see Table 3), a scale based on air temperature and wind speed. The work-break schedule applies to any four-hour period with moderate or heavy activity. The warm-up break periods are of 10 minute duration in a warm location. The schedule assumes that "normal breaks" are taken once every two hours. At the end of a 4-hour period, an extended break (e.g. lunch break) in a warm location is recommended. Keep in mind, older workers or workers with circulatory problems may require special protection against cold injury. |
| ERM North America | 2 | Form Rev.: 05-08 |



North America Job Hazard Analysis Work in Cold Environments

Project Name: ANG Western CRP, North Highlands ANG

Project Number: 0160280.09

Job / Task Name: Supplemental SI

JHA No.: 15

| Task Step | Hazard | Control Measures |
|-----------|--------|--|
| | | <p>4. Adequate insulating dry clothing to maintain core temperature above 96.8 °F (36 °C) must be provided to workers if it is performed at air temperatures below 40°F (4°C). The higher the wind speed and the lower the temperature in the work area, the greater the insulation value of the protective clothing required. An equivalent chill temperature can be computed using the air temperature and the wind velocity (see Table 3). "Wind chill factors" can also be heard on local weather broadcasts.</p> <p>5. For exposed skin, continuous exposure should not be permitted when the air speed and temperature results in an equivalent chill temperature of 25.6 °F (-3.2 °C). Superficial or deep local freezing will occur only at temperatures below 30.2 °F (-1 °C), regardless of wind speed.</p> |



North America Job Hazard Analysis Work in Cold Environments

Project Name: ANG Western CRP, North Highlands ANG
Project Number: 0160280.09
Job / Task Name: Supplemental SI
JHA No.: 15

Table 2.

| Work/Warm-Up Schedule for Four-Hour Shift | | | | | | | | | | | |
|---|---------------------------------------|-----------------------|------------------|-----------------------|------------------|-----------------------|------------------|-----------------------|------------------|-----------------------|------------------|
| Air Temperature | | Calm | | 5 mph wind | | 10 mph wind | | 15 mph wind | | 20 mph wind | |
| oC | oF | Max Work Period | Number of Breaks | Max Work Period | Number of Breaks | Max Work Period | Number of Breaks | Max Work Period | Number of Breaks | Max Work Period | Number of Breaks |
| -26 ^o to -28 ^o | -15 ^o to -19 ^o | Normal Breaks | 1 | Normal Breaks | 1 | 75 min. | 2 | 55 min | 3 | 40 min | 4 |
| -29 ^o to -31 ^o | -20 ^o to -24 ^o | Normal Breaks | 1 | 75 min. | 2 | 55 min. | 3 | 40 min. | 4 | 30 min. | 5 |
| -32 ^o to -34 ^o | -25 ^o to -29 ^o | 75 min. | 2 | 55 min. | 3 | 40 min. | 4 | 30 min. | 5 | Cease non-emerg. work | |
| -35 ^o to -37 ^o | -30 ^o to - 34 ^o | 55 min. | 3 | 40 min. | 4 | 30 in. | 5 | Cease non-emerg. work | | | |
| -38 ^o to -39 ^o | -35 ^o to -39 ^o | 40 min | 4 | 30 min | 5 | Cease non-emerg. work | | | | | |
| -40 ^o to -42 ^o | -40 ^o to -44 ^o | 30 min | 5 | Cease non-emerg. work | | | | | | | |
| -43 ^o & below | -45 ^o & below | Cease non-emerg. work | | | | | | | | | |



North America Job Hazard Analysis Work in Cold Environments

Project Name: ANG Western CRP, North Highlands ANG

Project Number: 0160280.09

Job / Task Name: Supplemental SI

JHA No.: 15

Table 3.

| Cooling Power of Wind on Exposed Flesh Expressed as Equivalent Temperature (under calm conditions)* | | | | | | | | | | | | | |
|--|--|----|----|--|-----|-----|-----|-----|--|------|------|------|--|
| Estimated Wind Speed (in mph) | Actual Temperature (°F) | | | | | | | | | | | | |
| | 50 | 40 | 30 | 20 | 10 | 0 | -10 | -20 | -30 | -40 | -50 | -60 | |
| Calm | 50 | 40 | 30 | 20 | 10 | 0 | -10 | -20 | -30 | -40 | -50 | -60 | |
| 5 | 48 | 37 | 27 | 16 | 6 | -5 | -15 | -26 | -36 | -47 | -57 | -68 | |
| 10 | 40 | 28 | 16 | 4 | -9 | -24 | -33 | -46 | -58 | -70 | -83 | -95 | |
| 15 | 36 | 22 | 9 | -5 | -18 | -32 | -45 | -58 | -72 | -85 | -99 | -112 | |
| 20 | 32 | 18 | 4 | -10 | -25 | -39 | -53 | -67 | -82 | -96 | -110 | -121 | |
| 25 | 30 | 16 | 0 | -15 | -29 | -44 | -59 | -74 | -88 | -104 | -118 | -133 | |
| 30 | 28 | 13 | -2 | -18 | -33 | -48 | -63 | -79 | -94 | -109 | -125 | -140 | |
| 35 | 27 | 11 | -4 | -20 | -35 | -51 | -67 | -82 | -98 | -113 | -129 | -145 | |
| 40 | 26 | 10 | -6 | -21 | -37 | -53 | -69 | -85 | -100 | -116 | -132 | -148 | |
| (Wind speeds greater than 40 mph have little additional effect.) | LITTLE DANGER In < hr with dry skin. Maximum danger of false sense of security. | | | INCREASING DANGER Danger from freezing of exposed flesh within one minute. | | | | | GREAT DANGER Flesh may freeze within 30 seconds. | | | | |
| | Trenchfoot and immersion foot may occur at any point on this chart. | | | | | | | | | | | | |



North America Job Hazard Analysis Work in Cold Environments

Project Name: ANG Western CRP, North Highlands ANG
Project Number: 0160280.09
Job / Task Name: Supplemental SI
JHA No.: 15

Personal Protective Equipment Required for this Task:

| Type | Description |
|-----------------------------------|---|
| Appropriate Cold-Weather Clothing | <ul style="list-style-type: none">• An outer wind-breaker layer that allows some ventilation (e.g., Gore-Tex, nylon);• A middle layer of wool or synthetic fabric that absorbs sweat and retains insulation in a damp environment; and• An inner layer of cotton or synthetic-weave fabric that allows ventilation.• Insulated protection for feet, hands, face, and head (hat and gloves, as a minimum), to protect against cold and dampness. Up to 40 percent of body heat may be lost when the head is exposed.• A change of clothing is to be kept available and changed into immediately if work clothes become wet (to prevent hypothermia). |

Training Required for this Task:

| Type | Description |
|-----------------------------------|---|
| Preventing Cold Weather Disorders | Powerpoint presentation can be located on ERM North American Minerva page at the following link. http://minerva/erm/globalsupport/healthandsafety/NA/HS%20Training%20Materials/Home.aspx |

Forms Associated with this Task:

| Type | Description |
|------|-------------|
| None | |

Site-Specific Job Hazard Analysis Completed by:

| Name | Date |
|------|------|
| | |

HEAT INDEX CHART, The Heat Index (HI) is the temperature the body feels when heat and humidity are combined.

Temperature (F) versus Relative Humidity (%)

| °F | 90% | 80% | 70% | 60% | 50% | 40% |
|-----|-----|-----|-----|-----|-----|-----|
| 80 | 85 | 84 | 82 | 81 | 80 | 79 |
| 85 | 101 | 96 | 92 | 90 | 86 | 84 |
| 90 | 121 | 113 | 105 | 99 | 94 | 90 |
| 95 | | 133 | 122 | 113 | 105 | 98 |
| 100 | | | 142 | 129 | 118 | 109 |
| 105 | | | | 148 | 133 | 121 |
| 110 | | | | | | 135 |

HI

Possible Heat Disorder:

80°F - 90°F

Fatigue possible with prolonged exposure and physical activity.

90°F - 105°F

Sunstroke, heat cramps and heat exhaustion possible.

105°F - 130°F

Sunstroke, heat cramps, and heat exhaustion likely, and heat stroke possible.

130°F or greater

Heat stroke highly likely with continued exposure.



North America Job Hazard Analysis Portable Hand and Power Tools

Project Name: ANG Western CRP, North Highlands ANG

Project Number: 0160280.089

Job / Task Name: Supplemental SI

JHA No.: 20

| Document Routing | |
|------------------|---|
| FSO | Retain copy in site health & safety file, amend to HASP as necessary. |
| Project Manager | Retain copy in the office health & safety file, amend to HASP as necessary. |

| | |
|----------------------|---|
| Instructions: | This JHA has been developed and approved by the North America Safety Team. Prior to conducting fieldwork, site-specific hazards related to this task must be incorporated by the project team. Once completed, the JHA should be reviewed regularly with site personnel who will be performing this task. |
|----------------------|---|

Task Description:

| |
|--|
| Guidelines for working with portable hand and power tools. |
|--|

Hazard Analysis:

| Task Step | Hazard | Control Measures |
|---------------------------------|--|--|
| Gather tools to take to jobsite | An improper tool available at jobsites encourages unsafe behaviors and could lead to injury. | Ensure tools taken to jobsites are kept in optimal condition (sharp, clean, oiled, etc.) to ensure efficient operation. Tools must only be used for their intended purposes – tools should not be used as pry-bars. Ensure power cords attached to powered-equipment are not damaged. Any damaged tool or electrical cord must be tagged and taken out of service. |
| Using cutting tools | Major and/or minor cuts to personnel | Fixed open-blade knives (such as pocket knives) may not be used on ERM jobsites, with few exceptions. If their use is required, cut-resistant gloves must be worn while using them and the PM or FSO must be informed prior to their use. Employees performing significant amounts of cutting tool use should must high-visibility gloves to encourage awareness of where hands are being placed. |



North America Job Hazard Analysis Portable Hand and Power Tools

Project Name: ANG Western CRP, North Highlands ANG
Project Number: 0160280.089
Job / Task Name: Supplemental SI
JHA No.: 20

| Task Step | Hazard | Control Measures |
|--------------------|--|--|
| Using screwdrivers | Puncture injuries | Do not hold objects in the palm of your hand and press a screwdriver into it – these objects should be placed on a flat surface. Do not use screwdrivers as hammers, or use screwdrivers with broken handles. Use insulated screwdrivers for work on electrical equipment. |
| Using hammers | Creation of sparks Particles may lodge in employee's eyes Loose handles may create a projectile hazard | Use brass hammers in areas where creating sparks would pose ignition hazards. Always use safety glasses when striking any object with a hammer. If hammer-head shows signs of mushrooming, replace it immediately. Replace any hammer with a loose handle so the hammer-head does not detach and cause injuries. |

Personal Protective Equipment Required for this Task:

| Type | Description |
|-----------------------|--|
| High-visibility glove | Gloves typically in fluorescent green, orange, or yellow. |
| Cut-resistant glove | Limited protection is afforded by leather gloves from cuts. Kevlar gloves provide more protection when significant cut/puncture hazards exist. |

Training Required for this Task:

| Type | Description |
|------|-------------|
| None | |



North America Job Hazard Analysis
Portable Hand and Power Tools

Project Name: ANG Western CRP, North Highlands ANG
Project Number: 0160280.089
Job / Task Name: Supplemental SI
JHA No.: 20


Forms Associated with this Task:

| Type | Description |
|------|-------------|
| None | |

Site-Specific Job Hazard Analysis Completed by:

| Name | Date |
|------|------|
| | |

STANDARD OPERATING PROCEDURES

|  | STANDARD OPERATING PROCEDURE | |
|---|------------------------------|-------------------------------|
| | SOP #: | 1 |
| | Title: | Hazard Communication (HazCom) |
| | Last Rev.: | 12/31/07 |
| | Page: | 1 of 2 |

SCOPE


This procedure provides guidance on meeting regulatory requirements and ensuring that the information necessary for the safe use, handling and storage of hazardous chemicals is provided and made available to employees.

DEFINITIONS

- **Hazardous Chemical** – Any chemical which is a physical hazard or a health hazard.
- **Hazard Warning** – Any words, pictures, symbols, or combination thereof appearing on a label or other appropriate form of warning which convey the specific physical and health hazard(s), including target organ effects, of the chemical(s) in the container(s).
- **Health Hazard** – A chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. The term "health hazard" includes chemicals that are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents that act on the hematopoietic system, and agents which damage the lungs, skin, eyes, or mucous membranes.
- **Physical Hazard** – A chemical for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive) or water-reactive.

PROCEDURE

- RCM Health and Safety Coordinator will develop a chemical inventory of all known chemicals to be used or present as a potential contaminant at the job site.
- RCM Health & Safety Coordinator will ensure that all containers (drums, bottles, etc.) are labeled with the identity of the known hazardous chemical contained and any appropriate hazard warnings. Containers that are not labeled or where labels have faded or been removed will be relabeled immediately.
- RCM Health & Safety Coordinator will include NIOSH Universal Chemical Safety Data Cards for chemicals present as site constituents of concern and Material Safety Data Sheets (MSDSs) for chemicals brought to the site for the job. For assistance, contact the RCM Health and Safety Coordinator.
- The Site Safety Officer will ensure employees have been trained on site-specific HazCom, including:

| | | |
|---|-------------------------------------|-------------------------------|
|  | STANDARD OPERATING PROCEDURE | |
| | SOP #: | 1 |
| | Title: | Hazard Communication (HazCom) |
| | Last Rev.: | 12/31/07 |
| | Page: | 2 of 2 |

1. Methods that may be used to detect a release of hazardous chemical(s) in the workplace;
 2. Physical and health hazards associated with chemicals;
 3. Protective measures to be taken;
 4. Safe work practices, emergency responses and use of personal protective equipment (PPE); and
 5. Information on the Hazard Communication Standard including:
 - a. Labeling and warning systems, and
 - b. An explanation of Material Safety Data Sheets.
- E. RCM Health & Safety Coordinator will identify PPE based on the task involved and the chemical properties.
- F. The Site Safety Officer will inform employees of any non-routine tasks and the chemical hazards associated with the tasks. Review the safe work practices and use of required PPE prior to the start of such tasks.
- G. The Site Safety Officer will provide information on hazardous chemicals known to be present to subcontractors and other employers on the site. Employers are responsible for providing necessary information to their employees. Ensure other onsite employers are provided with the applicable HazCom information.
- H. All site personnel are required to report any incident of a chemical over-exposure or of a chemical spill to the Site Safety Officer. Follow the emergency response/spill response procedures described in the HASP.

REFERENCES

Regulatory References

- 29 CFR 1910.1200, Hazard Communication

Technical References


NIOSH Universal Chemical Safety Data Cards

Procedural References

- SOP – 9, Personal Protective Equipment
- RCM Health and Safety Program, Appendix B, Section 3

REVISION LOG

| DATE | REV. # | APV'D | COMMENTS |
|----------|--------|-------|----------------|
| 12/31/07 | 0 | ELG | Issued for use |

|  | STANDARD OPERATING PROCEDURE | |
|---|------------------------------|-------------------------------|
| | SOP #: | 1 |
| | Title: | Hazard Communication (HazCom) |
| | Last Rev.: | 12/31/07 |
| | Page: | 1 of 2 |

SCOPE


This procedure provides guidance on meeting regulatory requirements and ensuring that the information necessary for the safe use, handling and storage of hazardous chemicals is provided and made available to employees.

DEFINITIONS

- **Hazardous Chemical** – Any chemical which is a physical hazard or a health hazard.
- **Hazard Warning** – Any words, pictures, symbols, or combination thereof appearing on a label or other appropriate form of warning which convey the specific physical and health hazard(s), including target organ effects, of the chemical(s) in the container(s).
- **Health Hazard** – A chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. The term "health hazard" includes chemicals that are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents that act on the hematopoietic system, and agents which damage the lungs, skin, eyes, or mucous membranes.
- **Physical Hazard** – A chemical for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive) or water-reactive.

PROCEDURE

- RCM Health and Safety Coordinator will develop a chemical inventory of all known chemicals to be used or present as a potential contaminant at the job site.
- RCM Health & Safety Coordinator will ensure that all containers (drums, bottles, etc.) are labeled with the identity of the known hazardous chemical contained and any appropriate hazard warnings. Containers that are not labeled or where labels have faded or been removed will be relabeled immediately.
- RCM Health & Safety Coordinator will include NIOSH Universal Chemical Safety Data Cards for chemicals present as site constituents of concern and Material Safety Data Sheets (MSDSs) for chemicals brought to the site for the job. For assistance, contact the RCM Health and Safety Coordinator.
- The Site Safety Officer will ensure employees have been trained on site-specific HazCom, including:

|  | STANDARD OPERATING PROCEDURE | |
|---|------------------------------|-------------------------------|
| | SOP #: | 1 |
| | Title: | Hazard Communication (HazCom) |
| | Last Rev.: | 12/31/07 |
| | Page: | 2 of 2 |

1. Methods that may be used to detect a release of hazardous chemical(s) in the workplace;
 2. Physical and health hazards associated with chemicals;
 3. Protective measures to be taken;
 4. Safe work practices, emergency responses and use of personal protective equipment (PPE); and
 5. Information on the Hazard Communication Standard including:
 - a. Labeling and warning systems, and
 - b. An explanation of Material Safety Data Sheets.
- E. RCM Health & Safety Coordinator will identify PPE based on the task involved and the chemical properties.
- F. The Site Safety Officer will inform employees of any non-routine tasks and the chemical hazards associated with the tasks. Review the safe work practices and use of required PPE prior to the start of such tasks.
- G. The Site Safety Officer will provide information on hazardous chemicals known to be present to subcontractors and other employers on the site. Employers are responsible for providing necessary information to their employees. Ensure other onsite employers are provided with the applicable HazCom information.
- H. All site personnel are required to report any incident of a chemical over-exposure or of a chemical spill to the Site Safety Officer. Follow the emergency response/spill response procedures described in the HASP.

REFERENCES

Regulatory References

- 29 CFR 1910.1200, Hazard Communication

Technical References


NIOSH Universal Chemical Safety Data Cards

Procedural References

- SOP – 9, Personal Protective Equipment
- RCM Health and Safety Program, Appendix B, Section 3

REVISION LOG

| DATE | REV. # | APV'D | COMMENTS |
|----------|--------|-------|----------------|
| 12/31/07 | 0 | ELG | Issued for use |

|  | STANDARD OPERATING PROCEDURE | |
|---|------------------------------|-------------|
| | SOP #: | 4 |
| | Title: | Heat Stress |
| | Last Rev.: | 8/3/2011 |
| | Page: | 1 of 5 |

SCOPE


This procedure provides work practices to minimize the impact of heat stress caused by exposure to hot environments or working conditions.

DEFINITIONS

- **Acclimatization** – The ability to adjust to hot working conditions. This adjustment to heat, under normal circumstances, usually takes about 5 to 7 days, during which time the body will undergo a series of changes that will make continued exposure to heat more endurable.
- **Heat Index** – An accurate measure of how hot it really feels when relative humidity (RH) is added to the actual air temperature.

PROCEDURE


- A. The Field Safety Officer will implement techniques for preventing heat stress-related health issues. Prevention techniques include:
 1. Track the weather forecast for the job site and use forecasted information to plan daily activities. Forecasts may be obtained from:
 - www.nws.noaa.gov
 - National Weather Service Phone Numbers
 - Weather Channel TV Network
 2. Provide access to shade as close as feasible to work areas, with adequate ventilation, and permit access by employees at all times. If the temperature does not exceed 85° F, provide access to shade upon request. The interior of a vehicle may not be used to provide shade unless the vehicle is air-conditioned and the air conditioner is on.
 3. In situations where provision of shade is not safe or feasible, use alternative cooling measures that provide equivalent protection.
 4. Schedule physically demanding and strenuous tasks, or tasks requiring full-body chemical protection, for early in the day, if possible.
 5. Drink at least 6-8 ounces of cool water every 60 minutes for the entire work shift.
 6. Review with employees during morning tailgate meetings the importance of drinking water and not waiting until they are thirsty, the number and schedule of water and rest breaks, the signs and symptoms of heat illness, and emergency response procedures in the HASP. When the temperature exceeds or is expected to exceed 90° F, encourage employees throughout the work shift to drink water and use shade for breaks and as needed to prevent overheating.
 7. During a heat wave or heat spike (e.g., a sudden increase in daytime temperature of 9° F or more), the work day will be cut short, will be rescheduled (e.g.,

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conducted at night or during cooler hours), or if possible cease for the day. If schedule modifications are not possible and workers have to work during a heat wave, increase the number of water and rest breaks, supervise workers to ensure that they stop work and take breaks, and observe closely all workers for signs and symptoms of heat illness.

8. Closely supervise employees during heat waves and when starting a new job, to ensure adequate acclimatization.
9. Use the buddy system and look for signs of heat stress. Any employee with signs of heat stress must immediately proceed to a shaded area. Signs and symptoms for various heat stress disorders and recommended first aid are listed in the following table.

| <i>Disorder</i> | <i>Symptoms</i> | <i>Cause</i> | <i>Prevention/First Aid</i> |
|---------------------------------|--|--|---|
| Heat Rash or Prickly Heat | <ul style="list-style-type: none"> ◆ Rash ◆ Itching | <ul style="list-style-type: none"> ◆ Hot, humid conditions ◆ Sweat doesn't evaporate easily ◆ Sweat ducts become clogged | <ul style="list-style-type: none"> ◆ Ointments ◆ Keep skin clean and dry ◆ Good daily personal hygiene |
| Heat Cramps | <ul style="list-style-type: none"> ◆ Sudden onset of muscle cramps usually in legs or arms ◆ Hot, moist skin ◆ Normal pulse ◆ Normal or slightly elevated temperature | <ul style="list-style-type: none"> ◆ Loss of water (sweating) ◆ Loss of electrolytes ◆ Replacing water but not electrolytes | <ul style="list-style-type: none"> ◆ Move into shade ◆ Loosen clothing ◆ Drink tepid electrolyte drinks or water ◆ Seek medical assistance if conditions persist |
| Heat Exhaustion | <ul style="list-style-type: none"> ◆ Pale, clammy skin ◆ Profuse perspiration ◆ Thirst from dehydration ◆ Weakness ◆ Headache ◆ Nausea ◆ Loss of coordination | <ul style="list-style-type: none"> ◆ Overexertion ◆ Excessive loss of water and electrolytes | <ul style="list-style-type: none"> ◆ Move into shade ◆ Remove PPE ◆ Loosen street clothing ◆ Cool by applying damp cool compresses or ice packs ◆ Drink tepid electrolyte drinks or water ◆ Summon medical assistance |
| Heat Stroke | <ul style="list-style-type: none"> ◆ Elevated temperature (>103F) ◆ Flushed, hot, dry skin ◆ Absence of sweating ◆ Delirious ◆ Rapid pulse ◆ Nausea ◆ Headache ◆ Dizziness ◆ Unconsciousness | <ul style="list-style-type: none"> ◆ Failure of body's cooling (sweating) mechanism | <ul style="list-style-type: none"> ◆ Summon medical assistance ◆ Move to shade ◆ Remove PPE ◆ Loosen street clothing ◆ Cool by fanning or applying damp compress or ice packs |

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10. The Field Safety Officer must verify that a work-rest cycle based on the heat index is implemented for site workers as applicable. Refer to the following three tables. To use the chart, read the temperature at the left and humidity across the top, the heat index is where the two intersect. For example, with a temperature of 96 and a humidity of 50%, the Heat Index is 108. Determine what the associated risk level is, based on the heat index. Use the risk level and heat index to determine the appropriate work-rest cycle.

Heat Index Chart

| Relative Humidity (%) | | | | | | | | | | | | | | |
|-----------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Temperature (F) | | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 |
| | 110 | 136 | | | | | | | | | | | | |
| | 108 | 130 | 137 | | | | | | | | | | | |
| | 106 | 124 | 130 | 137 | | | | | | | | | | |
| | 104 | 119 | 124 | 131 | 137 | | | | | | | | | |
| | 102 | 114 | 119 | 124 | 130 | 137 | | | | | | | | |
| | 100 | 109 | 114 | 118 | 124 | 129 | 136 | | | | | | | |
| | 98 | 105 | 109 | 113 | 117 | 123 | 128 | 134 | | | | | | |
| | 96 | 101 | 104 | 108 | 112 | 116 | 121 | 126 | 132 | | | | | |
| | 94 | 97 | 100 | 102 | 106 | 110 | 114 | 119 | 124 | 129 | 136 | | | |
| | 92 | 94 | 96 | 99 | 101 | 105 | 108 | 112 | 116 | 121 | 126 | 131 | | |
| | 90 | 91 | 93 | 95 | 97 | 100 | 103 | 106 | 109 | 113 | 117 | 122 | 127 | 132 |
| | 88 | 88 | 89 | 91 | 93 | 95 | 98 | 100 | 103 | 106 | 110 | 113 | 117 | 121 |
| | 86 | 85 | 87 | 88 | 89 | 91 | 93 | 95 | 97 | 100 | 102 | 106 | 108 | 112 |
| | 84 | 83 | 84 | 85 | 86 | 88 | 89 | 90 | 92 | 94 | 96 | 98 | 100 | 103 |
| | 82 | 81 | 82 | 83 | 84 | 84 | 85 | 86 | 88 | 89 | 90 | 91 | 93 | 95 |
| | 80 | 80 | 80 | 81 | 81 | 82 | 82 | 83 | 84 | 84 | 85 | 86 | 86 | 87 |

Heat Index Risk Level and Associated Health Effects

| Heat Index | Associated Risk |
|------------|---|
| >130 | <i>Extreme Danger</i> Heat stroke highly likely with continued exposure |
| 105-130 | <i>Danger</i> Heat exhaustion and heat cramps likely and heat stroke possible with prolonged exposure and/or physical activity |
| 90-105 | <i>Extreme Caution</i> Heat cramps and heat exhaustion possible with prolonged exposure and/or physical activity |
| 80-90 | <i>Caution</i> Fatigue possible with prolonged exposure and/or physical activity |

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NOTES:

- Heat Index values were devised for shady, light wind conditions. Exposure to full sun may increase these values by up to 15°.
- Heat Index values were devised for the general public wearing typical lightweight summer clothing. Acclimatized workers may be able to work under conditions with a slightly higher Heat Index.
- The use of personal protective equipment, including clothing increases the heat stress load on the body.

The work-rest cycle outlined below should be implemented based on the professional judgment of the Field Safety Officer and/or the Project Health and Safety Consultant. Workers must drink 8 ounces of cool water at each break.

| <i>Heat Index</i> | <i>Risk Level</i> | <i>Work-Rest Cycle</i> |
|-------------------|-------------------|-----------------------------------|
| > 130 | Extreme Danger | 15 minute break every 30 minutes |
| 105-130 | Danger | 15 minute break every 60 minutes |
| 90-105 | Extreme Caution | 15 minute break every 90 minutes |
| 80-90 | Caution | 15 minute break every 120 minutes |

- B. The Field Safety Officer and the Project and/or Construction Manager will observe workers to verify compliance with and effectiveness of prevention techniques.
- C. When an employee displays possible signs or symptoms of heat illness, the Field Safety Officer will check the sick employee and determine whether resting in the shade and drinking cool water will suffice or if emergency service providers will need to be called. WorkCare Incident Intervention (888-449-7787) should also be contacted to provide guidance on appropriate care. Do not leave a sick worker alone in the shade, as he or she can take a turn for the worse!
- D. Call emergency service providers per procedures outlined in HASP if an employee displays signs or symptoms of heat illness (loss of consciousness, incoherent speech, convulsions, red and hot face), does not look OK or does not get better after drinking cool water and resting in the shade. While the ambulance is in route, initiate/continue first aid (cool the worker: place in the shade, remove excess layers of clothing, place ice pack in the armpits and join area and fan the victim). Do not let a sick worker leave the site, as they can get lost or die (when not being transported by ambulance and treatment has not been started by paramedics) before reaching a hospital!
- E. In the event a heat stress related incident occurs, the Field Safety Officer will report the incident following guidelines in the HASP.
- F. Supervisors will be trained on these written procedures prior to being assigned to supervise other workers. Employees will be trained on these procedures via review of the site HASP and through participation in daily site tailgate meetings.

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REFERENCES

Regulatory References

Heat Illness Prevention Standard – Title 8 California Code of Regulations Section 3395

Technical References


- NOAA – National Weather Service, Heat Index, Measure of How Hot it Feels

Procedural References

None

REVISION LOG

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| 12/31/07 | 0 | ELG | Issued for use |
| 1/12/2011 | 1 | RLE | Renumbered, integrated with ERM H&S program, removed references to RCM |
| 8/3/2011 | 1 | RLE | Revised to incorporate CA Heat Illness Prevention Standard |

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SCOPE


This procedure provides work practices to minimize the impact of cold stress caused by exposure to cold environments or working conditions.

DEFINITIONS

- **Frostbite** – Occurs when the extremities do not get sufficient heat from the central body stores. The fluids around the cells of the body tissues freeze from exposure to low temperatures. This condition can result in damage to, and loss of, tissue. The most vulnerable areas are the nose, cheeks, ears, fingers, and toes.
- **Hypothermia** – This is the most severe form of cold stress and results from a drop in the body's core temperature. Hypothermia can occur in relatively mild temperatures if there is a wind and the person's clothing becomes wet. The signs or symptoms of hypothermia are:
 - First, uncontrollable shivering and the sensation of the cold;
 - Heartbeat slows and may become irregular;
 - Pulse weakens and blood pressure changes;
 - As the body's core temperature drops, other signs may include cool skin, slow irregular breathing, and apparent exhaustion;
 - When core temperatures are in the mid-range, the victim may become listless, confused, exhibit severe shivering, or develop severe pain in the extremities; and
 - Final signs are a significant drop in blood pressure, fatigue, and shallow respiration.

PROCEDURE

- A. The Field Safety Officer will implement techniques for preventing cold stress-related health issues. Prevention techniques include:
 1. Require the use of additional protective clothing.
 2. Allow workers to change clothes that have become wet.
 3. Provide thermal insulating materials on metal handles of tools and equipment.
 4. In snowy or icy conditions, require the use of UV eye protection, as well as from blowing crystals.
 5. Provide a warm and sheltered area for changing clothes and taking breaks.
 6. Provide hot liquids, such as soups, warm drinks, etc. in the break area.

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7. Use the buddy system and look for signs of cold stress. Any employee observed with signs of cold stress shall immediately proceed to the break area.
- B. The Field Safety Officer and the Project and/or Construction Manager will observe to verify compliance with and effectiveness of prevention techniques.
 - C. The Field Safety Officer will provide first aid treatment for cold stress related health issues include moving to warm area. Seek medical attention if signs or symptoms of hypothermia or frostbite are present.

REFERENCES

Regulatory References

None.

Technical References


None.

Procedural References

None.

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| 1/12/2011 | 1 | RLE | Renumbered, integrated with ERM H&S program, removed references to RCM |

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SCOPE

This procedure provides guidance for determining appropriate means for handling natural hazards that may be encountered while conducting fieldwork.

DEFINITIONS


None.

PROCEDURE

Potential exposure natural hazards during performance of this project is believed to be minimal. However since the work is performed outside some precautions should be taken to guard against the following hazards. Keep in mind that the hazards may vary depending on the time of year or geographical region. Infrequent hard freezes may allow insects and snakes to be active all year round in some parts of the United States. Refer to Attachments 1 through 3 for photos and more thorough descriptions of the more common natural hazards, which might be encountered.

- A. Identify type of natural hazard present.
- B. When a natural hazard (such as poisonous plants, feral animals, insects and snakes) is encountered, back away and evaluate the situation.
- C. Develop a plan which may include any of the following:
 1. Remove the natural hazard if it can be done safely.
 2. Avoid the natural hazard if it cannot be removed. Additionally, use appropriate PPE or outer clothing for protection from the hazard. Refer to SOP – 8, Personal Protective Equipment.
 3. Get assistance in removing or working around the natural hazard. In some instances, this may require professional help from animal control or an insect expert.
- D. In the event there is contact with the natural hazard, if it appears to be a life threatening situation, such as anaphylactic shock or a snake bite, seek medical attention immediately.

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A. POISONOUS PLANTS


1. Poison ivy is in the form of a vine, while oak and sumac are bush-like.
2. All produce a delayed allergic hypersensitivity.
3. The plant tissues have an oleoresin, which is active in live, dead, and dried parts and may be carried through dust, contaminated articles, and the hair of animals.
4. Symptoms usually occur 24 to 48 hours after exposure resulting in burning or stinging, and weeping and/or crusted blisters.
5. The best antidote for poisonous plants is recognition and avoidance.
6. Should exposure to any of these plants occur, notify the Site Safety Officer and wash the affected area with a mild soap and water, but do not scrub the area.

B. TICKS

1. Ticks attach to their host's skin and intravenously feed on its blood creating an opportunity for disease transmission.
2. Covering exposed areas of the body and the use of tick repellent are two ways to prevent tick bites.
3. Periodically during the workday employees should inspect themselves for the presence of ticks.
4. Notify the Site Safety Officer of any tick bites as soon as possible, medical attention may be required.

C. SPIDERS

1. Black Widow
 - a. The black widow is a common venomous spider found in vacant rodent burrows, under stones, logs and long grass, and in hollow stumps and brush piles.
 - b. If disturbed, they typically will retreat to a corner of their web but can be induced to bite only if pressed against the skin.
 - c. Notify the Site Safety Officer if bitten, because neurotoxins are injected, it is important to seek immediate medical attention.
2. Brown Recluse
 - a. The brown recluse or Fiddle Back Spider is another common venomous spider.

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- b. It hides in dark niches and corners, where it may spin a poorly organized, irregular web.
- c. It is shy and will try to run from a threatening situation but will bite if cornered.
- d. Check boots and protective clothing for spiders prior to putting them.
- e. The bite of the brown recluse is usually painless until 3 to 8 hours later when it may become red, swollen, and tender. Notify the Site Safety Officer if bitten.
- f. Prompt medical attention can reduce the extent of ulceration and alleviate other complications that may develop.

D. FIRE ANTS

- 1. One sure sign of the presence of fire ants is their conical mounds, which are a result of the digging of their chambers.
- 2. The sting of a fire ant results in localized reddening of the bite area, accompanied by sharp burning sensations.
- 3. The first ant sting releases a chemical substance that triggers other ants of the colony to sting.
- 4. Anyone seeing fire ant mounds present at the work site should notify the Site Safety Officer, who will then notify the rest of the crew so the mounds may be avoided if possible.

E. CHIGGERS

- 1. Chiggers, also known as “red-bugs” or “harvest mites”, are the immature stages of a tiny red mite.
- 2. They inhabit areas of tall grass, associated with low, wet spots, ponds and stream banks, wild berry patches, and forest underbrush.
- 3. The larvae attach themselves to the clothing of people or to the fur of passing animals.
- 4. Wear loose-fitting clothing (if possible) when working outdoors. Apply a repellent containing DEET (N,N-diethyl-meta-toluamide), to shoes, socks, and trousers before entering chigger-infested areas. Caution: some individuals may be sensitive to DEET – always read and follow label directions
- 5. Vehicles should be frequently vacuumed to reduce the number of chiggers that may have been deposited.

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6. Flowers of sulfur is another repellant of chiggers. Sulfur may be more benign to use than DEET on some body parts. Avoid breathing dust during application.

F. FLYING INSECTS


1. Flying insects such as mosquitoes, wasps, hornets, and bees may be encountered while site activities occur.
2. Wear long-sleeved clothes and long pants treated with repellent. Do not treat unexposed skin. Use the repellent according to the manufacturer's recommendations provided on the container.
3. Personnel should report flu-like symptoms to the Site Safety Officer, medical attention may be needed.

G. SNAKES

1. The most effective way to prevent snakebites is to avoid snakes.
2. Personnel should avoid walking in high grass and underbrush.
3. Visual inspection of work areas should be performed prior to activities taking place.
4. The use of leather boots and long pants will be required, since more than half of all bites are on the lower part of the leg.
5. No attempts at killing snakes should be made; many people are bitten in such an attempt.
6. If a snake bites someone, Notify the Site Safety Officer and seek medical services.

H. ALLIGATORS

1. Never approach an alligator. Always stay at least 30 yards away. Never wade or swim in areas that could contain large alligators.
2. Do not dump food or scraps into or near the water. This can attract alligators.
3. Always be aware of your surroundings and use caution and common sense.
4. If at any time personnel observe alligators at the site they will immediately inform the Site Safety Officer or Construction Manager, who will then notify the rest of the employees and local wildlife personnel.

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I. FERAL ANIMALS

1. Feral animals such as rats or other wildlife may be encountered during fieldwork.
2. If an animal is diseased, injured or tending a nest, they may become aggressive.
3. Notify the Site Safety Officer or Construction Manager if feral animals are at the site, who will then notify the rest of the employees and local wildlife personnel.

ATTACHMENTS

Attachment 1, Poisonous Plants

Attachment 2, Insects

Attachment 3, Snakes

Attachment 4, Other Natural Hazards

REFERENCES

Regulatory References

None

Technical References


None

Procedural References

SOP – 8, Personal Protective Equipment

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Attachment 1

Poisonous Plants

Most species of poison ivy, oak, and sumac have three leaflets; hence, the saying, "Leaves of three, let it be." These plants vary significantly in appearance in different regions of the country, but in most species the flower and fruit structures arise in the angle between the leaf and the twig, the flowers are greenish in spring, and the plant's mature fruit is off-white or pale yellow-green.

Several varieties, including two species each of poison ivy, poison oak, and poison sumac and six subspecies of poison ivy (*Toxicodendron radicans*), are found in the United States. Poison ivy (see figure A below) generally grows east of the Rocky Mountains and poison oak in the West. Both poison ivy and poison sumac are found along the Gulf Coast. Poison oak prefers swampy areas in the Southeast.

Figures A1, A2: Courtesy of Lisa A. Garner, MD; figure A3: staff photo; figure A4: Janet Robidoux

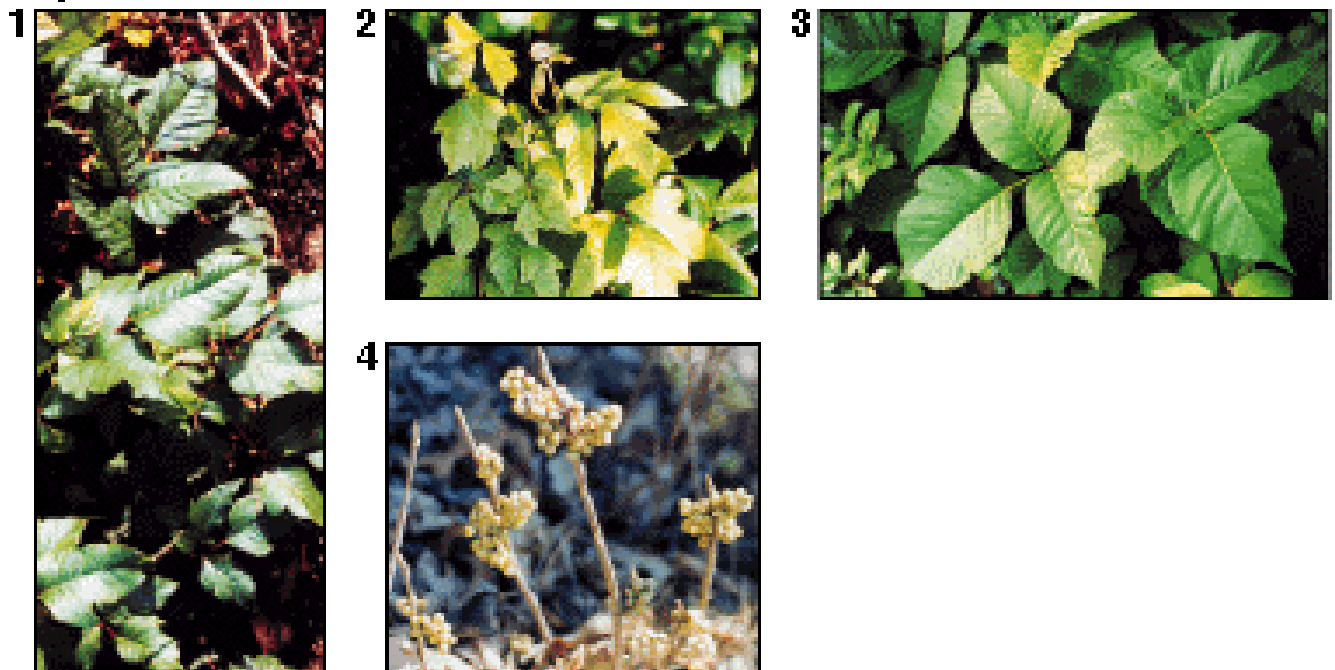



Figure A. Poison ivy (*Toxicodendron radicans*) can grow as a shrub or vine, but all varieties are characterized by glossy leaves that grow in clusters of three leaflets. The varieties shown here are found in Texas (1,2) and Minnesota (3). The off-white or pale yellow-green berries of poison ivy (4) often remain on the plant through the winter.

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Poison Ivy

A climbing vine with three serrated-edge, pointed leaves grows in the East, Midwest and South. In the northern and western states, poison ivy grows as a non-climbing shrub.


The appearance of these plants is variable. Leaves are alternate and normally consist of three leaflets with the stalk of the central leaflet being longer than those of the other two are but can be found with five or even seven leaflets. The leaflets are two to four inches long, dull or glossy green with pointed tips. The middle leaflet is generally larger than the two laterals. The edges of the leaflets may be toothed, lobed, or smooth. Virginia Creeper (*Parthenocissus quinquefolia*) is non-poisonous vine with five leaflets that is often mistaken for poison ivy.

Poison ivy can be a shrub or a woody vine. Yellowish-green flowers occur in compact clusters in leaf axils, in June or July followed by waxy, gray-white berries about three-sixteenths of an inch in diameter in late summer.



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Poison Oak

Poison oak also has three leaves. It grows in the sandy soil of the Southeast as a small shrub. In the western United States poison oak is a very large plant that grows as a standing shrub or climbing vine. Eastern poison oak has the most "oak-looking" leaves of any of the species. It usually has multi-lobed leaves, no aerial roots on the stems, and fuzzy fruits and leaves. It loves sandy soils. Western poison oak is found only along the Pacific coast and into the mountains and it usually has aerial roots extending from the main stem.



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Poison Sumac

A shrub or bush with two rows of 7-13 leaflets, most common in the peat bogs of the Northern United States and in swampy Southern regions of the country. A water loving swamp shrub (dendritic) or bush with two rows of 7-13 leaflets; growing from 6 to 20 feet in height, the Poison Sumac is found in the east from Quebec to Florida and westward along the coast to far west Texas between Shelby and Hardin counties.



Listed below are recommended actions to take to reduce the potential exposure to poisonous plant:

- Determine what types of poisonous plants may be present at the specific site.
- Use repellant sprays and coatings.
- Use netting or long sleeves with cuffs and long pants.
- Regularly inspect skin.
- Maintain a first aid kit on hand.

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Attachment 2 Insects

Chiggers



Chiggers, also known as “red-bugs” or “harvest mites”, are the immature stages of a tiny red mite. They inhabit areas of tall grass, associated with low, wet spots, ponds and stream banks, wild berry patches, and forest underbrush. The larvae attach themselves to the clothing of people or to the fur of passing animals. Before settling down to feed, chiggers move to a constriction, such as sock tops, waistbands, or armpits. Feeding chiggers inject a salivary fluid, which dissolves the host’s cells, and then they suck up the liquefied tissue. Within a few hours, small, reddish, intensely itching welts appear. These bites may continue to itch for several days up to two weeks after the chigger is dislodged. Following are suggestions that should provide some protection from chiggers:

- Stay out of areas where chiggers are likely to be present including wood lots, pastures, roadside ditches, or other areas with tall grasses and weeds. Chiggers are especially common in moist low-lying areas.
- Wear loose-fitting clothing (if possible) when working outdoors. Vehicles should be frequently vacuumed to reduce the number of chiggers that may have been deposited.
- Apply a repellent containing DEET to shoes, socks, and trousers before entering chigger-infested areas. Caution: some individuals may be sensitive to DEET – always read and follow label directions.
- Another repellent of chiggers is flowers of sulfur. Flowers of sulfur is powdered elemental sulfur available at a drug store or pharmacy as an over-the-counter preparation. It has a slight, rotten egg smell. Areas on the body that have tight clothing up against them such as socks, waistbands, etc. may be dusted with sulfur powder. Surveyors and other field personnel state that they fill a sock with sulfur and are able to dust these areas efficiently.

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Sulfur may be more benign to use than DEET on some body parts. Avoid breathing dust during application.


- Immediately after possible exposure to chiggers, take a bath, thoroughly scrubbing the body with hot soapy water. This will kill or dislodge many of the chiggers. The clothes that were worn when the bite(s) occurred should be placed in a plastic bag for temporary storage until they can be laundered.
- When bites begin to itch, one course of treatment is to apply rubbing alcohol, followed by one of the nonprescription local anesthetics. A baking soda paste, calamine lotion, or product such as "After-Bite" also will help reduce discomfort. Avoid scratching bites since this only increases irritation and may lead to a secondary infection of the bite.

Ticks

Ticks are vectors of many different diseases including Rocky Mountain spotted fever, Q fever, tularemia, Colorado tick fever, and Lyme disease. They attach to their host's skin and intravenously feed on its blood creating an opportunity for disease transmission. Covering exposed areas of the body and the use of tick repellent are two ways to prevent tick bites. Periodically during the workday employees will inspect themselves for the presence of ticks. If a tick is discovered, the following procedure should be used to remove it:

- Do not try to detach a tick with your bare fingers; bacteria from a crushed tick may be able to penetrate even unbroken skin. Fine-tipped tweezers should be used.
- Grip the tick as close to your skin as possible and gently pull it straight away from you until it releases its hold.
- Do not twist the tick as you pull and do not squeeze its bloated body. That may actually inject bacteria into your skin.
- Thoroughly wash your hands and the bite area with soap and water. Then apply an antiseptic to the bite area.
- Save the tick in a small container with the date, the body location of the bite, and where you think the tick came from.
- Notify the SSO of any tick bites as soon as possible.

Recently, Lyme disease has been the most prevalent type of disease transmitted by ticks in the United States.

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Spiders



A common venomous spider is the Black Widow. The adult female is glossy black with short, almost microscopic hairs and a crimson hourglass marking on the underside of the abdomen. They are found in dark corners of barns, stables, garages and piles of boxes and crates. They have also been known to reside in vacant rodent burrows, under stones, logs and long grass, and in hollow stumps and brush piles. Generally, Black Widows are not aggressive and usually can be induced to bite only if pressed against the skin. If disturbed, they typically will retreat to a corner of their web. However, these spiders are more aggressive if they are protecting an egg sac. After a bite, a dull numbing pain in the affected extremity occurs. In addition, pain and some muscular rigidity in the abdomen or the shoulder, back, and chest may occur. The bite may also produce headache, dizziness, skin rash, nausea, vomiting, anxiety and weakness, and increased skin temperature over the affected area may be observed. Ice may be placed over the bite to reduce the pain. Bites are rarely fatal to adults, but because the black widow spider injects neurotoxins, it is important to seek immediate medical attention.



Another venomous spider common in the southern United States is the Brown Recluse or Fiddle Back Spider. The Brown Recluse is about 1/4 to 1/2 inches in body length (most adults are about the size of a United States dime to a US quarter with legs extended). Coloration ranges from tan to dark brown, with the abdomen often darker than the rest of the body. The feature that most distinguishes the brown recluse from many other harmless spiders is a

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somewhat darker violin-shaped marking on top of the leg-bearing section of the body. The neck of the violin "silhouette" points towards the rear (abdomen) of the spider. The brown recluse roams at night seeking its prey. During the day, it hides in dark niches and corners, where it may spin a poorly organized, irregular web. Eggs are deposited in 1/2 inch long off-white silken egg sacs, often appearing flattened beneath and convex above. It is shy and will try to run from a threatening situation but will bite if cornered. People are sometimes bitten while they are asleep because they roll onto a brown recluse spider while it is hunting in the bed. More often the victim is bitten while putting on a shoe or piece of clothing that a spider has selected for its daytime hiding place. The bite of the brown recluse is usually painless until 3 to 8 hours later when it may become red, swollen, and tender. Later the area around the bite site may develop into an ulcerous sore from 1/2 to 10 inches in diameter. Healing often requires a month or longer, and the victim may be left with a deep scar. Prompt medical attention can reduce the extent of ulceration and alleviate other complications that may develop. It should be noted that not all brown recluse bites result in ulcerations or scarring.¹

Fire Ants


Fire ants are approximately 1/4-inch long and live in underground chambers that typically contain over 1,000 ants. One sure sign of the presence of fire ants is their conical mounds, which are a result of the digging of their chambers. The sting of a fire ant results in localized reddening of the bite area, accompanied by sharp burning sensations. The first ant sting releases a chemical substance that triggers other ants of the colony to sting. Anyone seeing fire ant mounds present at the work site should notify the SSHO, who will then notify the rest of the crew so the mounds may be avoided if possible.

Flying Insects

Flying insects such as mosquitoes, wasps, hornets, and bees may be encountered while site activities occur. Section 3.4.4 discusses problems associated with them. Mosquitoes can be the vectors for diseases such as the West Nile Virus and Saint Louis Encephalitis, reports of which appear in the media periodically. Avoiding mosquito bites is the best way to avoid potential exposure to mosquito-borne disease. Apply insect repellant containing DEET (N,N-diethyl-meta-toluamide), wear long-sleeved clothes and long pants treated with repellent and stay indoors during peak mosquito feeding hours (dusk until dawn) to further reduce your risk.

There is currently no vaccine to protect humans against Saint Louis Encephalitis or West Nile Virus. Individuals at project sites can reduce their risk from being infected with West Nile Virus by taking the following actions to protect against mosquito bites:

- Review the hazards of West Nile Virus periodically in morning safety meetings.
- Increase protective measures when working at dawn, dusk, and in the early evening.
- Reduce the area of exposed skin when working outdoors. Long-sleeved shirts with sleeves rolled down are recommended. Understand that mosquitoes may bite through thin clothing, so personnel should evaluate the actual Level D clothing worn, for example, heavy, long

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sleeve work shirts and heavy dungarees/jeans may be indicated. Activity at projects where disposable coverall use (i.e., Tyvek®) is specified, further reduces the risk of mosquito bites.

- For activities where only Level D PPE is specified, consider using disposable coveralls when working in wooded, highly vegetated, or swampy areas.
- Use an insect repellent containing approximately 30 percent DEET. In concentrations greater than 35 percent, DEET provides no additional protection. Use the repellent according to the manufacturer's directions provided on the container. Use just enough repellent to cover exposed skin and clothing. Do not treat unexposed skin. Frequent reapplication or saturation is unnecessary for effectiveness. Avoid prolonged and excessive use of DEET.
- When additional protection against mosquitoes is necessary, commercially prepared "clothing and gear" insect repellants containing 0.5 percent permethrin may be used. These repellants, such as Repel Permanone™ are available in the sporting goods departments at major retailers. Clothing and gear insect repellants are not for use on skin. Use the repellent according to the manufacturer's recommendations provided on the container.
- After returning from outdoor field activities, wash treated skin with soap and water.
- Personnel should report flu-like symptoms to the SSO.

West Nile Virus

The Centers for Disease Control and Prevention report that human illness from West Nile virus is rare, even in areas where the virus has been reported. The chance that any one person is going to become ill from a mosquito bite is low. West Nile virus is spread by the bite of an infected mosquito, and can infect people, horses, many types of birds, and some other animals. Most people who become infected with West Nile virus will have either no symptoms or only mild ones. On rare occasions, West Nile virus infection can result in a severe and sometimes fatal illness known as West Nile encephalitis (an inflammation of the brain). The risk of severe disease is higher for persons 50 years of age and older. There is no evidence to suggest that West Nile virus can be spread from person to person or from animal to person.

Saint Louis Encephalitis

The Centers for Disease Control and Prevention report mild infections occur without apparent symptoms other than fever with headache. More severe infection is marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, occasional convulsions (especially in infants) and spastic paralysis. There is no evidence to suggest that Saint Louis encephalitis can be spread from person to person or from animal to person.



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Table 1

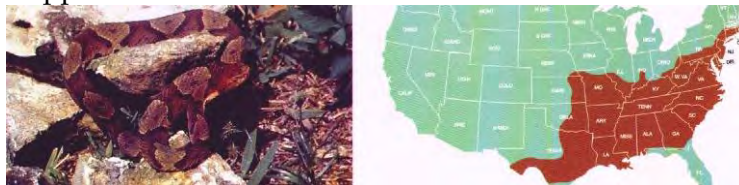
Flying Insect Information

| Organism | Description | Habitat | Problem | Severity | Protection |
|----------|--|---|--|--|--|
| Hornet | One inch long with some body hair. Abdomen is mostly black. | Round, paper like nest hanging from trees, shrubs, or under eaves of buildings. | One nest may contain up to 100,000 hornets that will attack in force at the slightest provocation. | Severe pain, allergic reactions similar to bees. | Do not come near or disturb nest. If a hornet investigates you, do not move. |
| Mosquito | Small, dark, fragile body with transparent wings. From 1/8 to 1/4 inch long. | Where water is available for breeding. | Bites and sucks blood. Itching and swelling result. | Can transmit encephalitis and other diseases. Scratching causes secondary infections. | Use plenty of insect repellent and wear gloves. Stay in windy areas. |
| Wasp | Very thin waist. Color can be black, yellow or orange with stripes. | Underground nest. Paper-like honeycomb nest in abandoned buildings hollow trees, etc. | Stings. Some species will attack if you get too close to the nest. | Severe pain, allergic reactions similar to bees. Can be fatal. | Avoid Nest. Do not swat at them. |
| Bee | Generally have yellow and black stripes and two pair of wings. | Hollow logs, underground nest, old buildings, | Stings when annoyed. Leaves venom sac in victim. | If person is allergic, nausea, shock, constriction of the airway can result. Death may result. | Be careful and watch where you walk. Cover exposed skin. Avoid areas where bees are swarming. Avoid wearing sweet fragrances and bright clothing. Move slowly or stand still when bees are swarming about you. |

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Attachment 3 Snakes

Copperhead



Coral



Cottonmouth



Diamondback Rattlesnake




Water Moccasin


The most effective way to prevent snakebites is to avoid snakes in the first place. Personnel should avoid walking at night or in high grass and underbrush. Visual inspection of work areas should be performed prior to activities taking place. The use of leather boots and long pants will be required, since more than half of all bites are on the lower part of the leg. No attempts at killing snakes should be made; many people are bitten in such an attempt.

If a snake bites someone, the following treatment should be initiated:

- Keep patient calm

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- Notify emergency medical services
- Wash the wound and keep the affected body part still
- Apply direct pressure to site of bite if bleeding is extreme
- Keep the affected area lower than the heart
- Carry a victim who must be transported, or have him/her walk slowly
- Transport to closest medical facility

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Attachment 4 **Other Natural Hazards**

Alligators


Alligators live in nearly all Louisiana parishes but are most common in the major river drainage basins and large lakes in the southern portion of the state. Most attacks involve animals over six feet long. Alligators become more active in the beginning of March, peaking in May, which is their mating season. Females will nest in June - July, and the eggs will hatch in August and September. Even a small amount of impounded water may contain a large alligator. Twilight and night are prime times for alligator attacks. Never approach an alligator. Always stay at least 30 yards away. Never wade or swim in areas that could contain large alligators. Do not dump food or scraps into or near the water. This can attract alligators. Always be aware of your surroundings and use caution and common sense. If at any time personnel observe alligators at the site they will immediately inform the SSO, who will then notify the rest of the crew and local wildlife personnel.

Feral Animals


Feral animals such as rats or other wildlife may be encountered during fieldwork. Typically, feral animals are as afraid or more afraid of humans and when encountered will run away from human contact. However, if an animal is diseased, injured or tending a nest, they may become aggressive. The most common disease encountered with feral animals is rabies. Signs of a rabies-infected animal include:

- Changes in an animal's behavior;
- General sickness;
- Difficulty swallowing;
- An increase in drool or saliva;
- Wild animals that appear abnormally tame or sick;
- Animals that may bite at everything if excited;
- Difficulty moving or paralysis; and
- Death.

Animals in the early stage of rabies may not have any signs, although they can still infect you if they bite you. The incubation period is the time from the animal bite to when signs appear. In rabies, it is usually 1-3 months. However, it can last as long as several years. Once the virus reaches the brain or spinal cord, signs of the disease appear. **In the event an animal is**

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encountered on the site, do not approach it. If it exhibits one or more of the signs listed above, call local wildlife personnel to get as

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| | Title: | Drum Handling |
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SCOPE

This procedure identifies the work practices and regulatory requirements regarding drum handling at the jobsite.

DEFINITIONS

None.


PROCEDURE

- A. When handling drums, follow the general drum handling requirements listed below:
 1. Hazardous substances and contaminated, liquids and other residues must be handled, transported, labeled, and disposed of in accordance with 29 CFR 1910.120(j).
 2. When practical, drums and containers must be inspected and their integrity must be assured prior to being moved.
 3. Unlabeled drums and containers must be considered to contain hazardous substances and handled accordingly until the contents are positively identified and labeled.
 4. Drums must be handled only if necessary. Prior to handling, all personnel should be warned about the hazards of handling and instructed to minimize handling as much as possible.
 5. Drums and containers that cannot be moved without rupture, leakage, or spillage must be emptied into a sound container using a device classified for the material being transferred.
 6. A ground-penetrating system or other type of detection system or device will be used to estimate the location and depth of buried drums or containers.
 7. Soil or covering material must be removed with caution to prevent drum or container rupture.
 8. Fire extinguishing equipment meeting the requirements of 29 CFR Part 1910, Subpart L, must be on hand and ready for use to control incipient fires.
- B. When opening drums and containers, such as for sampling or waste characterization purposes, handling shock sensitive wastes, radioactive wastes, or when shipping drums, the RCM Health and Safety Coordinator must develop a site specific drum handling plan to be included in the HASP

REFERENCES

Regulatory References

- 29 CFR 1910.120(j), Handling Drums and Containers

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- 29 CFR 1926.65(j), Handling Drums and Containers

Technical References


None

Procedural References

- ERM Corporate Health and Safety Program, Drum/Container/Cylinder Handling Procedures

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|-------------|---------------|--------------|-----------------|
| 12/31/07 | 0 | ELG | Issued for use |

|  | SAFE WORK PRACTICE | |
|---|--------------------|------------|
| | SOP #: | 13 |
| | Title: | Hand Tools |
| | Last Rev.: | 1/12/2011 |
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SCOPE

This procedure defines minimum expectations for the safe use and maintenance of tools and equipment, including tools and equipment which may be furnished by employees.

DEFINITIONS

Torque: The circular or rotating motion in tools such as drills, impact wrenches, saws, etc. which results in a strong twisting force

PROCEDURE

A. HAND TOOLS

1. Every tool was designed to do a certain job and employees should use tools only for their intended purpose.
2. Maintain hand tools in good condition - sharp, clean, oiled. .
3. Do not force tools beyond their capacity or use "cheaters" to increase their capacity. Do not use tools for pry bars.


B. PORTABLE POWER TOOLS

1. GUARDING

Guards or shields must be installed on all power tools before issue. Do not use improper tools or tools without guards in place.

C. OPERATING PRACTICES

1. Loose clothing, rings, and other jewelry must not be worn around operating machines. Keep sleeves buttoned or rolled up.
2. Keep fingers away from moving parts. Shut off machines to remove waste. Use a brush to clean up and debur. Be sure machine is fully stopped and not coasting.
3. Inspect at least daily before start-up. Look for loose or damaged parts and inadequate lighting.
4. Use clamps or vise to hold work.
5. Many machines have Safety Interlocking devices. Verify their operation prior to use , and NEVER BYPASS SAFETY INTERLOCK DEVICES.
6. Examine each power tool before using it. Look for damaged parts, loose fittings, frayed or cut electric cords. Tag and return defective tools for repairs.

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7. Some machines use both pneumatic and electric power. Both must be shut off to make repairs or to adjust moving parts. Bleed down tool to remove any stored energy left in the system.
8. Be prepared in case of jamming. Maintain good footing; and use two hands, Circular saws, chain saws and percussion tools shall not be equipped with a locking switch or trigger
9. Flying objects can result from operating almost any power tool. Be aware of others working around you and use proper eye protection.
10. Keep moving parts directed away from your body. Never touch a powered part unless power source is disconnected (such as drill chucks, blades, and bits).
11. Ground Fault Circuit Interrupters (GFCI) are required when using electrical power tools.

REFERENCES

Regulatory References

- 29 CFR 1910.241 Definitions.
- 29 CFR 1910.242 Hand and Portable Powered Tools and Equipment, General.
- 29 CFR 1910.243 Guarding of Portable Power Tools.
- 29 CFR 1910.244 Other Portable Tools and Equipment.
- 29 CFR 1926.300 General Requirements.
- 29 CFR 1926.301 Hand Tools.
- 29 CFR 1926.302 Power-operated Hand Tools.

Technical References


None

Procedural References

SWP 7 Personnel Protective Equipment

REVISION LOG

| DATE | REV. # | APV'D | COMMENTS |
|-----------|--------|-------|--|
| 12/31/07 | 0 | ELG | Issued for use |
| 1/12/2011 | 1 | RLE | Renumbered, integrated with ERM H&S program, removed references to RCM |

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|  | 48.0 VEHICLE SAFETY GUIDELINE | |
| APPLICABILITY: ERM North America Operations | DOCUMENT#: 48.0 | DATE OF LAST REVISION: 1.7.2010 |

48.0 VEHICLE SAFETY GUIDELINE

Every day ERM employees travel by truck, van, rental car, chauffeured car, and client and personal vehicles to conduct the work of the company. This normal and indispensable part of the workday includes risks that can be understood and managed. This guideline specifically supplements the general travel risk assessments implemented as part of ERM's Work Activity Risk Assessment (WARN) process. The risks from vehicle travel include but are not limited to:

- Accident due to other driver's inattention
- Accident due to ERM driver inattention
- Vehicle malfunction during travel
- Accident due to weather and road conditions
- Injury while attending to maintenance problems near the road
- Accident due to lack of knowledge of vehicle functions
- Hijacking / theft

The purpose of this Vehicle Safety Guideline is to help ensure that ERM employees have formally considered the potential risks of vehicle transportation while on company business and that the risks are managed effectively. Situations covered by this guideline include the following:

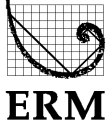
- Use of company-owned/ long term leased vehicles
- Use of rental vehicles for company business
- Use of personal vehicles for company business
- Contract driver and car
- Hijacking

Below are the specific elements of the guideline. Each section dealing with ERM drivers contains information on conditions of use, inspection, maintenance and repair, and minimum safety equipment.

Of note, this Vehicle Safety Guideline is meant to cover non-commercial vehicles, or those with a Gross Motor Vehicle Weight of 10,001 pounds or less.

48.1. FLEET MANAGER ROLE

ERM owns or maintains long term lease arrangements for such vehicles as trucks, vans, and even automobiles. Control of maintenance, inspection, and repair functions is most efficient and effective when one person has been assigned responsibility as a Business Unit (BU) Fleet Manager and branch employees also take a role as Office Fleet Coordinator.

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Each BU that owns or has long term leases for vehicles should develop a centralized fleet management process, sufficiently detailed to manage inspection and maintenance functions of its fleet. This may range from very simple systems to multi-person arrangements.

48.2. INCIDENT & NEAR-MISS REPORTING

The following incidents and near misses must be reported immediately to the Project Manager, Partner in Charge, and ERM BU or Division Health & Safety Leader, and reported to the ERM Event Communication System (ECS) within 24 hours. They should be investigated using ERM's standard incident investigation process. If the incident involves damage to a BU's fleet, then the Fleet Manager must also be informed.


- a. ANY incident or potentially serious near miss occurring on the job site, regardless of injury or property damage.
- b. ANY incident or potentially serious near miss occurring while driving to / from the job site or office, regardless of injury or property damage.
- c. ANY incident resulting in property damage (to company vehicle or other vehicles), filing of an insurance claim by either party, or filing of a police report, regardless of when/where it occurs.

Following any incident involving vehicles listed above, the driver of the vehicle may be asked to undergo drug and/or alcohol testing as part of the incident investigation. This determination will be made by the BU Health and Safety Leader and District or Division Managing Partner.

48.3. BASIC SAFE DRIVING POLICIES

The following rules cover ERM use of owned, leased, rented, and personal vehicles for work. **If they are not as stringent as certain specific state or local regulations or client requirements, then the more stringent requirements clearly must be met.**

- Employees should follow all posted signs and speed limits, all applicable laws and regulations, and any client-specific vehicle safety policies.
- Wearing of available seatbelts is required at all times while operating or riding in any motor vehicle on company business.
- All loose equipment must be secured before driving.
- Doors of vehicles that are unattended (even for a short period of time) should be locked so that all equipment inside them is secured. All critical documents and pieces of equipment should either be very well secured or removed from the vehicle if unattended for long periods of time, such as overnight.

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- Never transport people in the bed of a pickup truck and never transport more people than the seating capacity of the vehicle allows.
- Refer to the vehicle owner's manual for safe towing capacity of vehicles and safe towing procedures. When towing equipment, ensure that weight is distributed evenly and that warning/signal lights are working properly.
- When driving vehicles with the ERM company name and logo on the side, whether on or off the job site, you are a representative of ERM and should act professionally.
- ERM drivers must be aware that fatigue affects driving safety and include this safety factor in project budgeting and trip planning. As a benchmark, ERM employees should avoid driving after doing work-related activity (including driving) for more than 14 hours and should avoid driving more than 8 hours in any one work day. Consecutive work days of 14 hours are discouraged, particularly if long periods of driving are involved.
- All ERM employees driving on company business will receive awareness training on driver fatigue.
- The use of cell phones and other portable electronic devices while driving (including texting) is distracting and increases your risk of having an accident. Their use while driving is forbidden by law in certain countries, states, or regions and *is very strongly discouraged by ERM*. In almost all situations, it can and should be avoided.
 - Employees should not use cell phones and portable electric devices when attention to traffic lights, intersections, pedestrians, and other stopping and starting traffic is necessary. Use of these devices may cause drivers to miss traffic signals and delays response as incidents are developing around them.
 - The use of cell phones and other hand-held portable electronic devices is also strongly discouraged during highway driving, where attention to direction and speed are the only prominent requirements. If their use is unavoidable, consider pulling off the road until the conversation is complete.

48.4. COMPANY OWNED/LONG TERM LEASED VEHICLES

48.4.1. *Conditions of Use*

The vehicle driver must possess a valid governmental Driver's License. Drivers must follow all posted signs, speed limits, and all applicable laws and regulations. Drivers must maintain a safe driving record. An employee considered a negligent driver by the authority issuing the driver's license may be restricted from operating a company vehicle.

Unless by special arrangement and considering all security issues, company and long term leased vehicles should not normally be taken to a residence unless authorized by a District or Division Managing Partner. The security of equipment, tools, and documents in vehicles must be managed. Depending on the significance and cost of

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the items, they should either be removed from vehicles each evening or securely locked and hidden away from sight in the vehicle. Permanent storage of equipment in the vehicle is not allowed.

48.4.2. Inspection, Maintenance, and Repair

Company-owned or long term leased vehicles should be inspected on a regular basis, typically prior to first use and daily/weekly/monthly. These inspections must be documented using a form such as the ERM Vehicle Safety Form (see attached) or client-required form. On a monthly basis, other operational aspects such as oil level and belts should be checked and the results documented as well.

Any deficiencies noted on inspection forms should be reported promptly to the Office Fleet Coordinator or BU Fleet Manager. It is advisable for the Office Fleet Coordinator to periodically review these inspection forms to note any important trends that we or our vehicle leasing company should know.

Routine scheduled maintenance and repairs should be managed according to each BU's Fleet Management Procedures.

48.4.3. Minimum Safety Equipment

At a minimum, the following safety equipment should be located in a company-owned or long term leased vehicle:

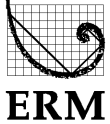
- fire extinguisher (type ABC), secured/mounted inside cab
- first aid kit
- spare tire and jack
- jumper cables (check instructions)
- flashlight
- a means of warning such as road flares or lighted triangles
- traffic cones or delineator posts (minimum of two)
- reflective safety vest
- disposable camera (critical for incident investigation and documentation)

48.5. RENTAL VEHICLES

48.5.1. Conditions of Use

All employees are strongly encouraged to rent vehicles from companies with which ERM has negotiated rates and contract terms. If employees cannot rent from a consistent provider, then they should purchase the collision damage waiver and personal accident insurance.

Drivers of rental vehicles must possess valid governmental Driver's Licenses. Drivers must follow all posted signs, speed limits, and all applicable laws and regulations.

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The security of equipment, tools, and documents in rental vehicles must be managed. Depending on the significance and cost of the items, they should either be removed from vehicles each evening or securely locked in the vehicle.

48.5.2. Inspection, Maintenance, and Repair

If a rental vehicle is used for intrusive field activities, gauging/sampling, operations and maintenance (O&M), construction/demolition, or any work at remote sites, basic functional aspects of these vehicles should be checked at first rental and then on a regular basis. These inspections must be documented using a form such as the ERM Vehicle Safety Form (see attached) or client-required form.

It is recommended that the drivers of rental vehicles used for other purposes also inspect the vehicle at least for damage on first receipt. Employees should not operate a rental vehicle that is in unsafe condition. Employees should contact the rental car company for maintenance/ repair/ or replacement of rental vehicles, and in the event of any property damage incurred.

48.5.3. Minimum Safety Equipment


When trucks and vans, or automobiles are rented **locally** for field activities, gauging/sampling, O&M, construction/demolition, or ANY work at remote sites, the following minimum safety equipment must be secured. It is most reliable when the equipment is always in the vehicle but it could also be present as part of an employee's field kit. From a vehicle safety standpoint this is the same situation as when using company-owned or leased vehicles:

- fire extinguisher (type ABC), secured/mounted inside cab
- first aid kit
- spare tire and jack
- flashlight
- a means of alarming such as road flares or lighted triangles
- traffic cones or delineator posts (minimum of two)
- reflective safety vest
- disposable camera (critical for incident investigation and documentation)

If we are renting trucks and vans from locations that are a significant distance away from our normal sources of safety equipment, a reasonable effort should be made to acquire this equipment from the local ERM office or other provider.

48.6. PERSONAL VEHICLES

48.6.1. Conditions of Use

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| APPLICABILITY: ERM North America Operations | DOCUMENT#: 48.0 | DATE OF LAST REVISION: 1.7.2010 |

When a personal vehicle is used on a work site, it is part of the equipment that represents ERM on the job. Its condition should not present potential safety hazards or cause a negative impact on job completion.

Drivers must possess a valid governmental Driver's License. They must follow all posted signs, speed limits, and all applicable laws and regulations. The security of ERM equipment, tools, and documents in personal vehicles must be managed. Depending on the significance and cost of the items, they should either be removed from vehicles each evening or securely locked in the vehicle and stored out of sight.

48.6.2. Inspection, Maintenance, and Repair

Staff should not use personal vehicles for work purposes if they are not in safe and reliable condition. If a personal vehicle is used for intrusive field activities, gauging/sampling, O&M, construction/demolition, or any work at remote sites, basic functional aspects of these vehicles should be checked on a daily basis. These inspections must be documented using a form such as the ERM Vehicle Safety Form (see attached) or client-required form.

48.6.3. Minimum Safety Equipment


When personal vehicles are used for intrusive field activities, gauging/sampling, O&M, construction/demolition, or ANY work at remote sites, the following minimum safety equipment should be secured. It is most reliable when the equipment is always in the vehicle but it could also be present as part of an employee's field kit. From a vehicle safety standpoint this is the same situation as leasing or owning a field vehicle:

- Fire extinguisher (type ABC), secured/mounted inside cab
- First aid kit
- spare tire and jack
- jumper cables (check instructions)
- flashlight
- a means of alarming such as road flares or lighted triangles
- traffic cones or delineators (minimum of two)
- reflective safety vest
- disposable camera (critical for incident investigation and documentation)

48.7. CONTRACT DRIVER AND CAR

48.7.1. Conditions of Use

In certain regions ERM consistently hires vehicles and drivers rather than driving for work purposes. While ERM employees will not drive or inspect these cars and are only passengers, we should always aim for the following safety practices:

| | | |
|---|--------------------------------------|---|
|  <p>Environmental Resources Management</p> | 48.0 VEHICLE SAFETY GUIDELINE | |
| APPLICABILITY: ERM North America Operations | DOCUMENT#: 48.0 | DATE OF LAST REVISION: 1.7.2010 |

- Attempt to establish long term relationships with a select number of companies whose quality in equipment and drivers is known.
- Strongly emphasize our desire that the hired vehicles have seat belts in the front and rear – this is our goal.
- Insist on seeing documentation that the company has a preventative maintenance program for its vehicles (certificate in the vehicle or other documentation).
- Request a copy of the driver's license in advance of hire and keep it on file.
- Insist on having an experienced driver who has not just begun work as a professional driver.

48.8. HIJACKING


In certain parts of the world, hijacking of vehicles is an increasing risk for ERM drivers. Below is awareness information on how hijacking may occur and how to avoid it.

48.8.1. Awareness for Avoiding Hijacking

- Hijackers may attempt to open your car door on a badly lit street or spot, usually approaching you from behind your car.
- Stop-signs, traffic lights and traffic intersections are common hijacking locations. Hijackers sometimes disguise themselves as street vendors or people trying to get your attention, stop your vehicle, and open your door.
- Hijackers overpower motorists at car service stations and snatch the keys from startled attendants. It is safer to patronize service stations during normal hours (8 am to 5 pm) and busy periods when incidents like this are less likely to occur.
- Hijackers nudge a vehicle in the rear. When the victim gets out of the car to inspect the damage to the car, they jump into the empty car.
- Prime hijacking times are between 6 and 8 am and between 6 and 8 pm, and after schools close between 12 and 3 pm, but it can happen at any time.
- Recent studies indicate that most of the hijackings in urban areas occur in the driveways of residential or commercial properties. Be extremely careful when leaving or arriving at your hotel, your lodge or a residence.
- Hijackers and their accomplices sometimes lie in the road as a ploy to attack unsuspecting motorists. Be wary of stopping in these situations.

48.9. TRAINING

Employee Defensive Driving training is necessary due to the hazards posed by this activity. Each employee designated as a "Hazardous Fieldworker" or "Non-Hazardous Fieldworker" in the H&S training database must attend ERM Vehicle Safety training. This training should be repeated at least every 3 years. Training to

| | | |
|---|-------------------------------|---|
|  <div> Environmental Resources Management </div> | 48.0 VEHICLE SAFETY GUIDELINE | |
| APPLICABILITY: ERM North America Operations | DOCUMENT#: 48.0 | DATE OF LAST REVISION: 1.7.2010 |

meet client, personal insurance company, or other requirements would likely meet ERM's requirements.

48.9.1. *Company Owned or Long Term Leased Vehicles*

- ERM employees should receive orientation prior to driving company-owned or long term leased vehicles for the first time. The BU Fleet Manager and/or Office Fleet Coordinator are responsible for developing and administering a process for orientations, performing training, and sending records of training to the Training Records Coordinator.

48.9.2. *High-Mileage/High Frequency Business Drivers*

- ERM employees who frequently drive company-owned or leased vehicles and other high mileage/ high frequency business drivers, as determined by the BU, should undergo a basic Defensive Driving class. Attendance at such training may also be one of the recommendations evolving from incident investigations of vehicle-related incidents. The class should include a test and a certificate of completion
- The most highly recommended class for these employees is one that involves an external expert trainer with an opportunity to demonstrate practical awareness through practice driving.
- An alternate method of providing defensive driving for this group includes on-line training. Generic defensive driving classes are available on the internet at a cost of approximately \$40 US. One on-line source is the US National Safety Council. Search the internet for "NSC Defensive Driving Course" and locate *National Safety Council Defensive Driving Course 8/6*. It is available in English and Spanish.
- Some level of refresher training should be provided every 3 years for this category of driver and more frequently if an ERM driver is involved in a preventable accident with injury/property damage or there is any reason to believe that refresher training is necessary in the interim.

48.9.3. *Other Drivers*

As determined by BU management, other ERM employees who use rental or personal vehicles to conduct sales and project activity should receive **one-time** defensive driving awareness training. This training could take the form of in-house training, on-line training, or other means of training. ERM has developed a training presentation, entitled *Introduction to Defensive Driving* and a test for use in meeting this more basic training requirement.

MATERIAL SAFETY DATA SHEETS

**NORLAB CALIBRATION GASES & EQUIPMENT -- METHANE IN AIR 0.0001% TO 2.5% --
6830-00F048862**

===== Product Identification =====

Product ID:METHANE IN AIR 0.0001% TO 2.5%
 MSDS Date:09/12/1995
 FSC:6830
 NIIN:00F048862
 MSDS Number: BZTzs
 === Responsible Party ===
 Company Name:NORLAB CALIBRATION GASES & EQUIPMENT
 Address:1121 W AMITY
 City:BOISE
 State:ID
 ZIP:83705
 Country:US
 Info Phone Num:208-336-1643
 Emergency Phone Num:208-336-1643
 CAGE:NORLA
 === Contractor Identification ===
 Company Name:NORLAB CALIBRATION GASES AND EQUIPMENT
 Address:1121 WEST AMITY
 City:BOISE
 State:ID
 ZIP:83705
 Country:US
 Phone:800-657-6672/208-384-1720 (FAX)
 CAGE:NORLA
 Company Name:NORLAB DIV OF NORCO, INC.
 Address:1121 W. AMITY
 Box:City:BOISE
 State:ID
 ZIP:83705
 Country:US
 Phone:208-336-1643
 CAGE:0YFB8

===== Composition/Information on Ingredients =====

Ingred Name:METHANE
 CAS:74-82-8
 RTECS #:PA1490000
 Fraction by Wt: .0001%
 ACGIH TLV:SIMPLE ASPHYXIAN

Ingred Name:COMPRESSED AIR, REFRIGERATED LIQUID
 RTECS #:AX5271000
 Fraction by Wt: <97.5%

===== Hazards Identification =====

Routes of Entry: Inhalation:YES Skin:NO Ingestion:NO
 Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO
 Health Hazards Acute and Chronic:EYES: CONTACT MAY CAUSE TISSUE
 FREEZING. SKIN: METHANE IS A SIMPLE ASPHYXIAN.
 Explanation of Carcinogenicity:NONE
 Effects of Overexposure:DIZZINESS, DEEPER BREATHING, NAUSEA,
 UNCONSCIOUSNESS.

===== First Aid Measures =====

First Aid:EYES: DON'T WASH W/HOT/EVEN TEPID WATER. IF VICTIM CAN'T TOLERATE LIGHT, PROTECT W/LIGHT BANDAGE/HANDKERCHIEF. INHALATION: REMOVE TO FRESH AIR. GIVE CPR/OXYGEN IF NEEDED. OBTAIN MEDICAL ATTENTION IN A LL CASES.

===== Fire Fighting Measures =====

Flash Point:GAS
Lower Limits:5
Upper Limits:15
Extinguishing Media:WATER, CO2, DRY CHEMICAL
Fire Fighting Procedures:SHOULD FLAME BE EXTINGUISED & FLOW OF GAS CONTINUE, INCREASE VENTILATION TO PREVENT FLAMMABLE MIXTURE FORMATION IN LOW AREAS/POCKETS. WEAR SCBA.

===== Accidental Release Measures =====

Spill Release Procedures:EVACUATE AREA. USE PROTECTIVE EQUIPMENT. IF LEAK IS IN USER'S EQUIPMENT, BE CERTAIN TO PURGE PIPING W/AN INERT GAS PRIOR TO ATTEMPTING REPAIRS. IF LEAK IS IN CONTAINER/CONTAINER VALVE, CONTACT CHEMTRE C/NEAREST NORCO LOCATION. (SEE SUPP)

===== Handling and Storage =====

Handling and Storage Precautions:USE IN VENTILATED AREA. VALVE PROTECTION CAPS MUST REMAIN IN PLACE UNLESS CONTAINER IS SECURED W/VALVE OUTLET PIPED TO USE POINT.
Other Precautions:DON'T DRAG/ROLL CYLINDERS. USE A SUITABLE HAND TRUCK FOR CYLINDER MOVEMENTS, A PRESSURE REDUCING REGULATOR WHEN CONNECTING CYLINDERS TO LOWER PRESSURE PIPING/SYSTEMS. DON'T HEAT CYLINDERS, USE A CHECK VALVE/TRAP IN DISCHARGING LINE.

===== Exposure Controls/Personal Protection =====

Respiratory Protection:USE POSITIVE PRESSURE AIR LINE W/MASK/SELF CONTAINED BREATHING APPARATUS.
Ventilation:HOOD W/FORCED VENTILATION. LOCAL/MECHANICAL VENTILATION.
Protective Gloves:PLASTIC/RUBBER
Eye Protection:SAFETY GOGGLES/GLASSES
Other Protective Equipment:SAFETY SHOES, SAFETY SHOWER.
Supplemental Safety and Health
SPILLS CONT'D: INCREASE VENTILATION. EXTINGUISH IGNITION SOURCES.
HANDLING & STORAGE CONT'D: PROTECT CYLINDERS. STORE IN COOL, DRY WELL VENTILATED AREA. AVOID TEMP TO EXCEED 130F. STORE UPRIGHT & FIRM LY SECURE. USE A "FIRST IN, FIRST OUT" INVENTORY SYSTEM. NEVER CARRY GAS CYLINDERS/CONTAINERS IN ENCLOSED SPACES.

===== Physical/Chemical Properties =====

Solubility in Water:NEGLIGIBLE
Appearance and Odor:A COLORLESS GAS W/NO ODOR.

===== Stability and Reactivity Data =====

Stability Indicator/Materials to Avoid:YES
OXIDIZERS

===== Disposal Considerations =====

Waste Disposal Methods:DON'T ATTEMPT TO DISPOSE OF WASTE/UNUSED
QUANTITIES. RETURN IN SHIPPING CONTAINER PROPERLY LABELED W/ANY
VALVE OUTLET PLUGS/CAPS SECURE & VALVE PROTECTION CAP IN PLACE TO
NORCO FOR PROPER DISPOSAL. NO NFLAMMABLE GAS UN1956

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assume responsibility for the suitability of this information to their
particular situation.

SCOTT SPECIALTY GASES -- ISOBUTYLENE IN AIR, (SEE SUPPL.) -- 6665-01-449-8454

===== Product Identification =====

Product ID:ISOBUTYLENE IN AIR, (SEE SUPPL.)

MSDS Date:11/20/1997

FSC:6665

NIIN:01-449-8454

Status Code:A

Kit Part:Y

MSDS Number: CLFCR

=== Responsible Party ===

Company Name:SCOTT SPECIALTY GASES

Address:2330 HAMILTON BLVD

City:SOUTH PLAINFIELD

State:NJ

ZIP:07080

Country:US

Info Phone Num:908-754-7700

Emergency Phone Num:908-754-7700

Resp. Party Other MSDS Num.:M-704/E-1

CAGE:54262

=== Contractor Identification ===

Company Name:PHOTOVAC INTL INC/DBA PHOTOVAC MONITORING INSTRUMENTS

Address:UNK

Box:UNK

City:DEER PARK

State:NY

ZIP:11729

Country:US

Phone:000-000-0000

CAGE:70123

Company Name:PINE ENVIRONMENTAL SERVICES INC

Address:379 PRINCETON-HIGHTSTOWN RD

Box:City:CRANBURY

State:NJ

ZIP:08512

Country:US

Phone:609-371-9663

Contract Num:SP0200-99-M-T071

CAGE:1JSC4

Company Name:SCOTT SPECIALTY GASES

Address:2330 HAMILTON BLVD

Box:City:SOUTH PLAINFIELD

State:NJ

ZIP:07080

Country:US

Phone:908-754-7700

CAGE:54262

===== Composition/Information on Ingredients =====

Ingred Name:ISOBUTYLENE

CAS:115-11-7

RTECS #:UD0890000

Fraction by Wt: 1-1500% PPM

Ingred Name:AIR

CAS:132259-10-0

Fraction by Wt: BALANCE

===== Hazards Identification =====

Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO
 Health Hazards Acute and Chronic:ACUTE EFFECTS: NONE. CHRONIC EFFECTS:
 NONE KNOWN.
 Explanation of Carcinogenicity:CARCINOGENICITY (U.S. ONLY): NTP - NO;
 IARC MONOGRAPHS - NO; OSHA REGULATED - NO.
 Effects of Overexposure:NONE.
 Medical Cond Aggravated by Exposure:NONE KNOWN.

===== First Aid Measures =====

First Aid:IN EVENT OF EXPOSURE, CONSULT A PHYSICIAN. INHALATION:
 IMMEDIATELY REMOVE VICTIM TO FRESH AIR. IF BREATHING HAS STOPPED,
 GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE
 OXYGEN. EYE CONTACT: NONE. SKIN CONTACT: NONE. INGESTION: NONE.

===== Fire Fighting Measures =====

Flash Point:NONFLAMMABLE
 Extinguishing Media:USE WHAT IS APPROPRIATE FOR SURROUNDING FIRE.
 Fire Fighting Procedures:WEAR SELF-CONTAINED BREATHING APPARATUS AND
 FULL PROTECTIVE CLOTHING. KEEP FIRE EXPOSED CYLINDERS COOL WITH
 WATER SPRAY. IF POSSIBLE, STOP THE PRODUCT FLOW.
 Unusual Fire/Explosion Hazard:CYLINDER RUPTURE MAY OCCUR UNDER FIRE
 CONDITIONS. COMPRESSED AIR AT HIGH PRESSURE WILL ACCELERATE THE
 COMBUSTION OF FLAMMABLE MATERIALS.

===== Accidental Release Measures =====

Spill Release Procedures:EVACUATE AND VENTILATE AREA. REMOVE LEAKING
 CYLINDER TO EXHAUST HOOD OR SAFE OUTDOOR AREA. SHUT OFF SOURCE IF
 POSSIBLE AND REMOVE SOURCE OF HEAT.

===== Handling and Storage =====

Handling and Storage Precautions:HANDLING: SECURE CYLINDER WHEN USING
 TO PROTECT FROM FALLING. USE SUITABLE HAND TRUCK TO MOVE CYLINDERS.
 STORAGE: STORE IN WELL VENTILATED AREAS. KEEP VALVE PROTECTION CAP
 ON CYLINDERS WHEN NOT IN USE .
 Other Precautions:PROTECT CONTAINERS FROM PHYSICAL DAMAGE. DO NOT
 DEFACE CYLINDERS OR LABELS. CYLINDERS SHOULD BE REFILLED BY
 QUALIFIED PRODUCERS OF COMPRESSED GAS. SHIPMENT OF A COMPRESSED GAS
 CYLINDER WHICH HAS NOT BEEN FILLED BY THE OWNER OR WITH HIS
 WRITTEN CONSENT IS A VIOLATION OF FEDERAL LAW (49 CFR)

===== Exposure Controls/Personal Protection =====

Respiratory Protection:IN CASE OF LEAKAGE, USE SELF-CONTAINED BREATHING
 APPARATUS.
 Ventilation:PROVIDE ADEQUATE GENERAL AND LOCAL EXHAUST VENTILATION.
 Protective Gloves:NONE
 Eye Protection:SAFETY GLASSES.
 Other Protective Equipment:SAFETY SHOES WHEN HANDLING CYLINDERS.
 Supplemental Safety and Health
 VENDOR (CAGE 70123) PART NUMBER: 350005. THIS ENTRY DESCRIBES ONE PART,
 SERIAL NUMBER XXXXX, ISOBUTYLENE IN AIR, OF A FIELD KIT. SEE THIS
 SAME NSN, SERIAL NUMBER XXXXX, A 10 HOUR RECHARGEABLE BATTERY

PACK, FOR DATA ON SECOND PART OF KIT.

===== Physical/Chemical Properties =====

HCC:G3
 Vapor Density:.991(AIR=1
 Spec Gravity:GAS
 Evaporation Rate & Reference:GAS
 Solubility in Water:18.68CM3/1@20C
 Appearance and Odor:COLORLESS, ODORLESS GAS

===== Stability and Reactivity Data =====

Stability Indicator/Materials to Avoid:YES
 OXIDIZING AGENTS.
 Stability Condition to Avoid:STABLE UNDER NORMAL STORAGE CONDITIONS.
 AVOID STORAGE IN POORLY VENTILATED AREAS AND STORAGE NEAR A HEAT
 SOURCE.
 Hazardous Decomposition Products:NONE.
 Conditions to Avoid Polymerization:WILL NOT OCCUR.

===== Toxicological Information =====

Toxicological Information:LETHAL CONCENTRATION (LC50): NONE
 ESTABLISHED. LETHAL DOSE 50 (LD50): NOT APPLICABLE. TERATOGENICITY
 : N/A. REPRODUCTIVE EFFECTS:N/A. MUTGENICITY: N/AP.

===== Ecological Information =====

Ecological:NO ADVERSE ECOLOGICAL EFFECTS ARE EXPECTED.

===== Disposal Considerations =====

Waste Disposal Methods:DISPOSE OF NON-REFILLABLE CYLINDERS IN
 ACCORDANCE WITH FEDERAL, STATE, AND LOCAL REGULATIONS. ALLOW GAS TO
 VENT SLOWLY TO ATMOSPHERE IN AN UNCONFINED AREA OR EXHAUST HOOD. IF
 THE CYLINDERS ARE THE REF ILLABLE TYPE, RETURN CYLINDERS TO
 SUPPLIER WITH ANY VALVE OUTLET PLUGS OR CAPS SECURED AND VALVE PRO
 TECTION CAPS IN PLACE.

===== MSDS Transport Information =====

Transport Information:CONCENTRATION: 1 - 1500 PPM. DOT DESCRIPTION (US
 ONLY): PROPER SHIPPING NAME: COMPRESSED GASSES, N.O.S.; HAZARD
 CLASS: 2.2 (NONFLAMMABLE); UN 1956; REPORTABLE QUANTITIES: NONE.
 LABELING: NONFLAMMABLE GAS. ADR/RID (EU ONLY): CLASS 2, 1A.
 SPECIAL PRECAUTIONS: CYLINDERS SHOULD BE TRANSPORTATED IN A SECURE
 UPRIGHT POSITION IN A WELL VENTILATED TRUCK.

===== Regulatory Information =====

SARA Title III Information:THE THRESHOLD PLANNING QUANTIRY FOR THES
 MIXTURE IS 10,000 LBS.
 Federal Regulatory Information:OSHA: PROCESS SAFETY MANAGEMENT: MINOR
 COMPONENT IS NOT LISTED IN APPENDIX A OF 29 CFR 1910.119 AS A
 HIGHLY HAZARDOUS CHEMICAL. TSCA: MIXTURE IS NOT LISTED IN TSCA
 INVENTORY. EU NUMBER: N/A. NUMBER IN ANNES 1 OF DIR 67/548:
 MIXTURE IS NOT LISTED IN ANNES 1. EU CLASSIFICATION: N/AP. R: 20;
 S: 9.

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MSDS Number: **18840** * * * * * Effective Date: **05/04/07** * * * * * Supersedes: **08/27/04**

| | | |
|--|--|---|
| MSDS Material Safety Data Sheet | | 24 Hour Emergency Telephone: 908-859-2151 CHEMTREC: 1-800-424-9300 |
| From: Mallinckrodt Baker, Inc. 222 Red School Lane Phillipsburg, NJ 08865 | | National Response in Canada CANUTEC: 613-996-6666 |
| Mallinckrodt CHEMICALS J.T. Baker | | Outside U.S. and Canada Chemtec: 703-527-3887 |
| NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals. | | |
| All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance. | | |

ISOPROPYL ALCOHOL (90 - 100%)

1. Product Identification

Synonyms: 2-Propanol; sec-propyl alcohol; isopropanol; sec-propanol; dimethylcarbinol

CAS No.: 67-63-0

Molecular Weight: 60.10

Chemical Formula: (CH₃)₂CHOH

Product Codes:

J.T. Baker: 0562, 5082, 9037, 9080, U298

Mallinckrodt: 0562, 3027, 3031, 3032, 3035, 3037, 3043, 4359, 6569, H604, H982, V555, V566, V681

2. Composition/Information on Ingredients

| Ingredient | CAS No | Percent | Hazardous |
|-------------------|-----------|-----------|-----------|
| Isopropyl Alcohol | 67-63-0 | 90 - 100% | Yes |
| Water | 7732-18-5 | 0 - 10% | No |

3. Hazards Identification

Emergency Overview

WARNING! FLAMMABLE LIQUID AND VAPOR. HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM. MAY BE HARMFUL IF ABSORBED THROUGH SKIN. MAY CAUSE IRRITATION TO SKIN.

SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 2 - Moderate

Flammability Rating: 3 - Severe (Flammable)

Reactivity Rating: 2 - Moderate

Contact Rating: 3 - Severe

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER

Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:

Inhalation of vapors irritates the respiratory tract. Exposure to high concentrations has a narcotic effect, producing symptoms of dizziness, drowsiness, headache, staggering, unconsciousness and possibly death.

Ingestion:

Can cause drowsiness, unconsciousness, and death. Gastrointestinal pain, cramps, nausea, vomiting, and diarrhea may also result. The single lethal dose for a human adult = about 250 mls (8 ounces).

Skin Contact:

May cause irritation with redness and pain. May be absorbed through the skin with possible systemic effects.

Eye Contact:

Vapors cause eye irritation. Splashes cause severe irritation, possible corneal burns and eye damage.

Chronic Exposure:

Chronic exposure may cause skin effects.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders or impaired liver, kidney, or pulmonary function may be more susceptible to the effects of this agent.

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Ingestion:

Give large amounts of water to drink. Never give anything by mouth to an unconscious person. Get medical attention.

Skin Contact:

Immediately flush skin with plenty of water for at least 15 minutes. Call a physician if irritation develops.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:

Flash point: 12C (54F) CC

Autoignition temperature: 399C (750F)

Flammable limits in air % by volume:

lcl: 2.0; ucl: 12.7

Listed fire data is for Pure Isopropyl Alcohol.

Explosion:

Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Contact with strong oxidizers may cause fire or explosion. Vapors can flow along surfaces to distant ignition source and flash back. Sensitive to static discharge.

Fire Extinguishing Media:

Water spray, dry chemical, alcohol foam, or carbon dioxide. Water spray may be used to keep fire exposed containers cool, dilute spills to nonflammable mixtures, protect personnel attempting to stop leak and disperse vapors.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures.

J. T. Baker SOLUSORB® solvent adsorbent is recommended for spills of this product.

7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product. Small quantities of peroxides can form on prolonged storage. Exposure to light and/or air significantly increases the rate of peroxide formation. If evaporated to a residue, the mixture of peroxides and isopropanol may explode when exposed to heat or shock.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

For Isopropyl Alcohol (2-Propanol):

-OSHA Permissible Exposure Limit (PEL):

400 ppm (TWA)

-ACGIH Threshold Limit Value (TLV):

200 ppm (TWA), 400 ppm (STEL), A4 - not classifiable as a human carcinogen.

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded, a full facepiece respirator with organic vapor cartridge may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact. Neoprene and nitrile rubber are recommended materials.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Clear, colorless liquid.

Odor:
Rubbing alcohol.

Solubility:
Miscible in water.

Specific Gravity:
0.79 @ 20C/4C

pH:
No information found.

% Volatiles by volume @ 21C (70F):
100

Boiling Point:
82C (180F)

Melting Point:
-89C (-128F)

Vapor Density (Air=1):
2.1

Vapor Pressure (mm Hg):
44 @ 25C (77F)

Evaporation Rate (BuAc=1):
2.83

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Heat and sunlight can contribute to instability.

Hazardous Decomposition Products:
Carbon dioxide and carbon monoxide may form when heated to decomposition.

Hazardous Polymerization:
Will not occur.

Incompatibilities:
Heat, flame, strong oxidizers, acetaldehyde, acids, chlorine, ethylene oxide, hydrogen-palladium combination, hydrogen peroxide-sulfuric acid combination, potassium tert-butoxide, hypochlorous acid, isocyanates, nitroform, phosgene, aluminum, oleum and perchloric acid.

Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Oral rat LD50: 5045 mg/kg; skin rabbit LD50: 12.8 gm/kg; inhalation rat LC50: 16,000 ppm/8-hour; investigated as a tumorigen, mutagen, reproductive effector.

| -----\Cancer Lists\----- | | | |
|-----------------------------|----------------------|-------------|---------------|
| Ingredient | ---NTP Carcinogen--- | | IARC Category |
| | Known | Anticipated | |
| Isopropyl Alcohol (67-63-0) | No | No | 3 |
| Water (7732-18-5) | No | No | None |

12. Ecological Information

Environmental Fate:
When released into the soil, this material is expected to quickly evaporate. When released into the soil, this material may leach into groundwater. When released into the soil, this material may biodegrade to a moderate extent. When released to water, this material is expected to quickly evaporate. When released into the water, this material is expected to have a half-life between 1 and 10 days. When released into water, this material may biodegrade to a moderate extent. This material is not expected to significantly bioaccumulate. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life between 1 and 10 days. When released into the air, this material may be removed from the atmosphere to a moderate extent by wet deposition.

Environmental Toxicity:
The LC50/96-hour values for fish are over 100 mg/l. This material is not expected to be toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: ISOPROPANOL
Hazard Class: 3
UN/NA: UN1219
Packing Group: II
Information reported for product/size: 200L

International (Water, I.M.O.)

Proper Shipping Name: ISOPROPANOL
Hazard Class: 3
UN/NA: UN1219
Packing Group: II
Information reported for product/size: 200L

15. Regulatory Information

```

-----\Chemical Inventory Status - Part 1\-----
Ingredient                                     TSCA  EC   Japan  Australia
-----
Isopropyl Alcohol (67-63-0)                   Yes  Yes  Yes    Yes
Water (7732-18-5)                             Yes  Yes  Yes    Yes

-----\Chemical Inventory Status - Part 2\-----
Ingredient                                     Korea  DSL   NDSL   Phil.
-----
Isopropyl Alcohol (67-63-0)                   Yes   Yes   No     Yes
Water (7732-18-5)                             Yes   Yes   No     Yes

-----\Federal, State & International Regulations - Part 1\-----
Ingredient                                     -SARA 302-  -SARA 313-
RQ   TPQ   List  Chemical Catg.
-----
Isopropyl Alcohol (67-63-0)                   No    No    Yes    No
Water (7732-18-5)                             No    No    No     No

-----\Federal, State & International Regulations - Part 2\-----
Ingredient                                     CERCLA  -RCRA-  -TSCA-
                                     261.33  8(d)
-----
Isopropyl Alcohol (67-63-0)                   No      No      No
Water (7732-18-5)                             No      No      No

Chemical Weapons Convention: No      TSCA 12(b): No      CDTA: Yes
SARA 311/312: Acute: Yes      Chronic: Yes      Fire: Yes Pressure: No
Reactivity: No      (Mixture / Liquid)

```

Australian Hazchem Code: 2[S]2

Poison Schedule: None allocated.

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 1 Flammability: 3 Reactivity: 0

Label Hazard Warning:

WARNING! FLAMMABLE LIQUID AND VAPOR. HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM. MAY BE HARMFUL IF ABSORBED THROUGH SKIN. MAY CAUSE IRRITATION TO SKIN.

Label Precautions:

Keep away from heat, sparks and flame.

Keep container closed.

Use only with adequate ventilation.

Wash thoroughly after handling.

Avoid breathing vapor or mist.

Avoid contact with eyes, skin and clothing.

Label First Aid:

If swallowed, give large amounts of water to drink. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.

Product Use:

Laboratory Reagent.

Revision Information:

No Changes.

Disclaimer:

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This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product.

Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose.

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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

APPENDIX C

FIELD FORMS

(INCLUDED ON CD IN APPENDIX A)



WELL APPLICATION AND PERMIT FORM

ENVIRONMENTAL MANAGEMENT DEPARTMENT – ENVIRONMENTAL COMPLIANCE DIVISION

10590 ARMSTRONG AVENUE • SUITE A • MATHER, CA 95655

TELEPHONE (916) 875-8400 FAX: (916) 875-8513

WELL INSPECTION LINE: (916) 875-8524

IS THIS PERMIT FOR A HAZARDOUS SUBSTANCE INVESTIGATION? ☐ YES ☐ NO

| | | | |
|---|-------------|---|-----------------------|
| FOR OFFICE USE ONLY | | EXPEDITED PROCESSING? <input type="checkbox"/> YES <input type="checkbox"/> NO | |
| <input type="checkbox"/> APPROVED <input type="checkbox"/> APPROVED W/CONDITIONS (ATTACHED) | | PERMIT NUMBER(S): _____ | |
| BY: _____ | DATE: _____ | DATE RECEIVED: _____ | TOTAL FEE: _____ |
| INITIAL GROUT BY: _____ | DATE: _____ | RECEIPT NO: _____ | DEPTH TO WATER: _____ |
| FINAL INSPECTION BY: _____ | DATE: _____ | WELL DEPTH: _____ | GROUT DEPTH: _____ |
| DESTRUCTION BY: _____ | DATE: _____ | GPS: N: <u>38</u> | W: <u>-121</u> |
| COMMENTS: _____ | | | |

| | |
|---|-----------------------------------|
| SITE ADDRESS: | |
| Job Address: _____ | Nearest Major Cross Street: _____ |
| Property Owner: _____ | Parcel Number(s): _____ |
| Well Contractor: _____ | CA License No.: _____ |
| Contractor's Address: _____ | |
| Well/Boring Identification Number(s): _____ | |

TYPE OF WORK: (California C-57 License required unless noted otherwise)

- | | | |
|---|--|--|
| <input type="checkbox"/> Well construction | <input type="checkbox"/> Vault box repair (General A or B) | <input type="checkbox"/> Well destruction (SUPPLEMENT REQUIRED) |
| <input type="checkbox"/> Pump replacement (or C-61) | <input type="checkbox"/> Well repair | <input type="checkbox"/> Exploratory boring (C-57 if water present) |
| <input type="checkbox"/> Well inactivation (Owner only) | <input type="checkbox"/> Pump repair (or C-61) | <input type="checkbox"/> Other: _____ |

INTENDED USE:

- | | | |
|--|--|---|
| <input type="checkbox"/> Domestic/private | <input type="checkbox"/> Dewatering | <input type="checkbox"/> Geotechnical boring |
| <input type="checkbox"/> Irrigation/agricultural | <input type="checkbox"/> Cathodic protection | <input type="checkbox"/> Environmental boring |
| <input type="checkbox"/> Water/vapor monitoring/extraction | <input type="checkbox"/> Heat exchange | <input type="checkbox"/> Other: _____ |
| <input type="checkbox"/> Public water system: _____ | | |

(NAME OF WATER PURVEYOR WITH CONTACT NAME AND TELEPHONE NUMBER)

DRILLING METHOD:

- ☐ Mud rotary ☐ Air Rotary ☐ Cable tool ☐ Auger ☐ Driven ☐ Other: _____

SETBACKS: (Wells only)

- Is the well located within 50 feet of a: ☐ sewer line, ☐ stream, ☐ ditch, ☐ drainage course, ☐ pond, or ☐ lake? ☐ No
- Is the well located within 100 feet of a: ☐ septic tank, ☐ leach line, ☐ deep trench, or ☐ animal enclosure? ☐ No

SPECIFICATIONS:

- | | | | |
|----------------------------------|-----------------|---|------------------------|
| BOREHOLE: Diameter: _____ | Depth: _____ | CASING: Diameter: _____ | Depth: _____ |
| Diameter: _____ | Depth: _____ | CASING: Diameter: _____ | Depth: _____ |
| CONDUCTOR: Diameter: _____ | Depth: _____ | IF STEEL: Gauge: _____ | or Thickness: _____ |
| ANNULAR SEAL: Depth: _____ | Material: _____ | IF PLASTIC: Type: _____ | (Must meet ASTM F-480) |
| TRANSITION SEAL: Material: _____ | | MULTIPLE COMPLETION? <input type="checkbox"/> Yes (DIAGRAM REQUIRED) | |
| COMMENTS: _____ | | | |

PUMP INSTALLATION/REPAIR:

Contractor: _____

License Number: _____ Type of Pump: _____ Horsepower: _____

I will comply with all Codes, Rules and Regulations of the State and County pertaining to or regulating wells and pumps, **call (916) 875-8524 for a grout inspection at least 24 hours prior to the requested appointment time**, submit a "Well Completion Report" (if required) within 60 days of the completion of my work so a final inspection can be made, and obtain WPD approval before placing a well in service.

| | |
|------------------------|---|
| SIGNATURE: _____ | <input type="checkbox"/> Property Owner |
| PRINTED NAME: _____ | <input type="checkbox"/> Well Contractor |
| COMPANY: _____ | <input type="checkbox"/> Agent (REQUIRES AUTHORIZATION FORM) |
| MAILING ADDRESS: _____ | |
| PHONE NUMBER: _____ | FIELD PHONE: _____ |

A SITE PLAN MUST BE SUBMITTED WITH EACH APPLICATION.
PERMIT EXPIRES ONE (1) YEAR AFTER DATE APPROVED (UNLESS EXTENDED)

Soil Gas Sampling Log

Project Name: ANG- North Highlands
Project Number: 160280.09

Date:
Set-up time:
Weather:
Field Staff:

Sample Point ID:

Location: Well Diameter:
Construction Material: Tubing Material:
Construction Depth: Length of Tubing:

Sample Apparatus Pressure Test

every 10 minutes until consistent within 1 in-Hg

| Time | Pressure Reading | Units | Comments |
|------|------------------|-------|----------|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Leak Test and Purge Volume

| | Well Diam. (in.) | Volume/ft (ml/ft) |
|--|------------------|-------------------|
| Temporary well: Height of casing or tubing | 0.25 | 10 |
| 1 Casing Volume = Casing height x Volume/ ft. | 0.75 | 87 |
| Permanent Well: | 1 | 154 |
| 1 Casing Volume = (Casing height x Volume/ ft.)+(sand pack depth x diameter) | 2 | 617 |

Atmospheric Helium concentration prior to purge:

Take one reading per purge

| Time | Purge Flow | Volume | Helium Detector Reading |
|------|------------|--------|-------------------------|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Sample Collection

Summa Canister Info:

Size (circle one): 1L 6L

Canister ID: Flow Controller ID:

| Time - Begin Sampling | Canister Vacuum | Time - End Sampling | Canister Vacuum |
|-----------------------|-----------------|---------------------|-----------------|
| | | | |

ANALYSES REQUIRED

TO-15

TO-17

Helium

FIELD OBSERVATIONS

Decontamination Method:

Sampler Signature(s):

ANG Daily Log

| | | | |
|-------------------|-------|-----------------|--------|
| Personnel: | _____ | Date: | _____ |
| | _____ | | |
| | _____ | | |
| | _____ | | |
| Weather: | _____ | Project: | 160280 |
| | _____ | | |
| | _____ | | |

Time:

Activities

[illegible]

APPENDIX D

SAMPLING PROCEDURES

(INCLUDED ON CD IN APPENDIX A)

Recommended Use Of The Terra Core®



NOTE: The Terra Core® Sampler is a single use device. It cannot be cleaned and/or reused.



Step 1

Have ready a 40ml glass VOA vial containing the appropriate preservative. With the plunger seated in the handle, push the Terra Core® into freshly exposed soil until the sample chamber is filled. A filled chamber will deliver approximately 5 or 10 grams of soil.

Step 2

Wipe all soil or debris from the outside of the Terra Core® sampler. The soil plug should be flush with the mouth of the sampler. Remove any excess soil that extends beyond the mouth of the sampler.



Step 3

Rotate the plunger that was seated in the handle top 90° until it is aligned with the slots in the body. Place the mouth of the sampler into the 40ml VOA vial containing the appropriate preservative and extrude the sample by pushing the plunger down. Quickly place the lid back on the 40ml VOA vial.

Note: When capping the 40ml VOA vial, be sure to remove any soil or debris from the top and/or threads of the vial.

Terms and Conditions of Sale



1. Acceptance. ALL SALES ARE SUBJECT TO AND EXPRESSLY CONDITIONED UPON THE TERMS AND CONDITIONS CONTAINED HEREIN. NO VARIATION OF THESE TERMS AND CONDITIONS WILL BE BINDING UPON SELLER, UNLESS AGREED TO IN WRITING AND SIGNED BY AN OFFICER OR OTHER AUTHORIZED REPRESENTATIVE OF SELLER. IF THESE TERMS AND CONDITIONS ARE NOT ACCEPTABLE TO BUYER, BUYER MUST SO NOTIFY SELLER IMMEDIATELY IN WRITING.
2. Terms, Delivery, Delays. Unless otherwise specified, terms are net 30 days from the date of invoice, F.O.B. shipping point, freight prepaid and added. All prices are subject to change without notice. Stenographic, clerical and computer errors are subject to correction. If financial condition of Buyer results in the insecurity of Seller, in Seller's sole discretion, as to the ultimate collectibility of the purchase price, Seller may, without notice to Buyer, delay or postpone the delivery of goods, and Seller at its option, is authorized to change the terms of payment to payment in full or in part in advance of shipment of the entire undelivered balance of said goods. Buyer agrees to pay all costs, including but not limited to, reasonable attorney and accounting fees and other expenses of collection resulting from any default by Buyer in any of the terms hereof. All risk of loss or damage during shipping shall be borne by Buyer. Seller reserves the right, in its discretion, to determine the exact method of shipment. Seller reserves the right to make delivery in installments, all such installments to be separately invoiced and paid for when due per invoice, without regard to subsequent deliveries. Delay in delivery of any installment shall not relieve Buyer or Buyer's obligation to accept remaining deliveries. Immediately upon Buyer's receipt of any goods shipped hereunder, Buyer shall inspect the same and shall notify Seller in writing of any claims for shortages, defects or damages and shall hold the goods for Seller's written instructions concerning disposition. Seller shall not be liable for any loss, damage or penalty as a result of any delay in or failure to manufacture, deliver or otherwise perform hereunder due to any cause beyond Seller's reasonable control, including, without limitation, strikes or labor difficulties, acts or omissions of any governmental authority or Buyer, accident, insurrection or riot, fires, floods or other acts of God, breakdowns of essential equipment, priorities or embargoes, shortages, delays in transportation, or inability to obtain necessary labor, fuel, materials, supplies or power at current prices or from usual sources.
3. Allocation of Goods. If Seller is unable for any reason to supply the total demands for goods specified in Buyer's order, Seller may allocate its available supply among any or all buyers on such basis as Seller may deem fair and practical, without liability for any failure of performance which may result therefrom.
4. Taxes and Other Charges. Any use tax, sales tax, excise tax, or any other tax, fee or charge of any nature whatsoever imposed by any governmental authority, on or measured by the transaction between Seller and Buyer, shall be paid by Buyer in addition to the prices quoted or invoiced.
5. Warranty. SELLER MAKES NO WARRANTIES REGARDING THE TERRA CORE™ SAMPLER, WHETHER ORAL, WRITTEN, EXPRESS, IMPLIED OR STATUTORY, INCLUDING ANY INFORMATION PROVIDED BY SALES REPRESENTATIVES IN MARKETING LITERATURE, DIRECTIONS FOR USE, OR ANY OTHER INFORMATION SUPPLIED WITH THE SAMPLER. IMPLIED WARRANTIES OF FITNESS AND MERCHANTABILITY SHALL NOT APPLY. Seller's warranty obligations and Buyer's remedies are solely and exclusively as stated herein. FURTHERMORE, SELLER SPECIFICALLY DISCLAIMS ANY WARRANTIES RELATING TO SAMPLE QUALITY OR SAMPLE PRESERVATION. SELLER DOES NOT WARRANT THAT THE USE OF THE TERRA CORE™ SAMPLER WILL RESULT IN COMPLIANCE WITH ANY SAMPLING METHODS OUTLINED BY ANY REGULATORY BODY. SELLER DOES NOT WARRANTY OR GUARANTEE SAMPLING RESULTS.
6. Limitation of Liability. IN NO EVENT SHALL SELLER BE LIABLE FOR ANTICIPATED PROFITS, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES, INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF REVENUE, DOWN TIME, REMEDIATION ACTIVITIES, REMOBILIZATION OR RESAMPLING, COST OF CAPITAL, SERVICE INTERRUPTION OR FAILURE OF SUPPLY, ANY LIABILITY OF BUYER TO A THIRD PARTY, OR FOR LABOR, OVERHEAD, TRANSPORTATION, SUBSTITUTE SUPPLY SOURCES OR ANY OTHER EXPENSE, DAMAGE OR LOSS, INCLUDING PERSONAL INJURY OR PROPERTY DAMAGE. SELLER IS NOT RESPONSIBLE FOR INTERPRETATION OF ANY SAMPLING METHODS OUTLINED BY ANY REGULATORY BODY OR BUYER'S INABILITY TO COMPLY WITH OR CORRECTLY FOLLOW ANY SUCH SAMPLING METHODS. SELLER IS NOT LIABLE FOR DAMAGE CAUSED BY ACCIDENT, ABUSE, MISHANDLING OR DROPPING OF SAMPLER, DAMAGES DUE TO SAMPLERS THAT HAVE BEEN OPENED, DISASSEMBLED OR MISHANDLED, OR DAMAGES DUE TO SAMPLERS NOT USED IN ACCORDANCE WITH THE DIRECTIONS. Seller's liability on any claim of any kind shall be replacement of such goods or refund of the purchase price. Seller shall not be liable for penalties of any description whatsoever. In the event the Terra Core™ sampler will be utilized by Buyer on behalf of a third party, such third party shall not occupy the position of a third-party beneficiary of the obligation or warranty provided by Seller, and no such third party shall have the right to enforce same. All claims must be brought within one (1) year of shipment, regardless of their nature.
7. Returns. Written authorization must be obtained from Seller prior to returning any goods. Buyer shall strictly comply with Seller's return shipment instructions. Returned goods will be subject to a restocking charge.
8. Technical Assistance. At Buyer's request, Seller may, at Seller's discretion, furnish technical assistance and information with respect to Seller's products. SELLER MAKES NO WARRANTIES OF ANY KIND OR NATURE, EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WITH RESPECT TO TECHNICAL ASSISTANCE OR INFORMATION PROVIDED BY SELLER OR SELLER'S REPRESENTATIVES. ANY SUGGESTIONS BY SELLER REGARDING USE, SELECTION, APPLICATION OR SUITABILITY OF THE SAMPLER SHALL NOT BE CONSTRUED AS AN EXPRESS WARRANTY OF ANY KIND, INCLUDING COMPLIANCE WITH ANY SAMPLING METHODS OUTLINED BY ANY REGULATORY BODY, UNLESS SPECIFICALLY DESIGNATED AS SUCH IN A WRITING SIGNED BY AN OFFICER OF SELLER.
9. Miscellaneous. Seller's failure to strictly enforce any term or condition of an order or to exercise any right arising hereunder shall not constitute a waiver of Seller's right to strictly enforce such terms or conditions or exercise such right thereafter. All rights and remedies with respect to any order are cumulative and are in addition to any other rights and remedies Seller may have at law or equity. Any waiver of a default by Buyer hereunder shall be in writing. If any provision of these agreed upon terms and conditions shall be held to be invalid, illegal or unenforceable, the validity, legality and enforceability of the remaining provisions shall not be affected or impaired thereby. The paragraph headings herein are for convenience only; they form no part of the terms and conditions and shall not affect their interpretation. This agreement and the terms and conditions herein shall be binding upon, inure to the benefit of, and be enforceable by, the parties hereto, and their respective heirs, personal representatives, successors and assigns.
10. Governing Law. All disputes relating to the terms hereof, performance of this order or any other claim related to Seller's goods shall be governed by the laws of the State of Wisconsin; provided, however, construction shall be without regard to any rule or presumption requiring construction against the party causing this agreement to be drafted. Buyer and Seller agree that any dispute arising between them which results in either party instituting court proceedings that such action will be maintained in the Circuit Court for Brown County, Wisconsin.

Canisters
and
Tedlar Bags

 **Air
Toxics LTD.**
Laboratory Services Since 1989

*Guide to
Air Sampling
& Analysis*



Always Air, Always Accurate

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Section 1.0 Introduction

Air Toxics Ltd. presents this guide as a resource for individuals engaged in air sampling. Air sampling can be more involved than water or soil sampling due to the reactivity of chemical compounds in the gas matrix and sample interaction with the equipment and media used. Ensuring that air samples are collected properly is an important step in acquiring meaningful analytical results. This guide is not a substitute for experience and cannot sufficiently address the multitude of field conditions. Note that this guide is intended for projects involving whole air sampling of volatile organic compounds (VOCs) in canisters and Tedlar® bags. Air Toxics Ltd. provides the "Guide to Sorbent-Based Sampling - Volatiles and Semi-Volatiles" for other types of sampling.

1.1 Whole Air Sampling of VOCs

This guide focuses on collecting a sample in the most common air sampling containers, Summa canisters and Tedlar® bags. The sample may be collected in the container either passively (i.e., by evacuating the canister prior to sampling) or actively (i.e., using a pump). The sample is referred to as a "whole air sample" and the compounds remain in the gas matrix (e.g., ambient air) inside the container.

1.2 Choosing Between Canisters and Tedlar® Bags

Table 1.2 compares the features of canisters and Tedlar® bags. Canisters have superior inertness, hold time to analysis and ruggedness. They also do not require a sampling pump. Tedlar® bags can be purchased inexpensively in bulk, carried to a sampling site in a briefcase, filled in seconds and shipped easily to the laboratory for analysis. Call Client Services at 800-985-5955 if you have questions regarding the appropriate sampling media.

Table 1.2 Comparison of Canisters to Tedlar® Bags

| | Canisters | Tedlar® Bags |
|-----------------------|---|--|
| Common Volumes | 1 and 6 L | 1, 3, and 5 L |
| Type of Sampling | Passive (vacuum) | Active (pump required) |
| Sample Handling | Room temperature | Room temperature |
| Media Hold Time | Up to 30 days recommended | Indefinite |
| Hold Time to Analysis | Up to 30 days | Up to 3 days |
| Surface Inertness | Excellent | Fair |
| Cleanliness | 10% or 100% certified to ppbv/pptv levels | Some VOCs present at 0.5 to 45 ppbv |
| Sampling Application | Ambient/indoor air, soil/landfill gas, stationary source | Ambient air (fixed gases only), soil/landfill gas, stationary source |
| Rule of Thumb | "ppbv device" | "ppmv device" |
| Advantages | Inertness, hold time, ruggedness, no pump | Purchase/shipping cost, availability, convenience |

Section 2. Canisters and Associated Media

This section provides a description of air sampling canisters, practical considerations for sampling, and step-by-step sampling instructions. Tables provide detailed information on many operational factors that ultimately influence the quality of the data obtained from a canister sample.

2.1 Introduction to Canisters

The canister is prepared for sampling by evacuating the contents to a vacuum of approximately 29.9 inches of Mercury (in. Hg). Opening the stainless steel bellows valve allows the air sample to enter the canister. When the target volume of sample is collected, the valve is closed and the canister is returned to the laboratory. Canisters range in volume from less than 1 liter (L) to greater than 6 L. At Air Toxics Ltd., 6 L canisters are used for ambient air samples and for taking integrated samples.

One liter canisters are generally used for taking high concentration (i.e., greater than 5 ppbv) grab samples, although exceptions to these guidelines are common.



2.1.1 Summa Canister

A Summa canister is a stainless steel container that has had the internal surfaces specially passivated using a "Summa" process. This process combines an electropolishing step with a chemical deactivation step to produce a surface that is nearly chemically inert. A Summa surface has the appearance of a mirror: bright, shiny and smooth. The degree of chemical inertness of a whole air sample container is crucial to minimizing reactions with the sample and maximizing recovery of target compounds from the container.

2.1.2 Canister Cleaning

Air Toxics Ltd. provides two types of canister cleaning certification, 10% and 100%, depending upon the requirements of the project. The 10% certification process is appropriate for routine ambient air applications and high concentration applications such as soil vapor and landfill gas monitoring. The 10% certification process begins by cleaning canisters using a combination of dilution, heat and high vacuum. Canisters are certified for approximately 60 VOCs using GC/MS. As part of our quality control plan we perform a 10% process certification which requires that target compound concentrations

be below 0.2 ppbv using GC/MS analysis. Alternatively, the 100% certification (i.e., individual certification) process is appropriate for ambient and indoor air applications driven by risk assessment or litigation requiring pptv (parts per trillion by volume) sensitivity. Similar to the 10% certification, the 100% certification also begins with the canister cleaning process. The difference with the 100% certification is that canisters are individually certified for a client-specific list of target compounds using GC/MS. When the 100% certified canisters are shipped the analytical documentation demonstrating that they are free of the target compounds down to the project reporting limits is emailed to the client. When sampling with certified media it is important to note that all media is certified as a train and must be sampled as such (i.e., a particular flow controller goes with a particular canister and is labeled as such).

*Specify whether your project requires
10% or 100% canister cleaning certification*

2.1.3 Canister Hold Time

Media Hold Time : Canister sampling differs considerably from collecting a water sample in a VOA vial or a soil sample in an amber jar in that the container (valued at over \$500) is cleaned and reused. Air Toxics Ltd. requires that our canisters be returned within 14 days of receipt to effectively manage our inventory. Once a canister is cleaned, certified and evacuated we recommend the canister be used for sample collection within 30 days. Over time, low-level (pptv) concentrations of typical VOCs may off-gas from the canister surface resulting in potential artifacts in the sample results.

Sample Hold Time: Although 30 days is the most commonly cited hold time for a canister sample, the hold time is compound-specific. For example, compounds such as chloroform, benzene, and vinyl chloride are stable in a canister for at least 30 days. In fact, EPA Method TO-15 states, "Fortunately, under conditions of normal usage for sampling ambient air, most VOCs may be recovered from canisters near their original concentrations for after storage times of up to thirty days". However, some VOCs such as bis(chloromethyl)ether degrade quickly and demonstrate low recovery even after 7 days. The standard VOC list reported by Air Toxics is stable up to 30 days after sample collection. Some projects require a more rigorous 14-day hold time.

2.2 Associated Canister Hardware

Associated hardware used with the canister includes the valve, brass cap, particulate filter and vacuum gauge.

2.2.1 Valve

An industry standard, 1/4 in. stainless steel bellows valve (manufactured by Swagelok or Parker Instruments) is mounted at the top of the canister. The valve allows a vacuum to be maintained in the canister prior to sampling and seals off the canister once the sample has been collected. No more than a half turn by hand is required to open the valve. Do not over-tighten the valve after sampling or it may become damaged. A damaged valve can leak, possibly compromising the sample. Some canisters have a metal cage near the top to protect the valve.

2.2.2 Brass Cap

Each canister comes with a brass cap (i.e., Swagelok 1/4 in. plug) secured to the inlet of the valve assembly. The cap serves two purposes: first, it ensures that there is no loss of vacuum due to a leaky valve or a valve that is accidentally opened during handling; second, it prevents dust and other particulate matter from fouling the valve. The cap is removed prior to sampling and replaced following sample collection.

Always replace the brass cap following canister sampling.



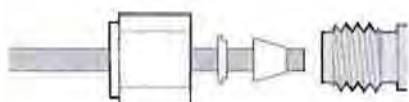
2.2.3 Particulate Filter

Particulate filters should always be used when sampling with a canister. Separate filters are provided to clients taking a grab sample and filters are built into the flow controllers for clients taking integrated samples. Air Toxics Ltd. provides either a 2 micron filter or a 7 micron filter. These devices filter particulate matter greater than 2 and 7 microns in diameter respectively. The shorter 2 micron filter is a fritted stainless steel disk that has been pressed into a conventional Swagelok adapter and is disposed of after each use. This device has a relatively high pressure drop across the fritted disk and restricts the flow into the canister. The 2 micron filter is standard for clients taking integrated samples. The longer 7 micron filter is cleaned in a similar manner as the stainless steel canisters after each single use, and does not significantly restrict the flow rate into the canister. The 7 micron filter is primarily used with grab samples. **Both the 2 and 7 micron filters are not calibrated devices and therefore the flow rates can and do vary for each filter.**

Always use the particulate filter for canister sampling.

2.2.4 Fittings

All fittings on the sampling hardware are 1/4 in. Swagelok; a 9/16 in. wrench is used to assemble the hardware. Compression fittings should be used for all connections; never use tube in tube connections. It is critical to avoid leaks in the sampling train. Leaks of



ambient air through fittings between pieces of the sampling train (e.g., tubing to particulate filter) will dilute the sample and cause the canister to fill at a faster rate than desired. Air Toxics can provide the necessary fittings and ferrules if requested.

2.2.5 Vacuum Gauge

A vacuum gauge is used to measure the initial vacuum of the canister before sampling, and the final vacuum upon completion. A gauge can also be used to monitor the fill rate of the canister when collecting an integrated sample.

Air Toxics Ltd. provides 2 types of gauges. For grab sampling, a test gauge checks initial and final vacuums only and is not to be sampled through. For integrated sampling a gauge is built into the flow controller and may be used for monitoring



initial and final vacuums, as well as monitoring the fill rate of the canister. Both gauges are not calibrated and are considered to be equally rough gauges, which also means they can provide you with differing numbers for the same canister. In special cases a pressure/vacuum gauge can be provided upon request. Air Toxics Ltd.'s gauges are provided only to obtain a relative measure of "change." Individuals with work plans that outline specific gauge reading requirements are strongly encouraged to purchase and maintain their own gauges.

The gauges that Air Toxics Ltd. provides are for rough estimates only. If the project plan requires a certain level of gauge accuracy the use of a calibrated gauge is highly recommended.

Table 2.2.3 Approximate Fill Times for Canisters

| CANISTER VOLUME | 7 micron filter | 2 micron filter |
|-----------------|-----------------|-----------------|
| 6 L | 16 sec | 3 min |
| 1 L | 3 sec | 30 sec |

Section 3.0 Sampling with Canisters

There are two basic modes of canister sampling: grab and integrated. A grab sample is taken over a short interval (i.e., 1-5 minutes) while an integrated sample is taken over an extended period (e.g., 0.5-24 hours). In both modes the canister vacuum is used to draw the sample into the canister.

3.1 Considerations for Grab Sampling With Canisters

The following are some considerations for collecting a grab sample in a canister.

• **Verify Initial Vacuum of the Canister:** Prior to shipment, each canister is checked for mechanical integrity. However, it is still important to check the vacuum of the canister prior to use. Air Toxics recommends doing this before going to the field if possible. The initial vacuum of the canister should be greater than 25 in. Hg. If the canister vacuum is less than 25 in. Hg, do not use it. Call Client Services at 800-985-5955 and arrange for a replacement canister. If sampling at altitude there are special considerations for gauge readings and sampling (see Section 5.2). The procedure to verify the initial vacuum of a canister is simple but unforgiving:

1. Confirm the valve is closed (knob should already be tightened clockwise)
2. Remove the brass cap
3. Attach gauge
4. Attach brass cap to side of gauge tee fitting, if one is not already there, to ensure a closed train
5. Open and close valve quickly (a few seconds)
6. Read vacuum on the gauge
7. Record gauge reading on "Initial Vacuum" column of chain-of-custody
8. Verify the canister valve is closed and remove gauge
9. Replace the brass cap



3.1.1 Step-By-Step Procedures for Canister Grab Sampling

These procedures are for a typical ambient air sampling application; actual field conditions and procedures may vary.

Before you get to the field:

1. Verify contents of the shipped package (e.g., chain-of-custody, canister, particulate filter, and gauge – if requested)
2. Verify the gauge is working properly
3. Verify the initial vacuum of canister

When ready to sample:

1. Confirm the valve is closed (knob should already be tightened clockwise)
2. Remove brass cap
3. Attach particulate filter to canister
4. Open valve 1/2 turn (6 L canister normally takes about 16 sec to fill)
5. Close valve by hand tightening knob clockwise
6. Verify and record final vacuum of canister (repeat steps used to verify initial vacuum)
7. Replace brass cap
8. Fill out canister sample tag (make sure the sample ID and date of collection recorded on the sample tag matches what is recorded on the COC exactly)
9. Return canister in box provided (unreturned canister charge of \$500 each)
10. Return sample media in packaging provided (unreturned equipment charges: \$45 per particulate filter; \$45 per gauge)
11. Fill out chain-of-custody and relinquish samples properly (it is important to note the canister serial numbers on the chain-of-custody)
12. Place chain-of-custody in box and retain pink copy
13. Tape box shut and affix custody seal at each opening (if applicable)
14. Ship accordingly to meet method holding times

• **Leave Residual Vacuum:** A grab sample can be collected either by allowing the canister to reach ambient conditions or by leaving some residual vacuum (e.g., 5 in. Hg) in the canister. In either case, the final vacuum should be noted in the "Final Vacuum" column on the chain-of-custody. This will enable the laboratory to compare the final vacuum with the receipt vacuum (i.e., the vacuum measured upon arrival at the laboratory).



3.2 Integrated Sampling with Canisters and Flow Controllers

An air sample collected over more than a few minutes is referred to as an integrated sample and can provide information on compound concentrations in air averaged or composited over time. An 8- or 10-hour integrated sample can be used to determine indoor air quality in the workplace. Similarly, a 24-hour integrated sample may be an economical and practical approach to determine residential exposure to indoor or outdoor air sources. The most common hardware configurations used to take an integrated sample are illustrated above.

Flow controllers are devices that regulate the flow of air during sampling into an evacuated canister. Also known as flow restrictors, these devices enable a sampler to achieve a desired flow rate and thus, a sampling interval. Air Toxics Ltd. provides two general types of flow controllers: mass flow controllers and critical orifice devices. Both devices are driven by differential pressure between ambient conditions and the vacuum in the canister.

3.2.1 Mass Flow Controller

A mass flow controller employs a diaphragm that actively compensates to maintain a constant mass flow rate. As the differential pressure decreases, the flow rate tends to decrease and the diaphragm responds by opening up to allow more air to pass through. Mass flow controllers can provide integrated samples with intervals ranging from hours to days. Air Toxics Ltd. provides a fixed mass flow controller that is calibrated at the laboratory for 24-hour sampling. Adjustable mass flow controllers have a knob that can be adjusted in the field to provide integrated samples with intervals ranging from 1 to 24 hours. The rugged conditions of field sampling are not usually compatible with adjustable mass flow controllers and Air Toxics Ltd. has designed a more reliable flow controller based on a critical orifice design.

3.2.2 Critical Orifice Device

Air Toxics Ltd. designed a critical orifice flow controller to provide time-weighted samples with intervals from 0.5 to 12 hours into a 6 L canister and 4 min. to 2 hrs. in a 1 L canister. The device restricts air flow by forcing the sample to enter a capillary column of minute radius. This device is passive compared to an actively compensating diaphragm and the flow rate decreases as the driving force (differential pressure) decreases. For sampling intervals from 0.5 to 12 hours, however, the flow rate is time weighted. The main advantages of the Air Toxics Ltd. flow controllers are improved ruggedness and cleanliness. With no moving or adjustable parts, the Air Toxics Ltd. design is unlikely to lose its flow setting. In addition, a vacuum gauge is built into the device to monitor sampling progress.



3.2.3 Sampling Interval and Flow Controller Setting

When you request canisters and flow controllers from Air Toxics Ltd., you will be asked for the sampling interval, and the flow controllers will be pre-set prior to shipment according to the table below. The flow controller is set to collect a 5 L sample over the sampling interval. Final canister vacuum is targeted at 5 in. Hg. The flow rate is set at standard atmospheric conditions (approximately sea level). If the air sample is from a process (pressurized or under vacuum) or is collected at elevation, the canister will fill faster or slower depending on sample conditions. If you specify the source at project set-up, we can set the flow controller accordingly. See Section 5.2 for a discussion of collecting a sample at elevation. The 24-hr flow controllers should not be used for process or source samples.

Table 3.2.3 Flow Rates for Selected Sampling Intervals (mL/min)

| Sampling Interval (hrs) | 4 min. | 0.5 | 1 | 2 | 4 | 8 | 12 | 24 |
|-------------------------|--------|------|------|------|------|------|-----|-----|
| 6 L Canister | na | 167 | 83.3 | 41.7 | 20.8 | 11.5 | 7.6 | 3.8 |
| 1 L Canister | 166.7 | 26.6 | 13.3 | 6.7 | - | - | - | - |

Note: Target fill volumes for 6 L and 1 L canisters are 5,000 mL and 800 mL, respectively.

$$\text{Flow Rate (mL/min)} = \frac{\text{Target Fill Volume (mL)}}{\text{Sampling Interval (min)}}$$

3.2.4 Final Canister Vacuum and Flow Controller Performance

Ideally, the final vacuum of a 6 L canister should be between 5-10 in. Hg or greater. As long as the differential pressure is greater than 4 in. Hg ambient pressure, then the flow through the device will remain approximately constant as the canister fills. If there is insufficient differential pressure, the flow through the controller will decrease as the canister pressure approaches ambient. Because of the normal fluctuations in the flow rate (due to changes in ambient temperature, pressure and diaphragm instabilities) during sampling, the final vacuum will range between 2 and 10 in. Hg.

- **If the residual canister vacuum is greater than 5 in. Hg** (i.e., more vacuum), less than 5 L of sample was collected. When the canister is pressurized to 5 psig prior to analysis, sample dilution will be greater than normal. This will result in elevated reporting limits.
- **If the residual canister vacuum is less than 5 in. Hg** (i.e., less vacuum), the initial flow rate was high or there was a leak in the connection. Once the vacuum decreases below 5 in.Hg, the flow rate begins to drop significantly. This scenario indicates that the sample is skewed in favor of the first portion of the sampling interval.
- **If the final vacuum is near ambient** (i.e., less than 1 in. Hg), there is inadequate differential pressure to drive the flow controller. The sampler cannot be certain the desired sampling interval was achieved before the canister arrived at ambient conditions. Although the actual sampling interval is uncertain, the canister still contains a sample from the site.

Table 3.2.4 Relationship Between Final Canister Vacuum, Volume Sampled, and Dilution Factor (6 L Canister)

| Final Vacuum (in. Hg) | 0 | 2.5 | 5 | 7.5 | 10 | 12.5 | 15 | 17.5 | 20 |
|-----------------------|------|------|------|------|------|------|------|------|------|
| Volume Sampled (L) | 6 | 5.5 | 5.4 | 5 | 4 | 3.5 | 3 | 2.5 | 2 |
| Dilution Factor* | 1.34 | 1.46 | 1.61 | 1.79 | 2.01 | 2.30 | 2.68 | 3.22 | 4.02 |

* Canister pressurized to 5 psig for analysis

$$\begin{aligned}
 \text{Final Reporting Limit} &= \text{Method Reporting Limit} \times \text{Dilution Factor (Canister Pressurization)} \times \text{Dilution Factor (Sample Concentration)} \\
 \text{Dilution Factor (Canister Pressurization)} &= \frac{\text{Pressurization for Analysis}}{\text{Receipt Vacuum}} = \frac{14.7 \text{ psig} + \text{Press. for Analysis (psig)}}{14.7 \text{ psig} \left[\frac{1 - \text{Rec. Vac (in Hg)}}{29.9 \text{ in. Hg}} \right]}
 \end{aligned}$$

3.2.5 Considerations for Integrated Sampling with Canisters

Collecting an integrated air sample is more involved than collecting a grab sample. Sampling considerations include verifying that the sampling train is properly configured, monitoring the integrated sampling progress, and avoiding contamination.

- **Avoid Leaks in the Sampling Train:** See Section 3.1 for instructions on how to securely assemble sampling hardware. A leak in any one of these connections means that some air will be pulled in through the leak and not through the flow controller. A final pressure reading near ambient is one indication that there may have been a leak.
- **Verify Initial Vacuum of Canister:** See Section 3.1 for instructions on verifying initial canister vacuum. If you are using an Air Toxics Ltd. critical orifice flow controller, note that you can use the built-in gauge.
- **Monitor Integrated Sampling Progress:** It's a good idea to monitor the progress of the integrated sampling during the sampling interval. The volume of air sampled is a linear function of the canister vacuum. For example, halfway (4 hours) into an 8-hour sampling interval, the canister should be half filled (2.5 L) and the gauge should read approximately 17 in. Hg. More vacuum than 17 in. Hg indicates that the canister is filling too slowly; less than 17 in. Hg and the canister is filling too quickly. If the canister is filling too slowly, a valid sample can still be collected (see Section 3.2.4). If the canister is filling too quickly because of a leak or incorrect flow controller setting, corrective action can be taken. Ensuring all connections are tight may eliminate a leak. It is possible to take an intermittent sample.
- **Avoid Contamination:** Flow controllers should be cleaned between uses. This is done by returning them to the laboratory.
- **Caution Against Sampling in Extreme Temperatures:** There can be some flow rate drift if the temperature of the controllers is allowed to vary significantly.

3.2.6 Step-by-Step Procedures for Integrated Sampling

These procedures are for a typical ambient air sampling application; actual field conditions and procedures may vary.

Before you get to the field:

1. Verify contents of the shipped package (e.g., chain-of-custody, canister, particulate filter and flow controller)
2. Verify the gauge is working properly
3. Verify the initial vacuum of the canister

When ready to sample:

1. Confirm the valve is closed (knob should already be tightened clockwise)
2. Remove brass cap from canister
3. Attach flow controller to canister
4. Place the brass cap at the end of the flow controller creating an air tight train, and quickly open and close the canister valve in order to check for leaks. If the needle on the gauge drops, your train is not airtight. In this case, try refitting your connections and/or tightening them until the needle holds steady
5. Once the sample train is airtight remove the brass cap from the flow controller and open the canister valve, 1/2 turn
6. Monitor integrated sampling progress periodically
7. Verify and record final vacuum of canister (simply read built-in gauge)
8. Close valve by hand tightening knob clockwise
9. Replace brass cap
10. Fill out canister sample tag (make sure the sample ID and date of collection recorded on the sample tag matches what is recorded on the COC exactly)
11. Return canisters in boxes provided (unreturned canister replacement charge of \$500 each)
12. Return sample media in packaging provided (unreturned equipment charges: \$45 per particulate filter; \$50-500 per flow controller)
13. Fill out chain-of-custody and relinquish samples properly (it is important to note the canister serial numbers on the chain-of-custody)
14. Place chain-of-custody in box and retain pink copy
15. Tape box shut and affix custody seal at each opening (if applicable)
16. Ship accordingly to meet method holding times

Important Information for Canister Sampling

- @ DO NOT use canister to collect explosive substances, radiological or biological agents, corrosives, extremely toxic substances or other hazardous materials. It is illegal to ship such substances and you will be liable for damages.
- @ ALWAYS use a filter when sampling. NEVER allow liquids (including water) or corrosive vapors to enter canister.
- @ DO NOT attach labels to the surface of the canister or write on the canister; you will be liable for cleaning charges.
- @ DO NOT over tighten the valve and remember to replace the brass cap.
- @ IF the canister is returned in unsatisfactory condition, you will be liable for damages.

For assistance call Client Services at 800-985-5955.

Section 4. Sampling with Tedlar® Bags

This section provides a description of Tedlar® bags, practical considerations for sampling, and step-by-step instructions for collecting a grab sample. A photograph illustrates the correct way to assemble the various sampling components.

4.1 Introduction to Tedlar® Bags

The Tedlar® bag is best suited for projects involving analysis of compounds in the ppmv range. However, Tedlar® bags may be used for other applications such as ambient air monitoring for atmospheric/ fixed gases.

They can be used to collect sulfur compounds, but only if the fittings are non-metallic (e.g., polypropylene, Teflon®, or Nylon).

A Tedlar® bag is made of two plies of Tedlar® film sealed together at the edges, and features a valve that allows for filling. Sample collection requires a pressurized sampling port, a low flow rate pump or a lung sampler. The bag expands as the sample enters. Air Toxics Ltd. maintains Tedlar® bags in 1, 3 and 5 L volumes.



4.1.1 Tedlar® Film

Tedlar® is a trade name for a polyvinyl fluoride film developed by DuPont Corporation in the 1960's. This patented fluoropolymer has been used in a wide variety of applications including protective surfacing for signs, exterior wall panels and aircraft interiors.

Tedlar® film is tough yet flexible and retains its impressive mechanical properties over a wide range of temperatures (from well below freezing to over 200°F). Tedlar® exhibits low permeability to gases, good chemical inertness, good weathering resistance and low off-gassing.

4.1.2 How "Active" is the Surface of a Tedlar® Bag?

The surface of a Tedlar® bag is a work in progress. The surface of a new bag is essentially free of VOCs at the single digit ppbv level. Compounds detected from analyzing new Tedlar® bags include methylene chloride, toluene, acetone, ethanol and 2-propanol. Note that 2-propanol has been detected in some new bags up to 45 ppbv. Once the Tedlar® bag is used, however, the surface has been exposed to moisture and possible

VOCs. It may irreversibly adsorb many VOCs at the low ppbv level. A series of purges with certified gas may not remove the VOCs from the surface. \$10 for a new bag is a small price to pay for peace of mind.



Never reuse a Tedlar® bag when sampling for ppbv level compounds.

4.1.3 Hold Time for a Tedlar® Bag

The media hold time for a Tedlar® bag is indefinite if stored out of sunlight in a cool, dry location. Tedlar® bags may be used to collect samples containing common solvents, hydrocarbons, chlorinated solvents, sulfur compounds and many other classes of compounds. The sample hold time to analysis varies for different classes of compounds:

- **24 hours:** Sulfur compounds (e.g., hydrogen sulfide and methyl mercaptan) and chemically active compounds (e.g., 1,3-butadiene)
- **72 hours:** Chlorinated solvents, aromatic compounds and atmospheric/fixed gases (oxygen, nitrogen, carbon dioxide)

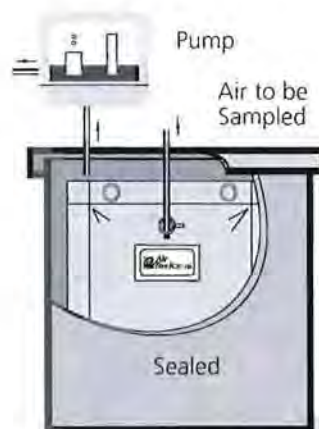
4.2 Tedlar® Bag Sampling

Using a Tedlar® bag to collect an air sample normally involves "active" sampling, unlike an evacuated canister that can be filled "passively" by simply opening the valve. There are two methods commonly used to fill a Tedlar® bag: a pump or a lung sampler.

- **Sampling with a Pump:** The most common method for filling a Tedlar® bag is to use a small pump with low flow rates (50-200 mL/min) and tubing to fill the bag. Air Toxics Ltd. does not provide pumps.
- **Sampling with a Lung Sampler:** A "lung sampler" may be used to fill a Tedlar® bag. Although a little more complicated than simply using a pump, the main advantage to using a lung sampler to fill a Tedlar® bag is that it avoids potential pump contamination.



A Tedlar® bag with attached tubing is placed in a small airtight chamber with the tubing protruding from the chamber. The sealed chamber is then evacuated via a pump, causing the bag to expand and draw the sample into the bag through the protruding tube. The sample air never touches the wetted surfaces of the pump. Air Toxics Ltd. does not provide lung samplers.



4.2.1 Considerations for Tedlar® Bag Sampling

Some considerations for collecting a Tedlar® bag sample:

- **Fill the Tedlar® bag no more than 2/3 full:** Allow for possible expansion due to an increase in temperature or decrease in atmospheric pressure (e.g., the cargo hold of a plane)
- **Keep the Tedlar® bag out of sunlight:** Tedlar® film is transparent to ultraviolet light (although opaque versions are available) and the sample should be kept out of sunlight to avoid any photochemical reactions
- **Protect the Tedlar® bag:** Store and ship the Tedlar® bag samples in a protective box at room temperature. An ice chest may be used, but DO NOT CHILL
- **Fill out the Tedlar® bag label:** It is much easier to write the sample information on the label before the Tedlar® bag is inflated
- **Provide a second Tedlar® bag:** Consider filling two bags per location in the rare occasion that a defective bag deflates before analysis. The "hold" sample does not need to be documented on the Chain-of-Custody and should have an identical sample ID to the original sample indicating that it is the "hold" sample
- **Avoid Contamination:** Care should be taken to avoid contamination introduced by the pump or tubing. Begin sampling at locations with the lowest compound concentrations (e.g., sample the SVE effluent before the influent). Decontaminate the pump between uses by purging with certified air for an extended period; better yet, use a lung sampler. Use the shortest length possible of Teflon® tubing or other inert tubing. DO NOT REUSE TUBING. If long lengths of tubing are used, consider purging the tubing with several volumes worth before sampling. If you are concerned about sampling for trace compounds, you shouldn't be using a Tedlar® bag (see Section 1.2)
- **Don't Sample Dangerous Compounds in a Tedlar® Bag:** Do not ship any explosive substances, radiological or biological agents, corrosives or extremely hazardous materials to Air Toxics Ltd. Tedlar® bag rupture during transit to the laboratory is possible and the sampler assumes full liability

4.2.2 Step-by-Step Procedures for Tedlar® Bag Sampling (Pump)

Note: These procedures are for a typical stationary source (e.g., SVE system) sampling application; actual field conditions and procedures may vary. See additional sampling considerations in Section 5.3 for sampling soil gas or landfill gas.

Before you get to the field:

1. Verify contents of the shipped package (e.g., chain-of-custody, Tedlar® bag, and tubing/fittings – if requested)
2. Verify pump cleanliness and operation (Air Toxics Ltd. does not provide pumps)

When ready to sample:

3. Purge sample port
4. Attach new Teflon® tubing from sample port or probe to low flow rate pump
5. Purge tubing
6. Fill out Tedlar® bag sample tag
7. Attach additional new Teflon® tubing from the pump outlet to the Tedlar® bag valve
8. Open Tedlar® bag valve
9. Collect sample (FILL NO MORE THAN 2/3 FULL)
10. Close Tedlar® bag valve by hand tightening valve clockwise
11. Return Tedlar® bag in boxes provided (DO NOT CHILL)
12. Fill out chain-of-custody and relinquish samples properly.
13. Place chain-of-custody in box and retain pink copy
14. Tape box shut and affix custody seal as both openings (if applicable)
15. Ship priority overnight to meet method holding times.

Section 5. Special Sampling Considerations

This section provides considerations for special sampling configurations that a sampler may collect in the field such as field duplicates or an ambient blank.

This section also provides considerations for sampling at altitude, as well as soil gas and landfill gas sampling.

5.1 Special Sampling Configurations

Special sampling configurations include a field duplicate, field split, field blank, ambient blank, and a trip blank. Call Client Services at 800-985-5955 if your project involves any of these special sampling configurations.

5.1.1 Field Duplicate

A field duplicate is a second sample collected in the field simultaneously with the primary sample at one sampling location. The results of the duplicate sample may be compared (e.g., calculate relative percent difference) with the primary sample to provide information on consistency and reproducibility of field sampling procedures. Due to the nature of the gas phase, duplicate samples should be collected from a common inlet. The configuration for collecting a field duplicate includes stainless steel or Teflon® tubing connected to a Swagelok "T". If integrated samples are being collected and the sample duration is to be maintained, the sample train should be assembled as follows: each canister should have a flow controller attached, then the duplicate sampling T should be attached to the flow controllers. If the collection flow rate from the sample port is to be maintained then the duplicate sampling T should be connected to the canisters; then the flow controller is connected to the inlet of the sampling T.

5.1.2 Field Blank

A field blank is a sample collected in the field from a certified air source. Analysis of the field blank can provide information on the decontamination procedures used in the field. Clean stainless steel or Teflon® tubing and a certified regulator should be used. It is imperative that individually certified canisters (the sample canister and the source canister/cylinder, if applicable) be used to collect a field blank.

5.1.3 Ambient Blank

An ambient blank is an ambient air sample collected in the field. It is usually used in conjunction with soil gas or stationary source (e.g., SVE system) sampling. Analysis of the ambient blank can provide information on the ambient levels of site contaminants. It is recommended that an individually certified canister be used to collect an ambient blank.

5.1.4 Trip Blank

When sampling for contaminants in water, the laboratory prepares a trip blank by filling a VOA vial with clean, de-ionized water. The trip blank is sent to the field in a cooler with new sample vials. After sampling, the filled sample vials are placed back in the cooler next to the trip blank and returned to the laboratory. Analysis of the trip blank provides information on decontamination and sample handling procedures in the field as well as the cleanliness of the cooler and packaging.

When sampling for compounds in air, a trip blank provides little, if any, of the information above. A trip blank canister can be individually certified, evacuated, and sent to the field in a box with the sample canisters. Since the valve is closed and the brass cap tightened, it is questionable if the trip blank canister contents are ever "exposed" to sampling conditions. **Air Toxics Ltd. does not recommend analyzing a trip blank for air sampling.**

5.2 Considerations for Sampling at Altitude

Sampling at altitudes significantly above sea level is similar to sampling a stationary source under vacuum, in that target fill volumes may be difficult to achieve. The figure below illustrates the relationship between increasing altitude and decreasing atmospheric pressure. Ambient conditions in Denver at 5,000 ft altitude are quite different from ambient conditions at sea level. Canister sampling is driven by the differential pressure between ambient conditions and the vacuum in the canister.

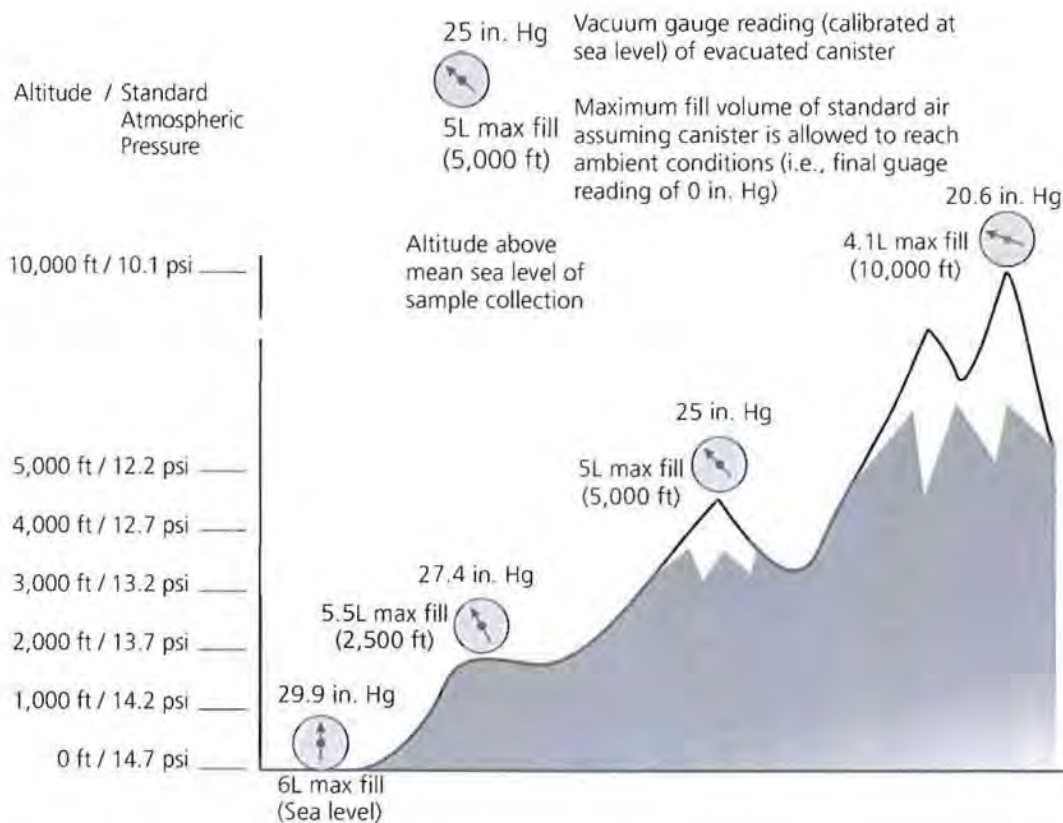
There is less atmospheric pressure in Denver and 5 L is the maximum fill volume of standard air assuming the canister is allowed to reach ambient conditions (i.e., final gauge reading of 0 in. Hg). Theoretically, if you sample high enough (e.g., in space), no sample would enter the canister because there is no pressure difference between the evacuated canister and ambient conditions. To fill a canister to 6 L in Denver, you would need to use an air pump.

Sampling at altitude also affects gauge readings. The gauges supplied by Air Toxics Ltd. (see Section 2.2.4) measure canister vacuum relative to atmospheric pressure and are calibrated at approximately sea level. Before sampling at altitude, the gauges should be equilibrated (see Section 3.1). But even after equilibrating the gauge, verifying the initial vacuum of a canister at altitude is misleading. In Denver at 5,000 ft, expect the gauge to read 25, not 29.9 in. Hg. You do not have a bad canister (i.e., leaking or not evacuated properly). The canister is ready for sampling and the gauge is working properly.



Rule of Thumb: For every 1,000 ft of elevation, the gauge will be off by 1 in. Hg and the fill volume will be reduced by 1/5 L.

If you have questions about sampling at altitude, please call Client Services at 800-985-5955.



5.3 Considerations for Soil Gas / Landfill Gas Sampling

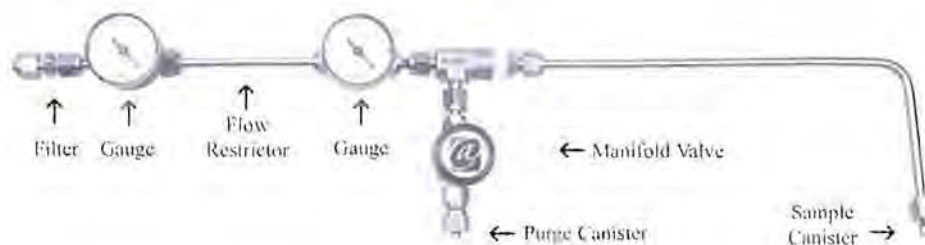
There are some additional sampling considerations for collecting grab samples (canister or Tedlar® bag) from a soil boring, landfill boring, SVE system or landfill gas (LFG) collection system. The general challenge with these samples arises from the need to employ long lengths of tubing to direct the soil gas, landfill gas or process air to the canister or Tedlar® bag. Tubing introduces the potential for contamination and diluting the sample.

5.3.1 Collecting Soil Gas Samples with Sampling Manifolds

Air Toxics provides soil gas sampling manifolds in order to facilitate meeting the numerous quality control guidelines for collecting soil gas data. Two of the most critical aspects of soil gas sampling are purging the lines and preventing leaks. The manifold setup allows for automatic leak-checking of the canister sample train without the application of a leak check compound to the canister fittings. When the purge can is opened and closed, it creates a vacuum within the canister lines and fittings. If this vacuum is maintained, the train is considered leak-free. Because there is only one connection – the probe tubing to sample train – the chance for leaks is greatly reduced.

The manifold's in line gauge system used with a purge canister enables the sampler to determine the appropriate purge volume. Typically, purge volumes of 3 to 5 times the volume of the train tubing are used, and once the purge volume is calculated the lines can be purged by opening the purge canister valve and monitoring the decrease in vacuum. This decrease in vacuum is proportional to the volume purged through the lines. There is a suggested flow rate of between 100 and 200 milliliters per minute, a step thought to prevent ambient air intrusion as a result of taking the sample too quickly. Our manifold has a "built-in" flow restrictor; a frit of stainless steel tubing between the two gauges that is calibrated to 167 milliliters per minute.

The first gauge, located prior to the flow restrictor, is a vacuum gauge that informs the sampler if sufficient vapor is being collected from the soil or if the substrate is too compacted. Because this is not a flow meter but a measure of pressure/vacuum, the gauge should read at zero if there is sufficient flow from the soil. If the gauge begins to read a vacuum, then the flow is being restricted. The second gauge, in line after the flow controller and prior to the purge canister, is a vacuum gauge that indicates to the sampler whether or not the canister is filling properly at the expected rate. This setup enables the sampler to evaluate the lithologic conditions at the site and determine if a valid soil gas sample is being taken. Finally, when duplicate samples are required, the manifold can be used as a duplicate sampling "T" by simply replacing the purge canister with another sample canister.



5.3.2 Step-by-Step Procedures for Soil Gas Sampling Using Sampling Manifolds

These procedures are for a typical soil gas sampling application; actual field conditions and procedures may vary.

Before you get to the field:

1. Verify contents of the shipped package (e.g., chain-of-custody, canister, particulate filter and flow controller)
2. Verify the gauge is working properly
3. Verify the initial vacuum of canister

When ready to sample:

Leak Check Test

1. Confirm that canister valves are closed (knob should already be tightened clockwise)
2. Remove brass caps from both the sample canister and the purge canister (unless using certified media there is no difference between the two)
3. Attach manifold to canisters
4. Confirm that there is a brass cap secured at the inlet of the manifold creating an air tight train, make sure the manifold valve above the purge canister is open, and quickly open and close the purge canister valve in order to check for leaks. If the needle on the gauge drops, your train is not airtight. In this case, try refitting your connections and/or tightening them until the needle holds steady

Purging

5. Once the sample train is airtight remove the brass cap from the manifold inlet, connect the tubing from the sample port using a compression fitting and open the purge canister valve, 1/2 turn
6. Monitor integrated sampling progress periodically. *Please note, because the purge canister is inline after the flow restrictor the line will not purge faster than at a rate of 167mls/min
7. Once the desired purge volume is met close both the manifold valve and the purge canister valve by hand tightening the knobs clockwise
8. If sampling at multiple locations, the purge canister can be disconnected from the manifold and used to begin purging the next sample location without compromising the sample train

Sampling

9. The line is now ready to be sampled. Open the sample canister valve and monitor sampling progress periodically.
10. When the sampling is complete close the valve and replace the brass cap on the canister; record final vacuum of canister (simply read built-in gauge)
11. Fill out canister sample tag (make sure the sample ID and date of collection recorded on the sample tag matches what is recorded on the COC exactly)
12. Return canisters in boxes provided (Unreturned canister replacement charge of \$500 each)
13. Return sample media in packaging provided (Unreturned equipment charges: \$45 per particulate filter; \$50-500 per flow controller)
14. Fill out chain-of-custody and relinquish samples properly (it is important to note the canister serial numbers on the chain-of-custody)
15. Place chain-of-custody in box and retain pink copy
16. Ship accordingly to meet method holding times

5.3.3 Special Considerations for Soil Gas and Landfill Gas Sampling

- **Use inert tubing.** Teflon® tubing is recommended. Tubing with an outer diameter of 1/4 in. works best with the fittings on the particulate filter.
- **Do not reuse tubing.** \$2 per foot for new tubing is a small price to pay for peace of mind.
- **Purge tubing adequately.** A long length of tubing has significant volume of "dead air" inside.

Without purging, this air will enter the canister and dilute the sample. Consider using a handheld PID/FID to confirm that you have purged the tubing and are drawing sample air through the tubing.

- **Avoid leaks in the sampling train.** Leaks of ambient air through fittings between pieces of the sampling train (e.g., tubing to particulate filter) will dilute the sample. Always use compression fittings for all connections; never use tube in tube connections.
- **Don't sample water.** If moisture is visible in the sample tubing, the soil gas sample may be compromised. Soil gas probes should be at an appropriate depth to avoid reaching the water table. Additionally, subsurface vapor should not be collected immediately after measurable precipitation.
- **Purge the sample port.** A sample port on an SVE system or LFG collection system can accumulate solids or liquids depending upon the location of the port in the process and the orientation of the port. An influent sample port located upstream of a filter or moisture knock-out can be laden with particulates or saturated with water vapor. Heavy particulate matter can clog the particulate filter and foul the canister

valve. It is important to prevent liquids from entering the canister. A sample port oriented downward may have liquid standing in the valve. Purge the sample port adequately before connecting the sampling train.

- **Consider the effects of sampling a process under vacuum or pressure.** When collecting a grab sample from a stationary source such as an SVE system or LFG collection system, some sample ports may be under vacuum or pressure relative to ambient conditions. When the sample port is under vacuum, such as the header pipe from the extraction well network, it may be difficult to fill the canister with the desired volume of sample. A vacuum pump may be used to collect a canister grab sample from a sample port under considerable vacuum. See the related discussion on sampling at altitude in Section 5.2. When the sample port is under pressure, such as the effluent stack downstream of the blower and treatment system, you may inadvertently pressurize the canister. Only a DOT-approved sample cylinder should be used to transport pressurized air samples. Under no circumstances should an Air Toxics Ltd. canister be pressurized more than 5 psig for a 6 L canister and 15 psig for a 1 L canister. Bleed off excess pressure by opening the valve temporarily while monitoring the canister with a pressure gauge.



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SORBENT & SOLUTION SAMPLING GUIDE

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1.0 INTRODUCTION

Air Toxics Ltd. presents this guide as a resource for air sampling. Air sampling can be more involved than water or soil sampling due to the reactivity of chemical compounds in the gas matrix and sample interaction with the sampling equipment and media. Ensuring that air samples are collected properly is an important step in acquiring meaningful analytical results. This guide is not a substitute for experience and cannot address the multitude of actual field conditions. Note that this guide is intended for typical projects involving sampling of volatile and semi-volatile organic compounds (VOCs and SVOCs) with sorbent tubes and impingers, and airborne particulates with filters. Air Toxics Ltd. also provides a "Guide to Air Sampling and Analysis – Canisters and Tedlar Bags" for whole air sampling of VOCs.

2.0 INTRODUCTION TO SORBENT SAMPLING

Using a sorbent to collect an air sample normally involves "active" sampling, unlike an evacuated canister that can be filled "passively" by simply opening the valve. The most common method to draw an air sample through a sorbent device is to use a small pump with low flow rates between 10 to 200 milliliters per minute (mL/min) and tubing for connecting the components. For high volume applications, a high volume air sampler can be used with a larger sorbent cartridge.

Determining the Safe Sampling Volume

Determining the appropriate volume of air sample to draw through a sorbent tube is critical to achieving the data quality objectives. The tendency is to increase the sampling volume in order to lower the final reporting limit.



Note that over-sampling may saturate the sorbent tube and allow the target compound to breakthrough. See method for volume guidelines.



2.0 INTRODUCTION TO SORBENT SAMPLING

It is imperative to know the flow rate through the sorbent tube and the sampling interval. A "set up" sorbent tube is often used to set the pump flow rate. It must be very similar to the actual sorbent tube being used for sample collection. The pressure drop through the sorbent tube determines the flow rate for a given pump setting. The flow rate through the sorbent tube should be monitored continuously (or at least periodically) using a rotometer or electronic flow sensor. If the sampling flow rate is greater than 200 mL/min, simple rotometers and electronic flow sensors cannot be used. It is necessary to use a device capable of measuring high flow rates. Refer to the method for information on the proper method of measuring the flow.

Common Sorbent Sampling Trains

The sampling train generally includes a sorbent tube, pump, and optional components such as a needle valve, particulate filter, and rotometer or electronic flow sensor. The sorbent tube is generally the first component in a sampling train, with the tubing and pump located downstream to minimize contamination of the sample.



The sorbent tube should be upstream of the pump.

For thermal desorption methods, it is critical that the air be drawn through the inlet side of the tube. The inlet side may be marked with a ring or the sampling direction may be indicated with an arrow. Proper orientation is especially important when using the multi-bed sorbent tubes described in EPA Method TO-17. If the low vapor pressure compounds are adsorbed on the high surface area sorbent (i.e., the one designed for gaseous compounds like vinyl chloride), they cannot be removed at the desorption temperatures routinely used.



For thermal desorption methods, the sorbent tube must be sampled in the appropriate direction.



2.0 SORBENT SAMPLING

Possible Components of a Sorbent Sampling Train

Tubing and Fittings: The components in the sampling train are connected with tubing and fittings as needed. Because tubing used to connect the sorbent tube to the pump does not come in contact with the air sample, the tubing material can be selected on its ability to seal. Tygon is an excellent material for this purpose, although Nylon and Teflon can be used. The length of tubing connecting the pump to the sorbent tube is not critical. Many sorbent tubes accept 1/4 in. Swagelok fittings and 1/4 in O.D. tubing.



Note that if the tubing is in the sample stream then it is necessary to select the appropriate grade material.

Needle Valve: If a variable speed/adjustable rate air sampling pump is not available, a needle valve can be used to adjust the flow rate. A rotometer (see the following section) with a built-in needle valve can provide an economical solution to adjust and measure sampling flow rate.

Rotometer or Electronic Flow Sensor: Although the flow rate for an air sampling pump can be calibrated before use, it is often desirable to include a flow measuring device in the sampling train. Note that the flow rate produced by a pump can decrease as more components are added to the sampling train. A rotometer is a relatively inexpensive meter that indicates flow with a small weight in a tapered column. As flow increases, air resistance of the weight increases and raises the weight until it is equilibrium with gravity. For best results, the rotometer must be kept vertical and free of particulates or moisture. An electronic flow sensor can provide more precise flow measurement than a rotometer, but is considerably more expensive. Both devices have optimum working ranges of flow rate (e.g., a typical rotometer may provide measurement from 100 to 500 mL/min).



Particulate Filter: If the air sample is known to have high levels of particulate matter, it may be necessary to place a filter at the sorbent tube inlet. In this case, the connecting tubing between the filter and the sorbent tube will be in the sampling stream and it should be new Teflon and as short as possible.

2.1 CONSIDERATIONS FOR SORBENT SAMPLING

Sorbent sampling requires the determination of the optimal sampling parameters: sample volume, flow rate and duration.

Appropriate sample volume should be determined by the media capacity and the required RLs. Matrix constituents such as water vapor and other non-target compounds should also be considered. See method specific sections for media capacity information and use the calculation provided to determine sample volume needed to meet specific RLs.

Determine the Final Reporting Limit for the Target Compound: the concentration may be a risk-based action level or EPA preliminary remediation goal (PRG).

Determine the Method Reporting Limit: the mass value is provided by the laboratory and is based on the analytical method selected and the sensitivity of the instrumentation. The method reporting limit may vary for each target compound.

Calculate the Sampling Volume: use the equation on the next page to determine the volume of air sample that must be drawn through the sorbent in order to achieve the final reporting limit.

Compare the Sampling Volume to the SSV: Refer to tables of safe sampling volume (SSV) for the sorbent being used – (e.g., Table 1 and Appendix 1 in Method TO-17). If the SSV for the compound of interest is not available, use the SSV of a compound in the same class (e.g., toluene for xylene, chloroform for carbon tetrachloride, etc.) and ensure that the compound will not breakthrough when sampling the volume calculated using the equation above. If breakthrough is a possibility, select a sorbent with greater sorbent strength (i.e., surface area).



2.1 CONSIDERATIONS FOR SORBENT SAMPLING

1) Calculate Minimum Sample Volume

$$\text{Minimum Volume (L)} = \frac{\text{Reporting Limit (ug)}}{\text{Action Level (ug/m}^3\text{)}} * \frac{1000 \text{ L}}{\text{m}^3}$$

Example: Screening Level = 0.08 ug/m³

$$\text{Minimum Volume (L)} = \frac{0.05 \text{ ug}}{0.08 \text{ ug/m}^3} * \frac{1000 \text{ L}}{\text{m}^3} = 625 \text{ Liters}$$

2) Calculate Minimum Flow Rate if time duration is set.

$$\text{Minimum Flow Rate (L/min)} = \frac{\text{Minimum Volume (L)}}{\text{Duration (min)}}$$

Example: TWA of 24 hours

$$\text{Minimum Flow Rate (L/min)} = \frac{625 \text{ L}}{24 \text{ hour} * 60 \text{ min}} = 0.44 \text{ L/min}$$

3) Calculate if Overloading of tube is possible.

For a source-impacted environment, estimate total concentration to estimate maximum volume. A safe sampling volume is considered to be 75% or less of the cartridge capacity.

Example: the standard TO-11A cartridge supplied by Air Toxics has a capacity of approximately 75 ug total carbonyls.

$$\text{Estimated maximum volume (L)} = \frac{(0.75 * 75 \text{ ug})}{\text{Est. Form. Conc (ug/m}^3\text{)}} * \frac{1000 \text{ L}}{\text{m}^3}$$

Example: Source-impacted site 3 ppmv (3700 ug/m³) Formaldehyde

$$\text{Estimated maximum volume (L)} = \frac{0.75 * 75 \text{ ug}}{3700 \text{ ug/m}^3} * \frac{1000 \text{ L}}{\text{m}^3} = 15 \text{ L}$$



2.1 CONSIDERATIONS FOR SORBENT SAMPLING

Avoid Over Sampling: The adage, “more is better”, often finds its way into sorbent sampling practice. In attempting to ensure low reporting limits, you may over sample a sorbent tube – especially if concentrations of target compounds are higher than expected.

Use a Backup Sorbent Tube: The use of a second, or “backup”, sorbent tube in series can help prevent compound breakthrough. Even if a safe sampling volume was calculated and not exceeded during sampling, a backup sorbent tube can provide insurance. The backup sorbent tube is only analyzed if a predetermined level of a given compound or total mass is found on the first tube. While the use of a backup sorbent tube will increase media costs, it usually has little effect on sampling costs. It will, however, provide definitive support for data integrity.



2.2 METHOD SPECIFIC SAMPLING INSTRUCTIONS

EPA Method TO-4A

Determination of Pesticides and Polychlorinated Biphenyls (PCBs) in Ambient Air using High Volume Polyurethane Foam (PUF) Sampling followed by Gas Chromatographic / Electron Capture Detector (GC/ECD)

<http://www.epa.gov/ttn/amtic/files/ambient/airtox/to-4a2r.pdf>

This method is applicable for the sample collection and analysis of pesticides and PCBs in ambient air. See pages 4A-32 and 4A-34 of the method for sampling diagrams.

TO-4A

| | |
|----------------------------|--|
| Media | PUF Cartridge (high volume) with Filter (quartz fiber) |
| Type of Pump | High volume sampler; flow rate capability of (~10cfm) |
| Sampling Rate and Interval | 0.225 m ³ /min for up to 24 hours |
| Sampling Volume | Up to 300 m ³ . Determined by user (as needed to achieve project reporting limits) |
| Sample Handling | Handle with aluminum foil and keep chilled at 4°C |
| Media Hold Time | 30 days from date of media certification |
| Extraction Hold Time | 7 days from sampling to extraction at 4°C |
| Sample Hold Time | 40 days from extraction to analysis at 4°C |
| Field QC | At least 1 field blank; it is to be treated exactly like a sample except no air is drawn through the cartridge |



2.2 METHOD SPECIFIC SAMPLING INSTRUCTIONS



Note: This method was developed using the PS-1 semi-volatile sampler provided by General Metal Works, Village of Cleves, OH as a guideline. EPA has experience in use of this equipment during various field monitoring programs over the last several years. Other manufacturers' equipment should work as well. However, modifications to these procedures may be necessary if another commercially available sampler is selected.

* Manufacturers include: Tisch Environmental, Anderson Instruments, and Thermo Environmental Instruments. Equipment specifications may vary by manufacture.



2.2 METHOD SPECIFIC SAMPLING INSTRUCTIONS

EPA Method TO-10A

Determination of Pesticides and Polychlorinated Biphenyls in Ambient Air using Low Volume Polyurethane Foam (PUF) Sampling followed by Gas Chromatographic / Electron Capture Detector (GC/ECD)

<http://www.epa.gov/ttn/amtic/files/ambient/airtox/to-10a.pdf>

This method is applicable for the sample collection and analysis of pesticides and PCBs in ambient air. See pages 10A-26 through 10A-28 of the method for sampling diagrams.

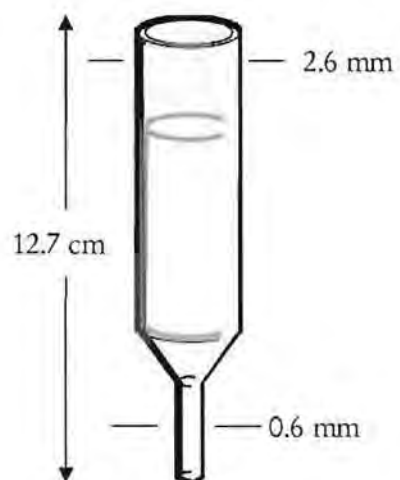
TO-10A

| | |
|----------------------------|--|
| Media | PUF Cartridge (low volume) with or without filter |
| Type of Pump | Personal/portable continuous flow sampling pump; flow rate capability of 1-5 L/minute |
| Sampling Rate and Interval | 1 to 5 L/min for 4 to 24hrs |
| Sampling Volume | Determined by user (as needed to achieve project RLs) |
| Sample Handling | Handle with aluminum foil and keep chilled at 4°C |
| Media Hold Time | 30 days from date of media certification |
| Extraction Hold Time | 7 days from sampling to extraction at 4°C |
| Sample Hold Time | 40 days from extraction to analysis at 4°C |
| Field QC | At least 1 field blank; it is to be treated exactly like a sample except no air is drawn through the cartridge |



2.2 METHOD SPECIFIC SAMPLING INSTRUCTIONS

TO-10A PUF Cartridge - Low Volume



2.2 METHOD SPECIFIC SAMPLING INSTRUCTIONS

EPA Method TO-13A

Determination of Polycyclic Aromatic Hydrocarbons (PAHs) in Ambient Air using Gas Chromatography / Mass Spectrometry (GC/MS)

<http://www.epa.gov/ttn/amtic/files/ambient/airtox/to-13arr.pdf>

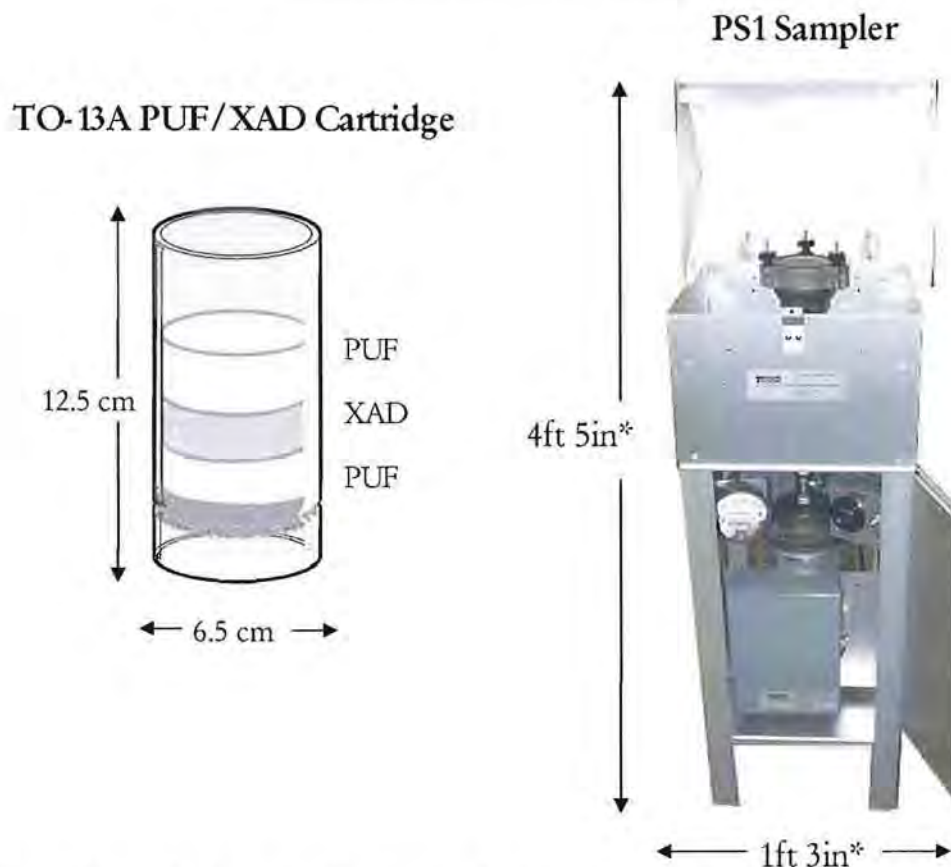
This method is applicable for the analysis of PAHs in ambient air. The high volume PUF/XAD sampling procedure is applicable for a 24-hr sampling period. See pages 13A-55 and 13A-56 of the method for sampling diagrams.

TO-13A

| | |
|----------------------------|--|
| Media | PUF/XAD Cartridge (high volume) with Filter (quartz fiber) |
| Type of Pump | High volume sampler*; flow rate capability of (~10cfm) |
| Sampling Rate and Interval | 0.225 m ³ /min for up to 24 hours |
| Sampling Volume | Up to 300 m ³ . Determined by user (as needed to achieve project reporting limits) |
| Sample Handling | Handle with aluminum foil and keep chilled at 4°C |
| Media Hold Time | 30 days from date of media certification |
| Extraction Hold Time | 7 days from sampling to extraction at 4°C |
| Sample Hold Time | 40 days from extraction to analysis at 4°C |
| Field QC | At least 1 field blank; it is to be treated exactly like a sample except no air is drawn through the cartridge |



2.2 METHOD SPECIFIC SAMPLING INSTRUCTIONS



Note: This method was developed using the PS-1 semi-volatile sampler provided by General Metal Works, Village of Cleves, OH as a guideline. EPA has experience in use of this equipment during various field monitoring programs over the last several years. Other manufacturers' equipment should work as well. However, modifications to these procedures may be necessary if another commercially available sampler is selected.

* Manufacturers include: Tisch Environmental, Anderson Instruments, and Thermo Environmental Instruments. Equipment specifications may vary by manufacture.



2.2 METHOD SPECIFIC SAMPLING INSTRUCTIONS

Modified EPA Method TO-13A Low Volume

Method TO-13A was intended for sampling SVOCs in ambient air and is generally unsuitable for indoor air applications. Placement of a high volume sampler in a home or office would be considered intrusive and impractical, at best. TO-13A can be modified such that the PUF and XAD-2 sorbent can be packed into a TO-10A cartridge or a XAD tube instead of the usual TO-13A cartridge. The TO-10A cartridge is packed with a combination of XAD-2 and PUF and may be used with or without a particulate filter (see Image 1). The XAD tube is packed with XAD-2 and also may be used with or without a filter (see Image 2). Both of these configurations are illustrated and can be provided by Air Toxics Ltd. on a project-specific basis, upon request.

Because of the pressure drop associated with having a packed bed of XAD-2 resin in the sampling tube, personal sampling pumps (e.g. normally used with small NIOSH sorbent tubes) may prove inadequate, given the large volume of air that must be sampled. These small pumps will have difficulty pulling flows greater than a few mL/min through the tube. A high capacity Kneuburger pump is powered by 12v – using a 12 volt converter or a 12 volt car battery (see Image 3).

| Application | Media Type | Considerations |
|-------------|--------------------------------|--|
| Indoor Air | PUF/XAD Cartridge - Low Volume | Desired volume to meet required reporting limits and desired duration of sampling i.e. 8hrs for an office or 12hrs for a home need to be calculated given the capacity of the car- |
| Soil Gas | XAD tube | Desired volume to meet required reporting limits considering the amount of vapor that can be collected from soil gas as well as the required flow rate of sampling need to be calculated given the capacity of the tube. |



2.2 METHOD SPECIFIC SAMPLING INSTRUCTIONS

IMAGE 1

PUF/XAD Cartridge - Low Volume

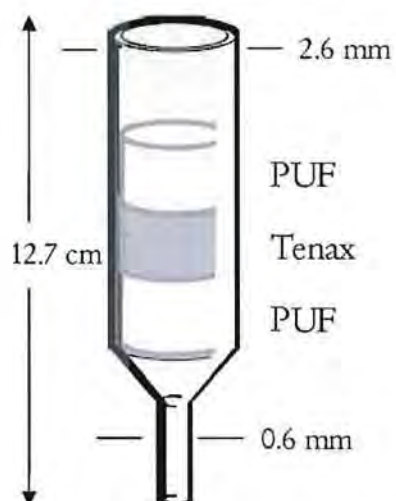


IMAGE 2

XAD Tube

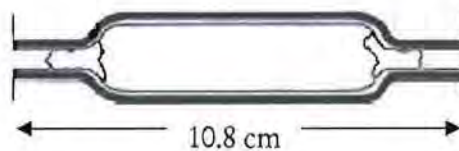
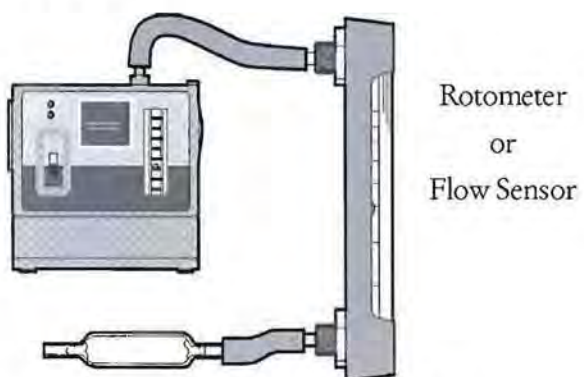


IMAGE 3



2.2 METHOD SPECIFIC SAMPLING INSTRUCTIONS

EPA Method 0010/8270C

Modified Method 5 Sampling Train

Determination of Destruction and Removal Efficiency (DRE) of Semivolatile Principal Hazardous Compounds (POHCs) from Incineration Systems and Stationary Sources.

Method 0010 - <http://www.epa.gov/epaoswer/hazwaste/test/under.htm>

Method 8270C - http://www.epa.gov/epaoswer/hazwaste/test/8_series.htm

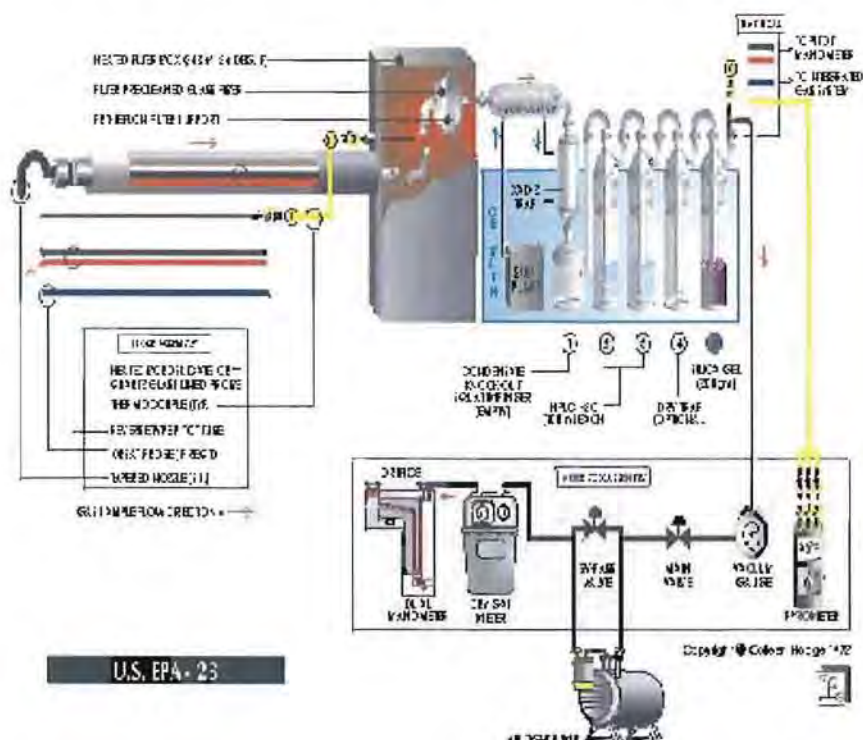
0010/8270C Modified Method 5 Sampling Train

| | |
|---------------------------------------|--|
| Media | Filter (quartz fiber) and sorbent trap (20 g XAD-2) |
| Type of Pump | Metering system. Pump capable of 4 cfm free flow. see section 4.1.3.9 of method 0010 |
| Sampling Rate and Interval | Determined by user (isokinetic) |
| Sampling Volume | Determined by user (3 dscm min or as needed to achieve project reporting limits) |
| Sample Handling | Wrap XAD-2 trap in aluminum foil, and keep chilled at 4°C |
| Media Hold Time | 30 days from date of media certification |
| Extraction Hold Time | 14 days from sampling to extraction at 4°C |
| Sample Hold Time | 40 days from extraction to analysis at 4°C |
| Components of the Sample Train | 1. Probe 2. Heated Filter 3. XAD-2 Sorbent Trap 4. Impingers 5. Condensates |



2.2 METHOD SPECIFIC SAMPLING INSTRUCTIONS

A typical MM5 sampling train



2.2 METHOD SPECIFIC SAMPLING INSTRUCTIONS

EPA Method TO-17

Determination of Volatile Organic Compounds in Ambient Air using Active Sampling Onto Sorbent Tubes.

<http://www.epa.gov/ttn/amtic/files/ambient/airtox/to-17r.pdf>

This method replaces earlier sorbent-based EPA Methods TO-1 and TO-2 and provides an alternative to canister-based EPA Method TO-15. The target compound list is the same as TO-15 (i.e., subsets of the 97 VOCs listed as hazardous air pollutants in the Clean Air Act Amendments of 1990). However, TO-17 can collect VOCs over a wider volatility range than TO-15, by using a tube with multiple sorbents packed in increasing sorbent strength. Both single and multi-bed sorbent tubes are described in TO-17. Tube Style 3 (i.e., Carbotrap 300 by Supelco) can be used for compounds ranging in volatility from $n\text{-C}_3$ to $n\text{-C}_{16}$ for air volumes of 2 L at relative humidity below 65% and temperatures below 30°C. Volumes greater than 5 L can be collected, but C_3 compounds are not quantitatively retained. Single bed tubes, such as Tenax TA, can be used to effectively collect Naphthalene and middle distillate fuels in indoor air.



| | |
|----------------------------|--|
| Media | Sorbent tube (e.g., Carbotrap 300) with optional particulate filter and ozone scrubber |
| Type of Pump | Low flow rate pump (10 to 200 mL/min) or high flow pump with low flow adapter |
| Sampling Rate and Interval | 17 and 67 mL/min for 1 hour (example flow rates) |
| Sampling Volume | 1 and 4 L (example volumes not mandated) |
| Sample Handling | Cap ends, place in culture tube, keep chilled at 4°C |
| Media Hold Time | Not specified - recommend 30 days at 4°C |
| Sample Hold Time | 30 days from collection at 4°C |
| Field QC | Field Blanks - two per sampling event |
| Distributed Pair | One location sampled at two volumes |



2.2 METHOD SPECIFIC SAMPLING INSTRUCTIONS

Although the method suggests sampling volumes of 1 and 4 L, there is considerable mention of calculating a safe sampling volume. The sampling volume you select should include consideration of both the desired final reporting limit and the safe sampling volume of the sorbent being used (see Section 2.1). The thought process is outlined below.

Determine the Final Reporting Limit for the Target Compound: the concentration may be a risk-based action level or EPA preliminary remediation goal (PRG).

Determine the Method Reporting Limit: the mass value is provided by the laboratory and is based on the analytical method selected and the sensitivity of the instrumentation. The method reporting limit may vary for each target compound.

Calculate the Sampling Volume: use the equation on page 6 of this guide to determine the volume of air sample that must be drawn through the sorbent in order to achieve the final reporting limit.

Compare the Sampling Volume to the SSV: Refer to tables of safe sampling volume (SSV) for the sorbent being used – (e.g., Table 1 and Appendix 1 in Method TO-17). If the SSV for the compound of interest is not available, use the SSV of a compound in the same class (e.g., toluene for xylene, chloroform for carbon tetrachloride, etc.) and ensure that the compound will not breakthrough when sampling the volume calculated using the equation above. If breakthrough is a possibility, select a sorbent with greater sorbent strength (i.e., surface area).

To illustrate the thought process, an example is provided below:

1. Assume Benzene is the target compound and must be reported at a final reporting limit of 0.0005 ug/L.
2. The laboratory provides a method reporting limit of 10 ng (0.010 ug).
3. Using Equation 3, the sampling volume = $0.010 / 0.0005 = 20$ L.
4. TO-17 Appendix 1 shows that for Benzene, a SSV of up to 26 L can be collected using a Type 3 (CarboTrap 300) multi-sorbent tube.

In this example, Benzene can theoretically be reported at a final reporting limit of 0.0005 ug/L with a sampling volume of 20 L.



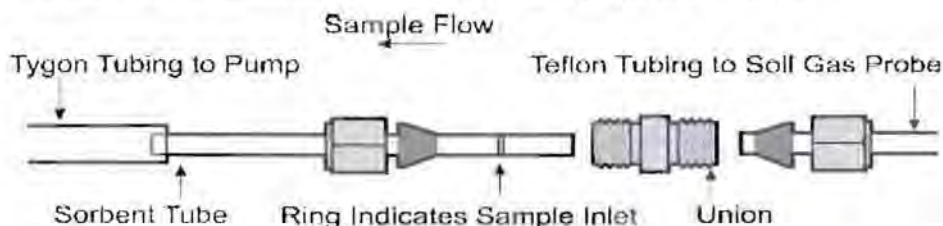
2.2 METHOD SPECIFIC SAMPLING INSTRUCTIONS

TO-17 Sampling Instructions

Application: Soil Gas

Media: TO-17 tube, 1/4" Teflon tubing, 1/4" Tygon tubing, 1/4" to 1/4" Union, 1/4" fittings with ferrules, a sample pump and a low flow holder maybe required if using a higher flow pump

Typical Sampling Parameters: Sample Flow Rate = 50 mL/min Total Vol. = 200 mL Duration = 4 min. These parameters may change depending on project objectives.



Instructions:

- 1) In order to calibrate the pump use a "set-up" tube. Using the Tygon tubing connect the sampling pump to the outlet of the sorbent tube, if using a higher flow pump a low flow holder may be necessary to lower the flow rate, then connect the inlet (the ringed side) to the calibrator. Adjust setting to desired flow rate and record.
- 2) Replace the "set-up" tube with a sample tube. Again using the Tygon tubing connect the sampling pump to the outlet of the sample tube. Attach the inlet to the union fitting using a Swagelok nut. Using a 9/16" wrench on the nut and a 7/16" wrench on the union, tighten the nut. In the same manner, attach the union to the Swagelok nut on the soil gas probe tubing. DO NOT OVERTIGHTEN.
- 3) Start the sample pump and record the start time. After the desired duration, stop the pump and record the end time.
- 4) Replace the end plugs on both ends of the sample tube. Record the sample ID, tube ID and the collection date/time on the COC.
- 5) When completed with a set of samples, re-attach the "set-up" tube to the calibrator and measure the post-sampling flow. Record post-sampling flow rate. This should match within 10% of the pre-sample flow rate.
- 6) Record sample volume on the COC using the average of the pre- and post- flow rates.
- 7) Send tubes to the lab in the cooler with ice.



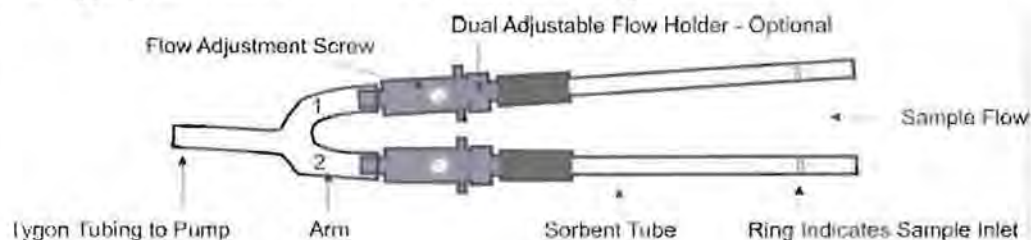
2.2 METHOD SPECIFIC SAMPLING INSTRUCTIONS

TO-17 Sampling Instructions

Application: Indoor Air

Media: TO-17 tube, 1/4" Tygon tubing, sample pump & optional dual adjustable flow holder

Parameters: Typical flows should be between 10 to 200 ml/min. Consult with the laboratory to insure appropriate volumes are collected to meet desired reporting limits.



Instructions:

- 1) Connect the sampling pump to the outlet of a "set-up" tube using Tygon tubing, connect the inlet (the ringed side) to the calibrator. Adjust setting to desired flow rate and record. A low flow holder may be required for a higher flow pump.
- 2) Replace the "set-up" tube with a sample tube. Using the Tygon tubing connect the sampling pump to the outlet of the sample tube.
- 3) The picture above shows a distributed pair using an adjustable 2-tube flow holder. This allows you to take replicate or distributed samples. The flow is adjusted by tightening the screw on the holder. Two different flows can be used to collect two volumes for a distributed pair. A 2-tube holder is not necessary for single sample collection. If using a dual holder it is important to notate which arm corresponds to each recorded flow measurement.
- 4) Start the sample pump and record the start time. After the desired duration, stop the pump and record the end time.
- 5) Replace the end plugs on both ends of the sample tube. Record the sample ID, tube ID and the collection date/time on the COC.
- 6) When completed with a set of samples, re-attach the "set-up" tube to the calibrator and measure the post-sampling flow. Record post-sampling flow rate. This should match within 10% of the pre-sample flow rate.
- 7) Record sample volume on the COC using the average of the pre- and post- flow rates.
- 8) Send tubes to the lab in the cooler with ice.



2.2 METHOD SPECIFIC SAMPLING INSTRUCTIONS

EPA Method 0030/5041A (VOST)

This method describes the collection of volatile principal organic hazardous constituents (POHCs) from the stack gas effluents of hazardous waste incinerators. For the purpose of definition, volatile POHCs are those POHCs with boiling points less than 100°C. If the boiling point of a POHC of interest is less than 30°C, the POHC may break through the sorbent under the conditions of the sample collection procedure.

ATL has validated a method of “diluting” a VOST sample prior to analysis in the case of high level matrices. The first step is to inject surrogate benzene-d6 onto the sample tube(s). Recovery is monitored as a means of ensuring the integrity of the sample transfers. The VOST tubes are then thermally desorbed into a Tedlar bag. This gaseous sample is screened using GC/FID and an acceptable amount of sample is transferred back onto a clean set of VOST tubes which are subsequently thermally desorbed per the method. High quality data is obtained from every tube.

Method 0031

M0031 was written in part to specify which organic compounds are appropriate for collection in contrast to M0030 which provided guidelines based on boiling point alone. Moreover, polar and reactive compounds are identified as poor performers for the M0031 collection strategy. In Method 0031 the VOST consists of three glass tubes containing Tenax, Tenax, and Anasorb, respectively, to trap the organic mass.

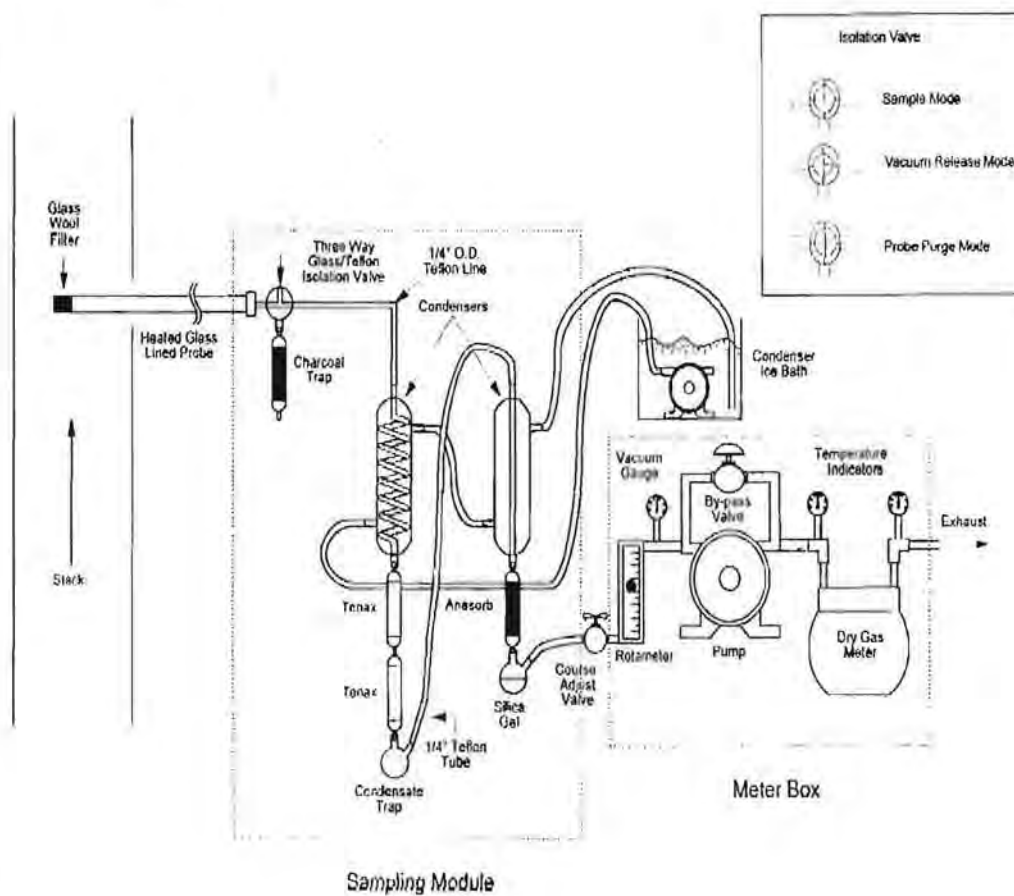
0030/5041A VOST

| | |
|-------------------------------|---|
| Media | One pair of glass sorbent tubes (1.6 g Tenax; 1.0 g Tenax / 1.0 g petroleum based charcoal) |
| Media Hold Time | 2 weeks at 4°C |
| Type of Pump | see method for sampling equipment |
| Sampling Rate/Interval | 1 L/min for 20 min (FAST-VOST); 250 mL/min for 20 min and 500 mL/min for 40 min (SLOW-VOST) |
| Sampling Volume | 20 L (FAST-VOST); 5 and 20 L (SLOW-VOST) |
| Sample Handling | Cap ends, place in culture tube, keep chilled at 4°C |
| Hold Time to Analysis | 14 days at 4°C |



2.2 METHOD SPECIFIC SAMPLING INSTRUCTIONS

VOST Sample Train



2.2 METHOD SPECIFIC SAMPLING INSTRUCTIONS

NIOSH 1500/1501

| | |
|------------------|---|
| Media | Coconut Shell Charcoal tube, 100mg/50mg tube |
| Media Hold Time | Use manufactures expiration date listed on tube |
| Type of Pump | Personal Sampling Pump |
| Sampling Rate | 0.01 - 0.2 L/min |
| Sampling Volume | Ranges from a minimum of 1L to a maximum of 30L Dependant on contaminant; see method |
| Sample Handling | Ship cold after sampling |
| Sample Hold Time | 30 days at 5°C |
| Field QC | 10% field blanks |

NIOSH 1550

| | |
|------------------------------|---|
| Media | Coconut Shell Charcoal tube, 100mg/50mg tube |
| Media Hold Time | Use manufactures expiration date listed on tube |
| Type of Pump | Personal Sampling Pump |
| Sampling Rate | 0.01 - 0.2 L/min |
| Sampling Volume | Minimum - 1.3 L; Maximum - 20 L |
| Sample Handling | Ship cold after sampling |
| Hold Time to Ex- traction | 7 days at 25°C |
| Extract Hold Time | 2 to 10 field blanks per set |



2.2 METHOD SPECIFIC SAMPLING INSTRUCTIONS

NIOSH 5515

| | |
|------------------|--|
| Media | 5515 filter + Sorbent (37 mm PTFE + 100mg/50mg XAD-2 tube) |
| Media Hold Time | Use manufactures expiration date listed on tube |
| Type of Pump | Personal Sampling Pump, capable of operating up to 8hrs at 2 L/min |
| Sampling Rate | 2 L/min |
| Sampling Volume | Minimum - 200 L; Maximum - 1000 L |
| Sample Handling | Handle with aluminum foil and keep chilled at 4°C and keep out of sunlight |
| Sample Hold Time | Unspecified; ATL uses 7 days |
| Field QC | 2 to 10 field blanks; 6 to 10 media blanks |

NIOSH 5503

| | |
|----------------------------|---|
| Media | 5503 filter + Sorbent (13 mm glass fiber + 100mg/50mg |
| Media Hold Time | Use manufactures expiration date listed on tube |
| Type of Pump | Personal Sampling Pump |
| Sampling Rate and Interval | 0.05 - 0.2 L/min |
| Sampling Volume | Minimum - 1 L; Maximum - 50 L |
| Sample Handling | Handle with aluminum foil and keep chilled at 4°C and keep out of sunlight |
| Hold Time | Unspecified for filter; ATL uses 7 days. Method allows 2 months for Florisil tube |
| Field QC | 2 to 10 field blanks per set |



3.0 SOLUTION SAMPLING

The gas can be drawn (bubbled) through a solution in an impinger to dissolve the compounds in the gas phase. The sampler records the flow rate and sampling interval for calculating compound concentration by volume. The impinger vial is subsequently capped, chilled (as required), and transported to the laboratory for analysis. Sampling with a solution is similar to sorbent sampling in that compounds are concentrated and the gas matrix is not collected. However, the solution is chosen so that the compounds of interest are either dissolved (and consequently remain in solution) or form a derivative in-situ (and the derivative remains in solution). The compounds/derivatives are analyzed directly or by chemical extraction. The solution (e.g., methanol, DNPH, water) is selected according to the type of air sampling and compounds targeted. An acidic solution of dinitrophenylhydrazine (DNPH) is used to derivatize C1-C3 carbonyl compounds.

3.1 METHOD SPECIFIC SAMPLING INSTRUCTIONS

EPA Method TO-5

Method for the determination of aldehydes and ketones in ambient air using High Performance Liquid Chromatography (HPLC). <http://www.epa.gov/ttn/amtic/airtox.html>

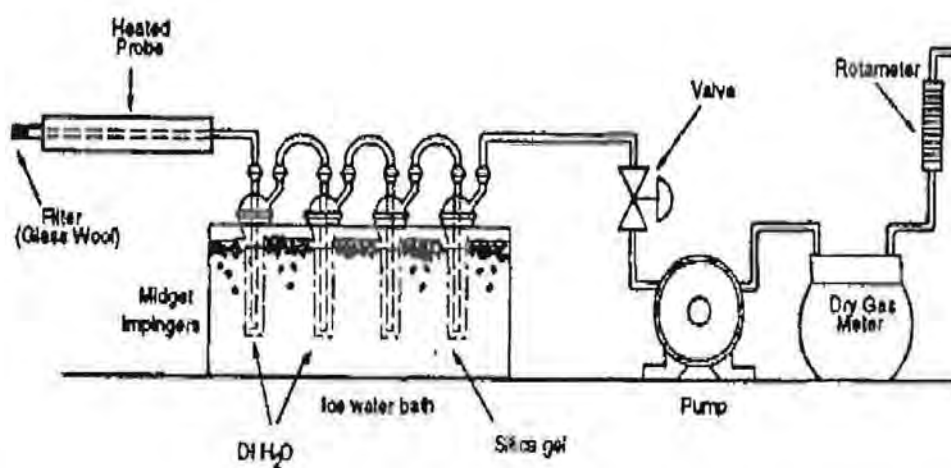
TO-5

| | |
|----------------------|---|
| Media | One pair of 40 mL glass vials with Teflon screw caps and 25 mL midget impingers in ice bath |
| Impinger Solution | 10 mL 2,4-dinitrophenylhydrazine (DNPH) and 10 mL iso-octane |
| Sampling Volume | Up to 80 L |
| Sampling Rate | 100 to 1,000 mL/min |
| Sample Handling | Cap vials and keep chilled at $4 \pm 2^{\circ}\text{C}$ |
| Media Hold Time | 48 hrs from date of media preparation at 4°C |
| Extraction Hold Time | 7 days from sampling to extraction at 4°C |
| Sample Hold Time | 30 days from extraction to analysis at 4°C |



3.1 METHOD SPECIFIC SAMPLING INSTRUCTIONS

Sampling Train



- Front and Back impingers are to be combined at the laboratory.
- Iso-octane can be used

Field QC:

Field Blank—At least one FB with each group of samples. FB is treated identically to the samples except that no air is drawn through the reagent.

3.1 METHOD SPECIFIC SAMPLING INSTRUCTIONS

EPA Method TO-11A

Formaldehyde and other carbonyl compounds (aldehydes and ketones) in air are collected by drawing sample through a DNPH-coated silica gel cartridge using a sampling pump. TO-11A can be applied to indoor air, ambient air, and source-impacted sites. Collection times up to 24 hours are used for low ppbv environments, and short-term sampling (5 to 60 minutes) can be used for higher concentration sites.

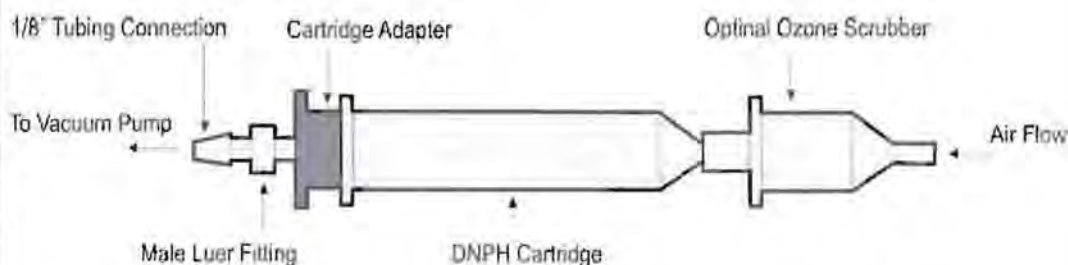
<http://www.epa.gov/ttn/amtic/airtox.html>

TO-11A

| | |
|--------------------|--|
| Media | Sep-Pak cartridges (DNPH-coated silica gel) an ozone scrubber is strongly recommended |
| Sampling Rate | Range: 0.1 to 2 L/min. Typical rate for ambient air <1 L/min when using a personal sampling pump. |
| Cartridge Capacity | S10 Supelco = Approximately 75 ug total carbonyls. Cartridges with higher capacity are available. If breakthrough is a concern, use a back-up tube. |
| Sample Handling | Cap ends, place in foil-lined envelope included in shipment. Label envelope with sample information. Keep chilled at ~4°C and keep out of sunlight. |
| Media Hold Time | Manufacturer's expiration date listed on cartridge |
| Sample Hold Time | 14 days |
| Field QC Samples | Field Blank – Treat in the same manner as samples, but do not draw air through cartridge. Field Duplicate – Collect a collocated sample using a second sampling port attached to the sample pump. Back-up tube – If breakthrough is a concern, a back-up tube can be connected to the sample tube. |
| Sampling QC | QC Measure and record the flow rate before and after sample collection. Flow rates should not vary more than 10% over the sampling duration. |



3.1 METHOD SPECIFIC SAMPLING INSTRUCTIONS



Interferences: Atmospheric ozone can result in a loss of formaldehyde and other carbonyl derivatives. An ozone scrubber is recommended to minimize interference. Particulate-laden atmospheres ($>50 \text{ ug/m}^3$) may result in flow drops during sampling. Additionally, acrolein and crotonaldehyde may partially degrade using DNPH-coated silica gel cartridges.

Special Considerations: Compound breakthrough can occur if too much volume is collected and the sorbent becomes overloaded. If breakthrough is a concern, cartridges may be sampled as a train. The two cartridges are analyzed separately by the laboratory to monitor breakthrough.



3.1 METHOD SPECIFIC SAMPLING INSTRUCTIONS

CARB Method 430

This method applies to the determination of formaldehyde and acetaldehyde emissions from stationary sources. The method is based on the use of high performance liquid chromatography (HPLC).

<http://www.arb.ca.gov/testmeth/vol3/vol3.htm> See sections 8.0 - 8.2 on pages 18 - 23 for sampling procedures.

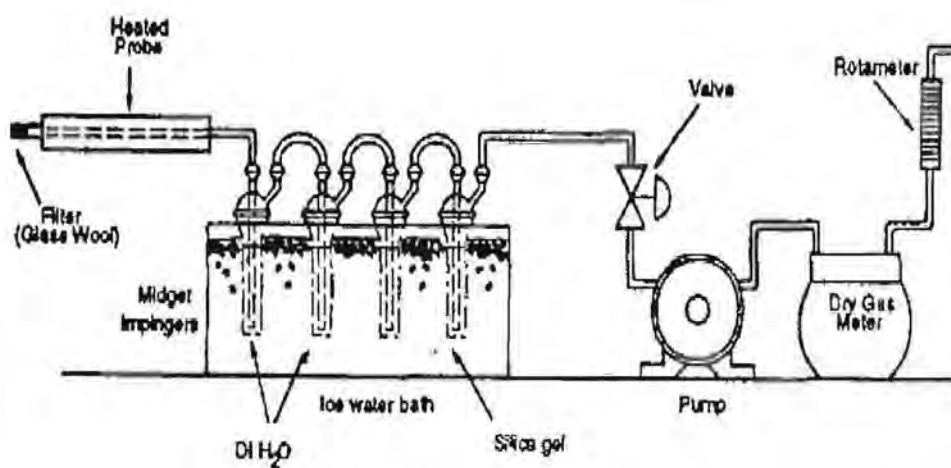
CARB 430

| | |
|-----------------------------|---|
| Media | One pair of 25 mL glass vials with Teflon screw caps and 35 mL midget impingers in ice bath |
| Impinger Solution | 10 mL 2,4-dinitrophenylhydrazine (DNPH) |
| Sampling Volume | Up to 80 L |
| Sampling Rate | 100 to 1,000 mL/min |
| Sample Handling | Cap vials and keep chilled at $4 \pm 2^{\circ}\text{C}$ |
| Media Hold Time | 48 hrs from date of media preparation at 4°C |
| Extraction Hold Time | 7 days from sampling to extraction at 4°C |
| Sample Hold Time | 30 days from extraction to analysis at 4°C |



3.1 METHOD SPECIFIC SAMPLING INSTRUCTIONS

Sampling Train



- Each vial will be treated as an individual sample, do not combine.
- Iso-octane should not be used.

Field QC:

Trip Blank

Field Blank

Field Spike (as requested)



3.1 METHOD SPECIFIC SAMPLING INSTRUCTIONS

EPA Method 0011 Sampling for selected aldehyde and ketone emissions from stationary sources. <http://www.epa.gov/epaoswer/hazwaste/test/under.htm>

Method 0011 sampling is comprised of an isokinetic sampling train containing DNPH filled impingers. Formaldehyde and other aldehydes and ketones react with the DNPH to form derivatives. The derivatives are extracted and analyzed by HPLC/UV.

Method 0011

| | |
|-----------------------------|--|
| Media | DNPH filled impingers |
| Sampling Rate | Determined by user (isokinetic) |
| Sampling Volume | Determined by user |
| Sample Handling | Cap vials and keep chilled at $4 \pm 2^{\circ}\text{C}$ |
| Media Hold Time | 5 days from date made and 2 days from date opened in the field |
| Extraction Hold Time | 7 days from sampling to extraction at 4°C |
| Sample Hold Time | 30 days from extraction to analysis at 4°C |
| Quality Control | <p>Field Spike - typically ~800 ug of formaldehyde. (Place the field spike into an impinger containing 200 mL of DNPH solution, recover, and return for analysis.)</p> <p>Sample Blank - add a volume of DNPH reagent and Methylene chloride equal to the total volume of the combined impingers and rinses.</p> <p>Matrix Spike Sample - this additional sample may be collected for use as a matrix spike sample as described in Sec. 8.0 of Method 8315.</p> <p>Field blanks - may be submitted with the samples collected at each sampling site.</p> |



3.1 METHOD SPECIFIC SAMPLING INSTRUCTIONS

EPA Method 316

Sampling and Analysis for Formaldehyde Emissions from Stationary Sources in the Mineral Wool/Wool Fiberglass Industries. <http://www.epa.gov/ttn/emc/promgate.html>

Method 316 sampling is comprised of an isokinetic sampling train containing reagent grade water filled impingers. Formaldehyde is absorbed in the DI water. The contents of the impinger and DI train rinses are analyzed for by a modified pararosaniline method. Samples are derivatized with pararosaniline and sodium sulfite to create a purple chromophore. The chromophore is analyzed by spectrophotometer set at 570nm.

EPA Method 316

| | |
|------------------|--|
| Media | Reagent grade water filled impingers |
| Sampling Rate | Determined by user (isokinetic) |
| Sampling Volume | 30 cubic ft minimum sample volume |
| Sample Handling | Cap vials and keep chilled at 2°C |
| Sample Hold Time | 14 days from date of collection at 2°C |
| Field Blank | 1 per set |



3.1 METHOD SPECIFIC SAMPLING INSTRUCTIONS

Air Toxics Method @ 71 Siloxanes

Siloxanes are a family of organic compounds containing chains of silicon, oxygen, and methyl groups. These organosilicon compounds, commonly called silicones, differ from naturally occurring inorganic forms of silicon (i.e., silicates). Siloxanes are manufactured in a wide variety of forms including low to high viscosity fluids, gums, elastomers, and resins.

Building on results of the 1997 Dow Corning landfill consortium investigation, the ATL method is based on drawing air-phase samples through a series of two midjet impingers containing methanol (see Table 1). Siloxanes present in the air-phase dissolve in the chilled methanol solution and are subsequently capped and kept chilled until analysis. The suggested media hold time is 30 days and the suggested sample hold time until analysis is 21 days.

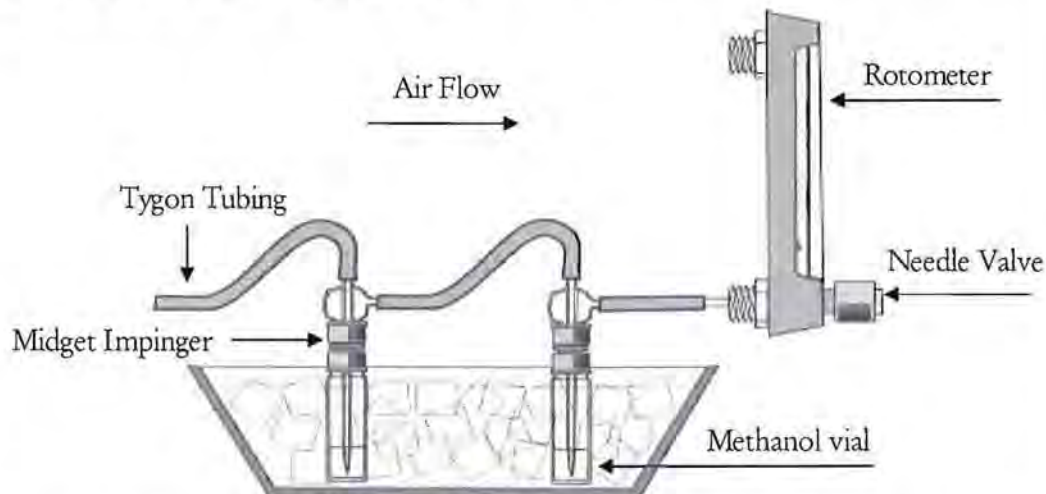
Air Toxics @ 71 Siloxanes

| | |
|-------------------|--|
| Media | One pair of 24 mL borosilicate glass vials with Teflon screw |
| Impinger Solution | Up to 15 mL methanol (6 mL suggested) |
| Sampling Volume | Determined by user (20 L suggested) |
| Sampling Rate | Determined by user (112 mL/min for 3 hours suggested) |
| Sample Handling | Cap vials and keep chilled at $4 \pm 2^{\circ}\text{C}$ |
| Media Hold Time | 30 days from date of certification |
| Sample Hold Time | 21 days from collection |



3.1 METHOD SPECIFIC SAMPLING INSTRUCTIONS

Collect the sample by attaching inert, flexible tubing from the source air stream to the inlet of the first impinger (see Figure 4). Additional tubing connects the outlet of the first impinger to the inlet of the second impinger and both impingers are chilled in an ice bath. If the source is not under pressure, a low-volume pump can supply the vacuum required to draw the sample through the impingers.



A needle valve and rotameter can be used to adjust and measure the flow rate of sample through the impingers. The user must determine optimum sampling rate and volume to achieve the data quality objectives of the sampling program. Sampling rates from 100 to 1,000 mL/min are appropriate as long as there is not significant loss of impinger solution. The amount of sample air drawn through the impingers and the amount of methanol in the impinger determine the final reporting limit concentration. The more sample air drawn through the impingers equates to more target constituent concentrated in the solution and thus lower reporting limits. Be careful not to over sample and saturate the solution. Less impinger solution equates to lower reporting limits, but has less capacity to dissolve the target constituents. For applications involving siloxanes removal from methane gas sources, Applied Filter Technology suggests filling each impinger with 6 mL of methanol and sampling at a flow rate of 112 mL/min for 180 minutes [4]. This arrangement results in a sampling volume of approximately 20 L.



4.0 FILTER SAMPLING

Gas may be drawn through a filter to immobilize the compounds suspended in a gas matrix (or adsorbed on particulates suspended in a gas matrix) onto the surface of the filter material. The sampler records the flow rate and sampling interval for calculating compound concentration by volume. The filter is bagged, chilled (as required), and transported to the laboratory for analysis. Sampling with a filter is similar to sorbent and solution sampling in that compounds are concentrated and the gas matrix is not collected. The filter may be weighed before and after sampling to provide a gravimetric analysis of the total particulates and compounds collected. In addition, the filter can undergo solvent extraction or digestion to determine the presence of organic and inorganic compounds. The filter (e.g., quartz fiber, mixed cellulose ester, Teflon) is selected according to the type of air sampling and compounds targeted.

4.1 METHOD SPECIFIC SAMPLING INSTRUCTIONS

PM10

This method provides for the measurement of the mass concentration of particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers (PM10) in ambient air over a 24-hour period for purposes of determining attainment and maintenance of the primary and secondary national ambient air quality standards for particulate matter.

<http://www.epa.gov/ttn/emc/promgate.html>

TSP

See PM10

The methods for TSP and PM-10 differ slightly in the conditioning requirements for the filters. Air Toxics treats the two methods the same way using the more stringent conditioning requirements.



4.1 METHOD SPECIFIC SAMPLING INSTRUCTIONS

PM10 & TSP

| | |
|----------------------------|---|
| Media | 8 X 10 inch glass fiber filter |
| Media Hold Time | None specified. |
| Type of Pump | High volume sampler* |
| Sampling Rate and Interval | 0.5 m ³ /min for 24 hours |
| Sampling Volume | 700 m ³ |
| Sample Handling | None Specified. Use protective packaging. Do not allow the filters to get wet or damaged. Do not handle with bare |
| Hold Time to Analysis | Air Toxics suggests 14-day sample hold time. |
| Analytical Method | Gravimetric |
| QC Samples | Duplicates, Lab Blank, Trip Blank |



* Manufacturers include: Tisch Environmental, Village of Cleves-Ohio; Anderson Instruments-500 Technology Ct, Smyrna, GA; and Thermo Environmental Instruments-8 West Forge Parkway, Franklin, MA.



APPENDIX E

HISTORICAL RECORDS

(INCLUDED ON CD IN APPENDIX A)

KEYED NOTES

- 1 REMOVE EXISTING WINDOWS
- 2 REMOVE EXISTING STAIR AND HANDRAIL
- 3 REMOVE EXISTING DOORS, WALLS (FULL HEIGHT) AND ASSOCIATED CEILING SUPPORT SYSTEMS
- 4 REMOVE EXISTING OVERHEAD DOOR AND HARDWARE
- 5 REMOVE EXISTING CONCRETE WALL AS REQUIRED FOR INSTALLATION OF NEW HOLLOW METAL DOOR AND FRAME
- 6 REMOVE STEEL COVER, PURGE HYDRAULIC FLUIDS, REMOVE VEHICLE LIFT, CLEAN SOIL
- 7 REMOVE EXISTING STUD WALL AS REQUIRED FOR INSTALLATION OF NEW DOOR AND FRAME AS SCHEDULED
- 8 REMOVE ALL TOILET ROOM FIXTURES AND PARTITIONS (COORDINATE WITH PLUMBING DRAWINGS)
- 9 REMOVE EXISTING DOOR AND FRAME
- 10 REMOVE EXISTING CEILING SYSTEM ABOVE THIS AREA
- 11 REMOVE EXISTING ACM FLOORING SYSTEM IN THIS AREA
- 12 EXISTING WOOD STUD WALL TO REMAIN
- 13 EXISTING SUPPORT COLUMNS AND BEAM TO BE REMOVED. COORDINATE REMOVAL AND REPLACEMENT OF OWNER ATTACHED EQUIPMENT WITH GOVERNMENT
- 14 REMOVE EXISTING ACM PIPING AND INSULATION THROUGHOUT ENTIRE BUILDING
- 15 REMOVE AND RELOCATE EXISTING DOOR, FRAME AND ALL HARDWARE

GENERAL NOTES

1. ASBESTOS/LEAD PAINT SURVEY AVAILABLE FROM THE ANG. ALL WORK NOTED WITH POTENTIAL FOR ASBESTOS REMOVAL SHALL BE COMPLETED UNDER DIRECTION OF THE GOVERNMENT.
2. SPECIFICATION FOR ASBESTOS REMOVAL PROVIDED IN THESE DOCUMENTS WAS PREPARED BY THE GOVERNMENT AND IS ATTACHED AS A SEPARATE DOCUMENT.



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North Highlands, California 95660

ISSUED:

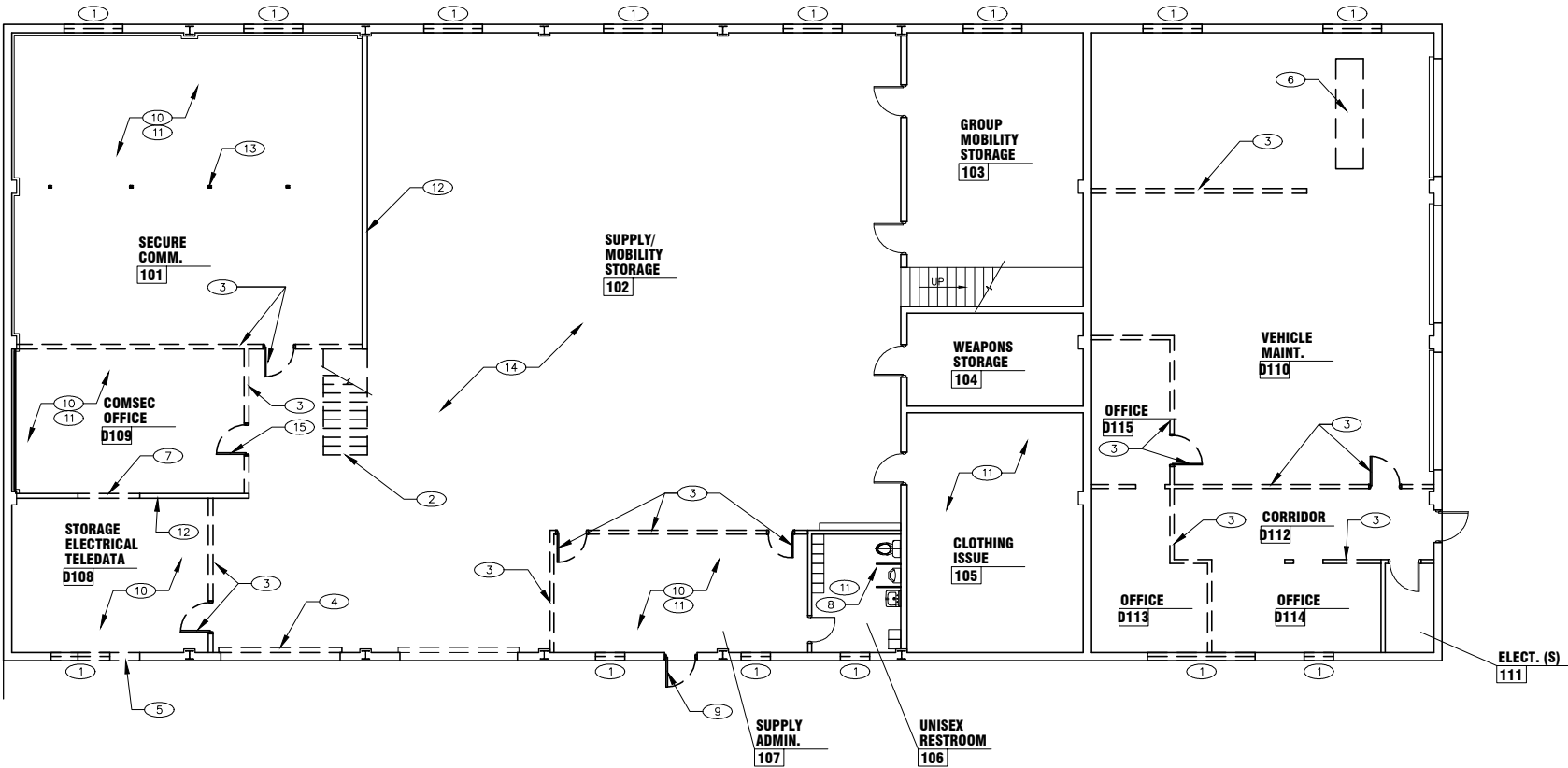
MAH NO.: C270-03E
DATE: APRIL 12, 2004
DWN. BY: KJC
CKD. BY: DRC

DO NOT SCALE DRAWINGS
SHEET CONTENTS:

FIRST FLOOR
DEMOLITION PLAN

10125

A1.1
RZJQ 012008



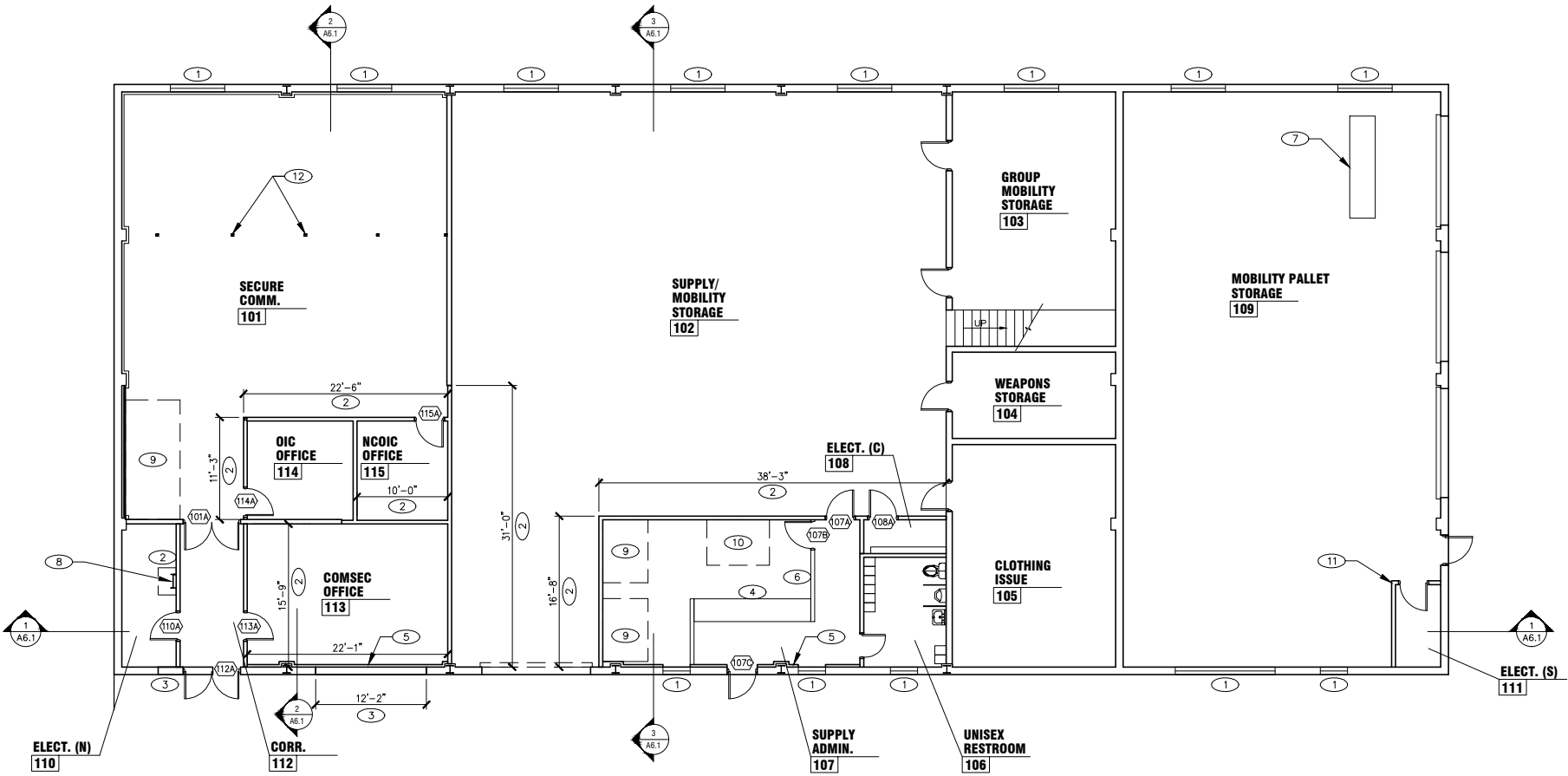
FIRST FLOOR DEMOLITION PLAN
1/8" = 1'-0"
FLOOR ELEV: 100'-0"
PLAN NORTH

GENERAL NOTES

1. MATCH EXISTING MATERIALS AND FINISHES AS REQUIRED FOR AREAS TO BE REPLACED OR PATCHED DUE TO CONSTRUCTION OPERATIONS.
2. FIELD VERIFY ALL DIMENSIONS.

KEYED NOTES

- 1 NEW FIXED BLAST RESISTANT WINDOWS (SEE DETAILS ON DRAWING A8.1)
- 2 NEW INTERIOR CONSTRUCTION (SEE DETAILS ON DRAWING A7.1)
- 3 MASONRY INFILL EXISTING OPENING. MATCH EXISTING THICKNESS
- 4 NEW SERVICE COUNTER (SEE DETAILS ON DRAWING A7.1)
- 5 EXISTING CONCRETE WALL FURRED OUT WITH 2 1/2" RESILIENT CHANNELS & 5/8" GYP. BD. (INSULATED WITH BATT INSULATION)
- 6 NEW HALF-HEIGHT PARTITION WALL (CONSTRUCT PER DETAILS ON DRAWING A7.1)
- 7 CONCRETE INFILL OVER CLEAN SOIL
- 8 LADDER TO MEZZANINE (SEE DETAILS ON A7.1)
- 9 DEDICATED WORKSPACE (FURNITURE BY GOVERNMENT)
- 10 SHARED WORKSPACE (FURNITURE BY GOVERNMENT)
- 11 FINISH TO MATCH EXISTING WHERE DEMOLITION HAS OCCURED
- 12 NEW BEAM AND COLUMN LINE (SEE DRAWING S5.1)



FIRST FLOOR PLAN
1/8" = 1'-0"
FLOOR ELEV: 100'-0"



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M&H NO.: C270-03E
DATE: APRIL 12, 2004
DWN. BY: KJC
CKD. BY: DRC

DO NOT SCALE DRAWINGS
SHEET CONTENTS:

FIRST FLOOR PLAN

10125

A2.1
RZJQ 012008

ANALYTICAL EVALUATION/TEST RESULTS
PHYSICAL SCIENCES LAB, McCLELLAN AFB, CA 95652-5990
TELEPHONE (916)643-6988

EX 10
COM

TO: EMC/ L. BUTTON

FROM: MAQCB/3-6988

SUBJECT: OIL/ WATER SEPERATOR SAMPLES
TAKEN FROM A. N. G.

TESTED BY: FONG/DOMEK/
KILBURN

DATE: 18 JUN 87

PROJECT NO. 87-526

DATE SAMPLED: 20 APR 87

| LAB NO. | DESCRIPTION | TEST RESULTS |
|---------|--|--|
| 453-87 | EMC #871314 ANG OIL/WATER SEPERATOR MAINTAINCE BLDG | SAMPLE COMPOSITION: WATER 60% VOL SILICONE FLUID 16% VOL PETROLEUM OIL 12% VOL SOLVENT SIMILAR TO STADDARD SOLVENT 12% VOL CHLORINATED SOLVENTS <0.01% VOL |
| 454-87 | EMC #871315 ANG OIL/WATER SEPERATOR POWER PRODUCTION BLDG | SAMPLE COMPOSITION: WATER 95% VOL PETROLEUM OIL 5% VOL CHLORINATED SOLVENTS <0.01% VOL |

REMARKS: SAMPLE ANALYZED BY FTIR, HEADSPACE-GC,
AND GC-MS.

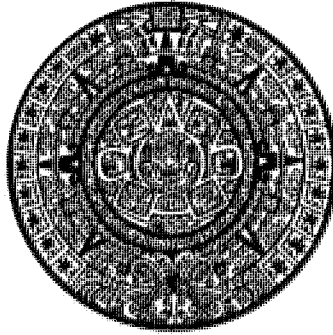
OFFICAL SIGNATURE

REVIEWED BY:

R. Fong

R. Fong
CHEM SCIENCES SR
DIR. OF MAINTENANCE

JUN 25 1987



AZTECA
CONSTRUCTION, INC.

TANK REMOVAL AND SITE REMEDIATION REPORT

FOR

**AIR NATIONAL GUARD FACILITY
3900 ROSEVILLE ROAD
NORTH HIGHLANDS, CALIFORNIA**

PREPARED FOR

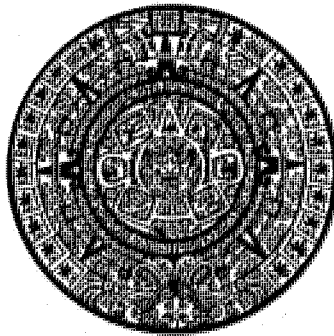
**DEPARTMENT OF THE ARMY AND AIR FORCE
NORTH HIGHLANDS, CALIFORNIA**

BY

**AZTECA CONSTRUCTION, INC
3871 SECURITY PARK DRIVE
RANCHO CORDOVA, CALIFORNIA 95742**

AZTECA PROJECT NO. 95146

JULY 1996



AZTECA
CONSTRUCTION, INC.

July 30, 1996

Department of the Army and Air Force
3900 Roseville Road
North Highlands, CA 95842

Attention: Lieutenant Colonel Gericke

**RE: North Highlands Air National Guard Facility
Tank Removal Report**

Dear Ltc. Gericke:

Azteca Construction, Inc. (Azteca) has prepared the following tank removal report for your project at the North Highland Air National Guard facility at 3900 Roseville Road, North Highlands, California (Azteca Job No. 95146). The report covers the removal of two underground storage tanks and an oil water seperator, as well as the removal of contaminated soil and site restoration.

If you have any questions about the contents of this report, or if you need additional assistance, please call either Kelly Gregory or myself at (916) 351-0202.

Regards,

David W. Bieber, R.G.
Staff Geoscientist

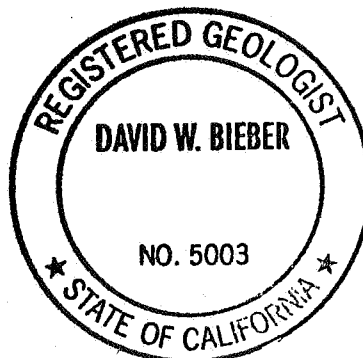


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| 2 | Copies of UST Removal Permits |
| 3 | Hazardous Waste Manifest and Certificate of Destruction for USTs |
| 4 | Laboratory Reports from UST Removal |
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I. Introduction

Azteca construction, Inc. (Azteca) was contracted by the Department of the Army and Air Force, California National Guard to perform work at the Air National Guard (ANG) Facility located at 3900 Roseville Road, North Highlands, California (See Geocon Figure 1 - Site Location, in Attachment 1 - Geocon Environmental Consultants Site Investigation Report). Azteca's work included the removal of two underground storage tanks (USTs) and an oil/water separator, excavation and disposal of contaminated soil, site restoration, and the installation of two above ground storage tanks. This report provides details of the UST removal and site remediation and restoration.

The ANG facility is located at 3900 Roseville Road in North Highlands, California. McClellan Air Force Base is located north of the ANG, across Roseville Road, and the site is separated from Interstate 80 on the south by a chain link fence. The work area occupies the southern portion of the ANG facility adjacent to and west of Building 4.

II. Site History

The two USTs removed from the project site included Tank No. 108, a 2,000 gallon steel gasoline tank, and Tank No. 107, a 3,100 gallon steel diesel fuel tank. Tank No. 108, the gasoline tank was installed in 1966, and at various times reportedly contained diesel fuel, leaded gasoline, and unleaded gasoline. The diesel fuel tank, tank No. 107, was installed in January of 1961. The tanks were used by the ANG and affiliated organizations for refueling military vehicles. No data was available to Azteca regarding the quantities of fuel pumped at the site during the time that the tanks were in use. The gasoline and diesel tanks last contained fuel in the middle of 1994, at which time they both failed a pressure test.

III. Site Geology and Hydrology

The soils excavated during the UST removal were described as Riverbank Formation. The Riverbank Formation is made up of alluvial soils generally consisting of dense, clayey silty sands, interbedded with very stiff to hard clays and silts. During the site investigation performed on the site by Geocon Environmental Consultants, isolated lenses of poorly graded sands were also noted.

Groundwater was not reported during the tank removal, site investigation, or site remediation. As a portion of a groundwater investigation for McClellan Air Force Base, Optech reportedly drilled four borings on the ANG facility grounds in December of 1994. The depth to groundwater reported in the Optech borings was approximately 110 feet below ground surface (bgs).

IV. UST Removal

On December 5, 1995 Azteca removed both USTs from the site under permit from the Sacramento County Hazardous Materials Division (Attachment 2 - Copies of UST Removal Permits). Chris Hamilton with the Sacramento County Hazardous Materials division, was the Sacramento County representative responsible for oversight for the tank removals. After they were removed, both tanks were inspected for signs of leakage. Both tanks appeared to be in good condition, with no holes or other obvious signs of failure observed. Only a minimal amount of piping was removed along with the tanks, since the fuel dispensers were co-located with the tanks. In addition to the two USTs, a 375 gallon oil/water separator was removed from the project site. No information was available regarding the history of the oil/water separator.

When tank No. 107, the diesel tank, was removed, some staining was observed at the south end of the excavation in the area of the fill port and dispenser line. No obvious evidence of contamination was observed when the gasoline tank, tank No. 108 was removed. Soil from the removal of the USTs was stockpiled in on and totally enclosed in visqueen. The soil under the tanks and the spoils stockpile from the tank excavation were sampled as per Sacramento County and Regional Water Quality Control Board standards. When the samples were analyzed, contamination by gasoline, diesel, toluene, ethylbenzene, and xylene were discovered. No ground water was observed in the UST excavations. Since the location of the visible staining was under the fill end of the diesel tank, and the tanks appeared sound, the probable source of the contamination was overspill from fueling operations.

After removal, Erickson Environmental, Inc. (Erickson) of Richmond, California transported the tanks under a uniform hazardous waste manifest to their Richmond, California facility. Erickson is a licensed waste treatment facility, where the tanks are cleaned, decommissioned, and the resulting metal sold as scrap. Copies of the the hazardous waste manifest and certificate of destruction are included in Attachment 3

V. Sampling of the UST Excavations and Stockpiled Soils

At the direction of Chris Hamilton, one sample was taken from the soil at each end of each tank. In addition to the four soil samples collected from under the tanks, six composite samples were collected from the spoils stockpiled on site from the UST removals. A total of ten samples were collected and analyzed variously for a combination of total petroleum hydrocarbons as gasoline and diesel (TPHg and TPHd), benzene, toluene, ethylbenzene, and total xylenes (BTEX), and soluble threshold limit concentration lead (STLC Lead). Samples for laboratory analysis were sent to Excelchem Environmental Labs (Cal-DHS Certified Laboratory No. 1760) for analysis.

The results of the sampling are summarized in Table 1 and the laboratory reports are in Attachment 4, sample locations are shown in Geocon's report - Figure 2. Moderate level gasoline contamination between 11 and 78 parts per million (ppm) was detected in the bottom of the gasoline UST excavation and in the bottom of the diesel UST excavation adjacent to the gasoline UST excavation. Diesel contamination between 1,100 and 4,400 ppm was detected in the samples from the bottom of both the gasoline and diesel UST excavations. Ethylbenzene, xylenes, and a trace of toluene were detected in the soil samples. No soluble lead or benzene were detected in any of the samples analyzed.

VI. Site Remediation

In order to assess the extent of contamination and determine the most feasible remedial alternative, Geocon Environmental Consultants of Sacramento, California was contracted to prepare a site investigation. The site investigation was performed on April 11 and 12, 1996 as per a work plan Geocon submitted to Sacramento County. Geocon's investigation revealed the presence of localized soil contamination in the UST removal areas, extending to a depth of approximately 15 feet. Possible localized low level oil and grease contamination was found in the area of the oil/water separator. Based on the results of the investigation, it was determined that the best approach to remediation of the UST area was to over-excavate the site, and dispose of the contamination off site at a licensed remediation facility. Geocon recommended against further investigation or remediation in the area of the oil/water separator.

After the tanks were removed, but before remediation could take place, rain water accumulated in the UST excavation. The rain water was sampled and found to be non-detect (ND) for contaminants of concern on the project site. Since the water in the excavation was not contaminated, it was allowed to dissipate naturally.

On April 29 and 30, and May 1, 1996, Azteca over-excavated 483.63 tons of soil from the site. The excavation was monitored with an organic vapor meter/photo ionization detector (OVM/PID), by placing a sample of the excavated soil in a Ziplock bag for several minutes, and sampling the headspace. Excavation continued until the PID was unable to detect contamination, at which time, excavation was halted and a sample collected for laboratory analysis. If laboratory analysis revealed the presence of remaining contamination, excavation resumed, and an additional one to two feet of soil was removed. Excavation of the site continued until all laboratory samples were ND for gasoline, diesel, and their constituents. Excavated soil from the remedial excavation was stockpiled on visqueen and covered to exclude moisture and prevent blowing dust. At the conclusion of digging, the excavation measured approximately 25 feet by 40 feet, and averaged 16 feet deep (Figure 1 - Area of Remedial Excavation).

As excavation proceeded, samples were collected and sent to Excelchem Environmental Labs for analysis for TPHg, TPHd, and BTEX on a 24 hour turn-around time. Samples were collected from both the bottom of the excavation and the sidewalls for analysis. The results of the analysis of the remedial samples are summarized in Table 2, and the laboratory reports are presented in Attachment 5. Sample locations are shown in Figure 1.

A total of 483.63 tons of soil were excavated from the ANG site during the remedial activities. The soil was transported in 25 loads over a three day period to Murieta Soil Technologies, L.L.C. (MST), as a non-hazardous waste (Attachment 6 - Non-hazardous Waste Manifests for the Soil Transported to MST). MST remediated the soil using their bioremediation process to remove all detectable contamination, as attested to by the Certificates of Release of Liability and Certificate of Contamination Destruction, issued for the soil by MST (Attachment 7).

VII. Conclusions/Recommendations

During the remedial excavation, all known contamination in the area of the former USTs was removed. Given the shallow depth of known contamination (16 feet) verses the reported depth to groundwater (110 feet), it is unlikely that the contamination from the oil/water separator and USTs removed on the ANG site have effected ground water. Possible low level contamination by heavy hydrocarbons may still be present in the area of the former oil/water. However, heavy hydrocarbons generally have a low mobility and low toxicity, therefore since groundwater is relatively deep, the contamination poses a low risk to human health and welfare or the environment. No further investigation of, or remedial work on the areas of the former USTs and oil/water separator are recommended at this time.

TABLE 1
LABORATORY DATA FROM UST REMOVAL

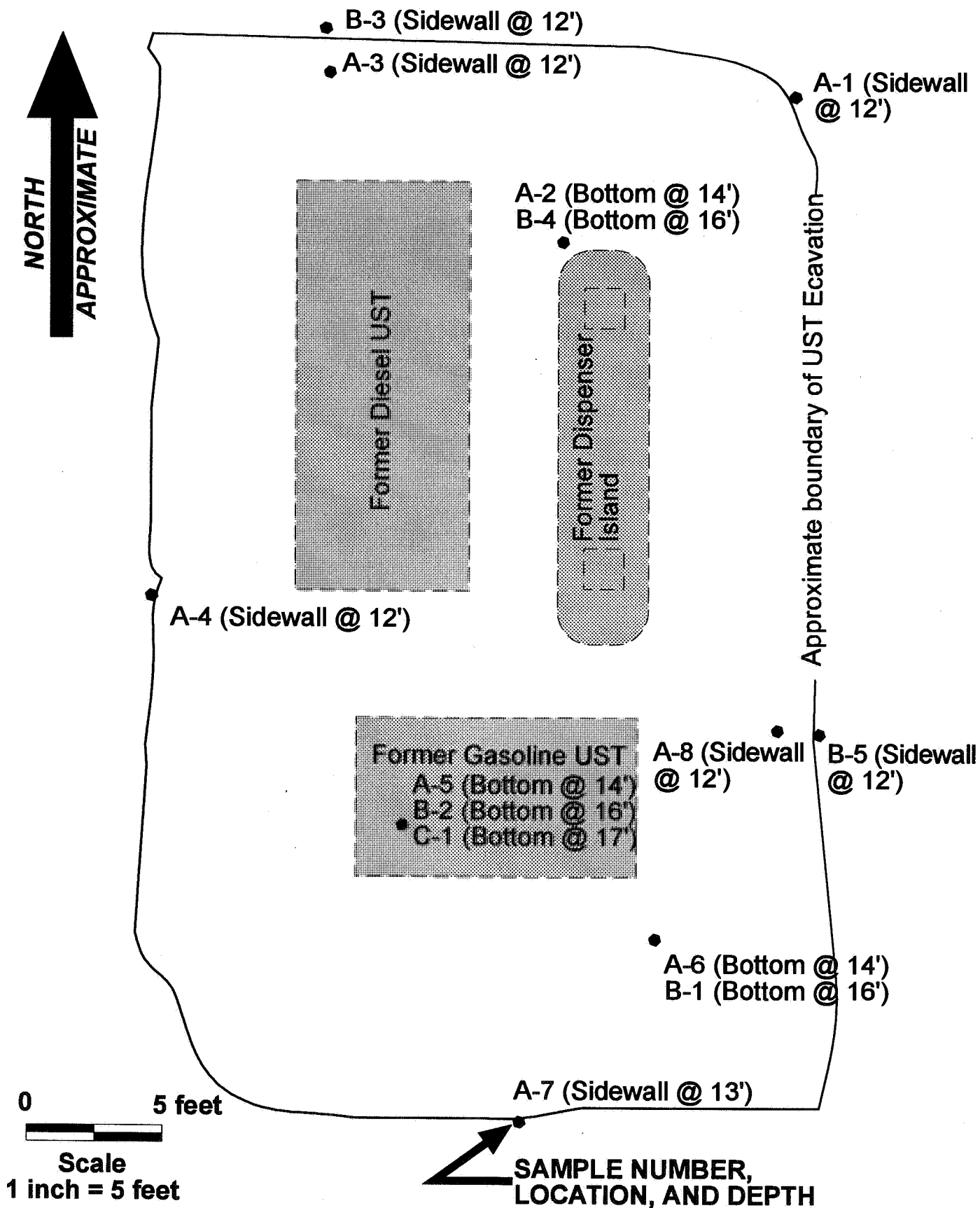
| Sample No. | Location | TPHg PPM | TPHd PPM | Benzene PPM | Toluene PPM | Ethylbenzene PPM | Xylenes PPM | STLC Lead PPM |
|---------------|-----------------------------------|-------------|-------------|----------------|----------------|---------------------|----------------|------------------|
| 107N | North end of diesel tank. | NT | 4,400 | ND | ND | 0.03 | 0.18 | NT |
| 107S | South (fill) end of diesel tank. | 78 | 3,100 | ND | ND | 0.16 | 0.42 | NT |
| 108E | East end of gasoline tank. | 44 | 2,600 | ND | 0.15 | 0.18 | 1.5 | ND |
| 108W | West (fill) end of gasoline tank. | 11 | 1,100 | ND | ND | 0.24 | 0.15 | ND |
| 1 Com A,B,C,D | | ND | 260 | ND | ND | ND | 0.005 | ND |
| 2 Com A,B,C,D | | ND | 220 | ND | ND | ND | 0.008 | ND |
| 3 Com A,B,C,D | | NT | 270 | ND | ND | 0.007 | 0.082 | NT |
| 4 Com A,B,C,D | | NT | 110 | ND | ND | 0.006 | 0.022 | NT |
| 5 Com A,B,C,D | | NT | 300 | ND | ND | ND | 0.034 | NT |
| 6 Com A,B,C,D | | NT | 1,900 | ND | ND | 0.02 | 0.19 | NT |

TABLE 2
LABORATORY DATA FROM REMEDIAL EXCAVATION

| Sample No. | Location | Depth feet | TPHg PPM | TPHd PPM | Benzene PPM | Toluene PPM | Ethylbenzene PPM | Xylenes PPM |
|------------|-------------------------------------|---------------|-------------|-------------|----------------|----------------|---------------------|----------------|
| NE A-1 | Northeast corner, sidewall | 12 | ND | ND | ND | ND | ND | ND |
| NEB A-2 | Northeast corner, excavation bottom | 14 | ND | 79.2 | ND | ND | ND | 0.006 |
| NW A-3 | Northwest corner, sidewall | 12 | 64.3 | 6940 | ND | ND | 0.01 | 0.086 |
| W A-4 | West side, sidewall | 12 | ND | ND | ND | ND | ND | ND |
| WB A-5 | Western corner, excavation bottom | 14 | 1.67 | 121 | ND | ND | ND | ND |
| SWB A-6 | Southwest corner, excavation bottom | 14 | ND | 21.9 | ND | ND | ND | ND |
| SB A-7 | South side, sidewall | 13 | ND | ND | ND | ND | ND | ND |
| SEB A-8 | southeast side, sidewall | 12 | ND | 91.6 | ND | ND | ND | ND |
| B1 | Southwest corner, excavation bottom | 16 | ND | ND | ND | ND | ND | ND |
| B2 | Western corner, excavation bottom | 15 | ND | 106 | ND | ND | ND | ND |
| B3 | Northwest corner, sidewall | 12 | ND | ND | ND | ND | ND | ND |
| B4 | Northeast corner, excavation bottom | 16 | ND | ND | ND | ND | ND | ND |
| B5 | southeast side, sidewall | 12 | ND | ND | ND | ND | ND | ND |
| C1 | Western corner, excavation bottom | 17 | ND | ND | ND | ND | ND | ND |

ND - Not detected at or above reporting limit.

NT - Sample not tested for this compound.



**AREA OF REMEDIAL EXCAVATION
NORTH HIGHLANDS AIR NATIONAL GUARD FACILITY
3900 ROSEVILLE ROAD, NORTH HIGHLANDS< CA**

Attachment 1

Geocon Environmental Consultants Site Investigation Report

SOIL INVESTIGATION REPORT
FOR
AIR NATIONAL GUARD FACILITY
3900 ROSEVILLE ROAD
NORTH HIGHLANDS, CALIFORNIA

PREPARED FOR
AZTECA CONSTRUCTION
SACRAMENTO, CALIFORNIA

PREPARED BY
GEOCON ENVIRONMENTAL CONSULTANTS
SACRAMENTO, CALIFORNIA

PROJECT NO. S8119-06-01

MAY 1996

GEOCON

Environmental Consultants Inc.

GEOTECHNICAL ENGINEERING AND ENVIRONMENTAL SCIENCES

Project No. S8119-06-01
May 3, 1996

Azteca Construction
3871 Security Park Drive
Rancho Cordova, California 95742-6920

Attention: Ms. Kelly Gregory

Subject: AIR NATIONAL GUARD - NORTH HIGHLANDS FACILITY
NORTH HIGHLANDS, CALIFORNIA
SITE INVESTIGATION REPORT

Dear Ms. Gregory:

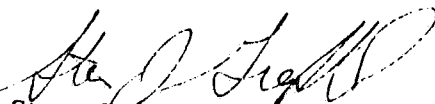
In accordance with your request, Geocon Environmental Consultants has performed environmental engineering services at the Air National Guard facility located at 3900 Roseville Road, in North Highlands, California.

Enclosed is the Site Investigation Report for the subject site which summarizes the results of the soil investigation performed on April 11 and 12, 1996.

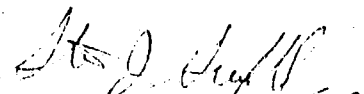
If there are any questions concerning the contents of this report, or if we may be of further service, please contact the undersigned at your convenience.

Very Truly Yours,

GEOCON ENVIRONMENTAL CONSULTANTS


Steven J. Greenfield, PE
Project Manager




Robert LoRusso
Staff Engineer

SJG/RL:ds

- (3) Addressee
- (1) Sacramento County Environmental Management Department
Attention: Mr. Cris Hamilton

3235 Sunrise Blvd., Suite 6
Rancho Cordova, CA 95742
(916) 852-9118
Fax (916) 852-9132

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SITE INVESTIGATION REPORT

1.0 INTRODUCTION

The purpose of the subsurface investigation was to provide additional information regarding the vertical and lateral extent of potential petroleum hydrocarbon soil impacts within the site boundaries. The site investigation work completed by Geocon was performed in general accordance with the Site Investigation Workplan, dated April 5, 1996.

1.1 Project Location and Site Description

The site is located adjacent to and west of Building 4 within the southern portion of the Air National Guard facility located at 3900 Roseville Road in North Highlands, California. Two fuel underground storage tanks (USTs) were formerly located northwest of Building 4. The USTs consisted of a 2,000 gallon gasoline tank and a 3,000 gallon diesel tank. In addition, a 375 gallon oil/water separator was located southwest of Building 4. A six foot high chainlink fence separates the southern site boundary from Interstate 80. The ground surface is covered with asphalt concrete in the vicinity of the USTs and with concrete in the vicinity of the oil/water separator. The excavations created during the tank removals were open during the subsurface investigation conducted on April 11 and 12, 1996. The USTs excavations extend approximately 11 feet below the ground surface (bgs) and the oil/water separator excavation is approximately 7 feet deep. Temporary fencing surrounds both open excavations. The approximate location of the site is depicted on the attached Vicinity Map, Figure 1. The existing site layout is depicted on the attached Site Plan, Figure 2.

1.2 Description of UST Removal and Sampling Activities

Azteca Construction removed the fuel USTs and the oil/water separator on December 5, 1995. Analytical results of soil samples obtained from beneath the USTs indicate that petroleum hydrocarbon soil impacts remain at the site. Total petroleum hydrocarbons as diesel fuel (TPHd) were reported to range from 16 to 4,400 parts per million (ppm) and total petroleum hydrocarbons as gasoline (TPHg) were reported to range from 11 to 78 ppm. In addition, two soil samples were obtained from the oil/water separator excavation and analyzed for total oil and grease (O&G) and TPHd. Oil and grease concentrations were reported to range from 210 to 320 ppm and TPHd concentrations were reported to be 9.9 and 16 ppm.

2.0 SCOPE OF SERVICES

Outlined below is a summary of the scope of services performed by Geocon in general conformance with the referenced Workplan.

- Prepared the referenced Workplan dated April 5, 1996, which describes the scope of services and quality assurance/quality control sampling and laboratory procedures.
- Prepared a Health and Safety Plan dated April 5, 1996 to provide guidelines on the use of personal protective equipment (PPE) during the field activities. The Health and Safety Plan also provided guidelines on the use of onsite monitoring equipment and action levels for upgrades to higher PPE.
- Contacted the local utility companies via Underground Service Alert (Reference No. 80438) to attempt to delineate any known buried utilities in the vicinity of proposed subsurface investigation locations.
- Advanced five soil borings, ranging in depths from approximately 26 to 41 feet bgs. Three of the borings were excavated in the vicinity of the UST excavation. One of these borings was drilled at an angle and advanced beneath the excavation. The remaining two borings were excavated in the vicinity of the oil/water separator excavation.
- Collected relatively undisturbed soil samples at approximate 5-foot intervals to the maximum depth explored utilizing a modified "California" sampler equipped with 6-inch-long brass sample tubes to facilitate sample handling and storage. Following sample collection, the tubes were capped, labeled, chilled, and transported to a California-certified environmental laboratory utilizing standard chain-of-custody procedures.
- Performed headspace surveys on the soil samples collected using a portable organic vapor analyzer (OVA), equipped with a photo ionization detector (PID) or flame ionization detector (FID). The headspace readings are recorded on the boring logs presented in Appendix A.
- Provided quality control/quality assurance (QA/QC) procedures during the field activities. These procedures included cleansing/rinsing of the sampling equipment prior to each sampling effort, cleansing/rinsing of the drill rig augers prior to and between borings, and providing chain-of-custody documentation for each sample collected and transferred to the laboratory for analytical testing.
- Backfilled the borings with bentonite-cement grout in accordance with the requirements of the Sacramento County Hazardous Materials Division.
- Submitted selected soil samples from each boring for analysis by a California-certified analytical testing laboratory.

Preliminary Assessment Questions for North Highlands ANG, CA
April 2012

Questions posed by Native Energy (Debbie Zapalac)

Responses provided by California Air National Guard (CANG) Chief Master Sargent Warner Ratcliff

1. Any changes to the Areas of Concern (AOCs) since 2009 (i.e., equipment or mission changes, leaks, spills)?

CANG Answer: There have been no changes.

2. Any spills elsewhere at the Station since 2009? If so, can details be provided?

CANG Answer: No, we have not had any spills.

3. Any documentation available regarding removal of hydraulic lift in Vehicle Maintenance Bay? Any as-built drawings showing details of vehicle lift? Please provide.

CANG Answer: Yes, we have documentation from the project.

4. In the February 2009 PA/SI Trip Report, there was a picture showing the Former Vehicle Wash Rack adjacent to Building 4. Also, in an interview form (Fonda Wicker) in the 2005 EBS, it was stated that the "Building 4 wash rack drain plugged. OWS believed to have been pulled during remediation." Was there remediation conducted and if so, can details be provided? Did the wash rack drain to the OWS that was removed in 1995? Any as-built drawings showing details of washrack and OWS that can be provided?

CANG Answer: Yes it did. Any information we have is in the UST removal closure report provided.

5. Are there any closure reports or documentation available on the USTs removed in December 1995 that can be provided?

CANG Answer: Yes we will provide the closer report and other related documents.

6. Is the OWS at Bldg. 9 still the only OWS on site?

CANG Answer: Yes

3.0 INVESTIGATIVE METHODS

3.1 Drilling and Soil Sample Collection

Five soil borings (B-1 through B-5) were advanced utilizing a CME 75 truck-mounted drill rig equipped with 8-inch diameter hollow stem augers at the approximate locations depicted on the Site Plan, Figure 2. The borings were advanced to depths ranging between approximately 26 and 41 feet bgs. Drill cuttings were stockpiled on visqueen pending receipt of laboratory analysis and subsequent disposal following regulatory protocols.

Boring B-1 was drilled at a 30 degree angle from vertical to facilitate sample collection beneath the former diesel UST excavation. The angle boring was placed such that the drilling auger passed beneath the southern sidewall at an elevation of approximately one foot below the base of the excavation. The angle boring was terminated once the augers reached the projection of the northern sidewall at a vertical depth of 33 feet bgs. The horizontal projection of the angle boring is depicted as a dashed line on the Site Plan, Figure 2 and a cross section of the excavation and angle boring is depicted on Figure 3.

Soil samples were collected from the borings at approximate five-foot vertical intervals utilizing a two-inch diameter split spoon sampler equipped with a six-inch-long by two-inch diameter brass sample tubes to facilitate sample handling and storage. The borings were logged under the supervision of a California registered engineer utilizing the Unified Soil Classification System. Copies of the boring logs are included in Appendix A. The sample tubes were capped, labeled and chilled pending transport to an analytical laboratory. The soil samples were field screened with a photo-ionization detector or a flame ionization detector to assess possible qualitative indicators of volatile organic compounds. The results of the field screening are presented on the boring logs.

Quality assurance/quality control procedures were provided during the field exploration activities. These procedures included cleansing/rinsing of the sampling equipment and steam cleaning augers prior to and between borings. Cleansing/rinsing of the sampling equipment was performed prior to the collection of each soil sample by washing the equipment with a trisodium phosphate solution followed by subsequent tap water and deionized water rinses. Soil samples were delivered to a California certified analytical laboratory following standard chain-of-custody procedures.

3.2 Analytical Methods

Selected soil samples were analyzed for the presence of TPHlg, TPHld, and total petroleum hydrocarbons as motor oil, (TPHmo) following EPA Test Method 8015 modified, and benzene, toluene, ethylbenzene, and total xylenes (BTEX) following EPA Test Method 8020. In addition,

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May 3, 1996

selected soil samples obtained from the two borings excavated in the vicinity of the oil/water separator were analyzed for concentrations of O&G in accordance with Standard Method 5520F.

4.0 INVESTIGATIVE FINDINGS

4.1 Site Geology

Alluvial soils of the Riverbank Formation were encountered beneath the asphalt concrete to the maximum depth of exploration, 41.5 feet. The alluvial soils encountered generally consist of dense, clayey and silty sand interbedded with very stiff to hard clays and silts. Isolated lenses of poorly graded sands were also noted during the subsurface investigation.

4.2 Site Hydrogeology

Groundwater was not encountered during the subject subsurface investigation. Optech previously excavated four borings within the Air National Guard Facility during a subsurface investigation performed for McClellan Air Force Base in December 1994. The depth to groundwater was reported to be approximately 110 feet bgs within these borings.

4.3 Soil Sample Analytical Results

A total of 10 selected soil samples collected from the three borings associated with UST excavation (Borings B-1 through B-3), at depths ranging from 11.5 to 32 feet bgs, were tested for the presence of TPHg, TPHd, TPHmo, and BTEX. Concentrations of these compounds were not detected within any of these analyzed samples. However, soil cuttings generated from Boring B-1 at an approximate depth of 13 to 15 feet bgs were noted to have a mild to distinct petroleum hydrocarbon odor. The odor was also noted as the augers were advanced to a depth of approximately 19 to 23 feet bgs; however, the precise depth of the origin of the cutting is not known. Samples obtained from discrete depths of 11.5, 15, and 19 feet bgs did not contain detectable concentrations of petroleum hydrocarbons.

Five selected soil samples collected from the two borings associated with the oil/water separator excavation (Borings B-4 and B-5), at depths ranging from 10 to 40 feet bgs, were analyzed for concentrations of TPHg, TPHd, TPHmo, and BTEX. Concentrations above the detection limits were not reported for any of the samples. In addition, six of the samples collected from Borings B-4 and B-5 were analyzed for concentrations of O&G. The results of the laboratory analyses indicate O&G concentrations ranging from 6 to 24 mg/kg.

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May 3, 1996

5.0 DATA EVALUATION AND DISCUSSION

5.1 Former Underground Storage Tank Excavation

Analytical data obtained during the subsurface investigation indicates that an extensive petroleum hydrocarbon plume does not remain at the site. However, based on field observations petroleum hydrocarbon impacted soil does remain beneath the western side of the excavation at an approximate depth on the order of 13 to 15 feet bgs.

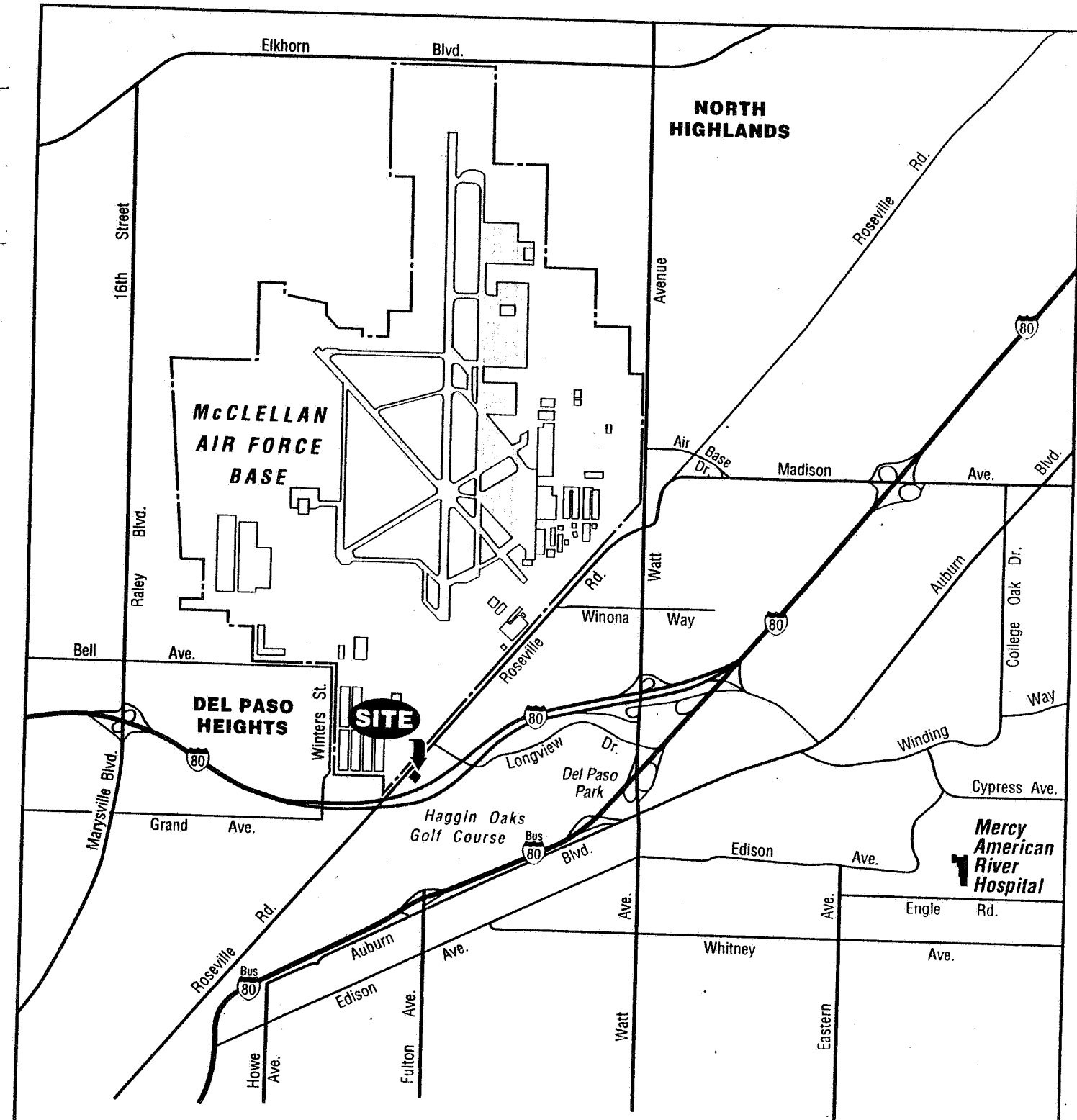
5.2 Oil/Water Separator Excavation

The results of the subsurface investigation in the vicinity of the oil/water separator indicate that low concentrations of oil and grease exist within the soil. The reported concentrations range from 6 to 24 mg/kg. Although the test methodology is structured to detect only oil and grease associated with petroleum hydrocarbons, it is common to detect naturally occurring oils and greases at low concentrations. This is further substantiated by the lack of detection of petroleum hydrocarbons within the heavier carbon ranges associated with the TPHd and TPHmo analyses. In addition, the detected oil and grease concentrations are in the heavy petroleum hydrocarbon range, which typically have a low mobility and toxicity.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on Geocon's review of the soil data acquired during the subsurface investigation, conclusions and recommendations regarding petroleum hydrocarbon impacts at the site are presented below.

- The site is underlain by interbedded clayey and silty sand and lenses of silts and clays extending to the maximum depth of exploration of 41 feet bgs. Groundwater was not encountered during the subsurface investigation. Previous subsurface investigations at the site have encountered groundwater at a depth on the order of 100 to 110 feet bgs.
- Detectable concentrations of TPHg, TPHd, TPHmo, and BTEX were not reported for any of the analyzed soil samples. Relatively low levels of O&G, ranging from 6 to 24 mg/kg were reported for the six samples analyzed from the two borings associated with the former oil/water separator excavation. These six samples were obtained at depths ranging from 10 to 40 feet bgs.
- Soil cuttings obtained during the advancement of Boring B-1, located along the west side of the former diesel UST excavation, contained a petroleum hydrocarbon odor. It is estimated that these cuttings were obtained from a depth of approximately 13 to 15 feet bgs. Soil samples analyzed from depths of 11.5, 15, and 19 feet bgs within this boring did not contain detectable petroleum hydrocarbon concentrations.
- Petroleum hydrocarbon impacted soil remains beneath the western side of the former UST excavation, based on distinct odors noted within the cuttings obtained from Boring B-1, and the analytical results of bottom samples obtained during the tank removal.
- It is recommended that the known soil impacts located at the bottom of the existing UST excavation be removed. The excavation may also require widening along the western sidewall. It is anticipated that approximately 2 to 4 feet of additional excavation will be necessary to remove the petroleum hydrocarbon impacts. Confirmation soil samples should be collected in the bottom of the excavation and at the base of each sidewall.
- The detected O&G impacts associated with the oil/water separator excavation are in the heavy petroleum hydrocarbon range, which typically have a low mobility and toxicity. In addition, the absence of TPHd and TPHmo concentrations in these samples indicates that the O&G concentrations may represent naturally occurring non-petroleum based oils and greases. Based on this information and the relatively low concentrations, additional soil investigation or remediation in the vicinity of the oil/water separator excavation do not appear warranted at this time.



0 1/2 1
Scale in Miles

GEOCON

ENVIRONMENTAL CONSULTANTS INCORPORATED
3235 SUNRISE BLVD. - SUITE 6 - RANCHO CORDOVA, CALIFORNIA 95742
PHONE 916 852 9118 - FAX 916 852-9132

Air National Guard

3900 Roseville Road
North Highlands, California

VICINITY MAP

S8119-06-01

May 1996

Figure 1

0 30
Scale in Feet

Building 1

Approximate Location of
Gasoline & Diesel
UST Excavations

B2

107N(4,400)

Edge of
Asphalt

B1

107S
(3,100)

108W
(1,100)

108E
(2,600)

B3

B5

Approximate
Location
of Oil/Water
Separator
Excavation

B4

Building 4

LEGEND:

B1

Approximate Location & Horizontal
Projection of Angle Boring

B2

Approximate Boring Location

107N •
(4,400)

Approximate Location of Soil Sample
Obtained During Tank Removal

Total Petroleum Hydrocarbons as
Diesel in Milligrams Per Kilogram

A A'

Location of Cross Section (See Figure 3)

GEOCON

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3235 SUNRISE BLVD. - SUITE 6 - RANCHO CORDOVA CALIFORNIA 95742
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Air National Guard

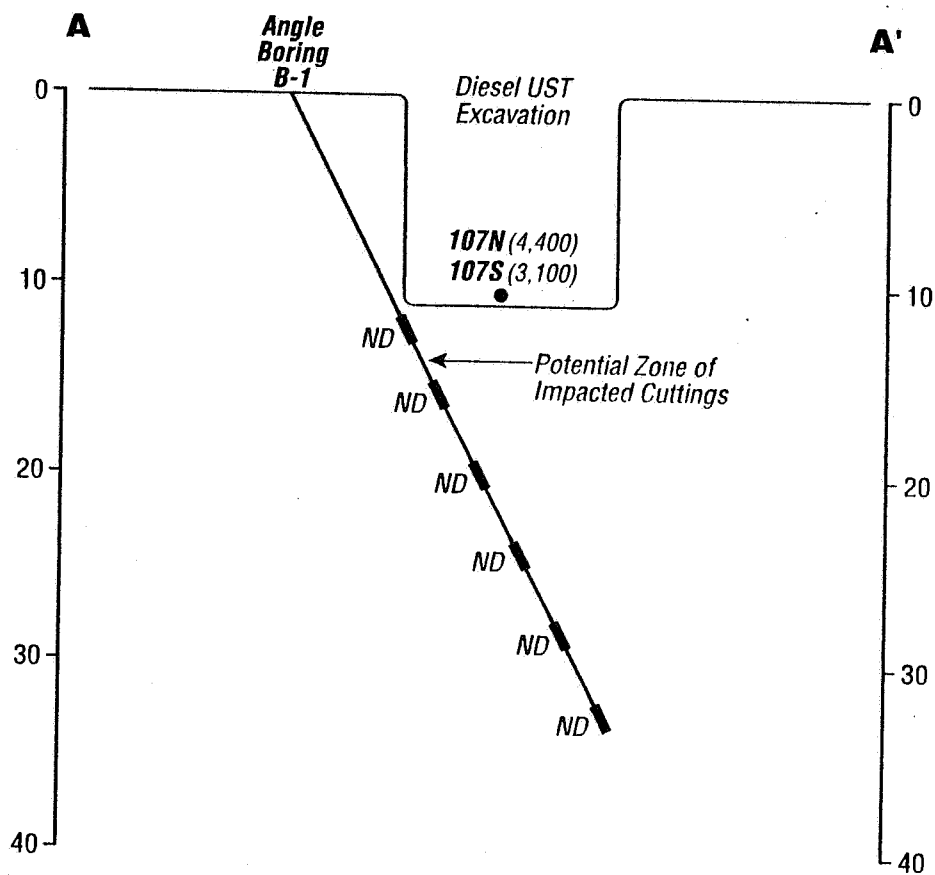
3900 Roseville Road
North Highlands, California

SITE PLAN

S8119-06-01

May 1996

Figure 2



SCALE: 1" = 10'

LEGEND:

- 107N • (4,400)** Approximate Projection of Soil Sample Obtained During Tank Removal
- ND** Below the Laboratory Detection Limits For TPHg, TPHd, TPHmo & BTEX

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PHONE 916 852-9118 - FAX 916 852-9132

Air National Guard

**3900 Roseville Road
North Highlands, California**

CROSS SECTION A - A'

S8119-06-01

May 1996

Figure 3

TABLE I
SUMMARY OF SOIL ANALYTICAL TEST RESULTS
AIR NATIONAL GUARD
NORTH HIGHLANDS, CALIFORNIA

| SAMPLE ID | DATE | TPHg (mg/kg) | TPHd (mg/kg) | TPHmo (mg/kg) | O & G (mg/kg) | BENZENE (ug/kg) | TOLUENE (ug/kg) | ETHYL BENZENE (ug/kg) | TOTAL XYLENES (ug/kg) |
|-----------|---------|-----------------|-----------------|------------------|------------------|--------------------|--------------------|-----------------------------|-----------------------------|
| B1-11.5 | 4/11/96 | <1.0 | <10 | <10 | --- | <5.0 | <5.0 | <5.0 | <5.0 |
| B1-15 | 4/11/96 | <1.0 | <10 | <10 | --- | <5.0 | <5.0 | <5.0 | <5.0 |
| B1-19 | 4/11/96 | <1.0 | <10 | <10 | --- | <5.0 | <5.0 | <5.0 | <5.0 |
| B1-23.5 | 4/11/96 | <1.0 | <10 | <10 | --- | <5.0 | <5.0 | <5.0 | <5.0 |
| B1-27.5 | 4/11/96 | <1.0 | <10 | <10 | --- | <5.0 | <5.0 | <5.0 | <5.0 |
| B1-32 | 4/11/96 | <1.0 | <10 | <10 | --- | <5.0 | <5.0 | <5.0 | <5.0 |
| B2-15 | 4/11/96 | <1.0 | <10 | <10 | --- | <5.0 | <5.0 | <5.0 | <5.0 |
| B2-25 | 4/11/96 | <1.0 | <10 | <10 | --- | <5.0 | <5.0 | <5.0 | <5.0 |
| B3-10 | 4/11/96 | <1.0 | <10 | <10 | --- | <5.0 | <5.0 | <5.0 | <5.0 |
| B3-25 | 4/11/96 | <1.0 | <10 | <10 | --- | <5.0 | <5.0 | <5.0 | <5.0 |
| B4-10 | 4/12/96 | --- | --- | --- | 24 | --- | --- | --- | --- |
| B4-20 | 4/12/96 | <1.0 | <10 | <10 | 11 | <5.0 | <5.0 | <5.0 | <5.0 |
| B4-30 | 4/12/96 | --- | --- | --- | 6 | --- | --- | --- | --- |
| B4-35 | 4/12/96 | <1.0 | <10 | <10 | 7.6 | <5.0 | <5.0 | <5.0 | <5.0 |
| B4-40 | 4/12/96 | <1.0 | <10 | <10 | 6.8 | <5.0 | <5.0 | <5.0 | <5.0 |
| B5-15 | 4/12/96 | <1.0 | <10 | <10 | --- | <5.0 | <5.0 | <5.0 | <5.0 |
| B5-25 | 4/12/96 | <1.0 | <10 | <10 | 14 | <5.0 | <5.0 | <5.0 | <5.0 |

NOTES: TPHg = Total petroleum hydrocarbons as gasoline
 TPHd = Total petroleum hydrocarbons as diesel fuel
 TPHmo = Total petroleum hydrocarbons as motor oil
 O&G = Total oil and grease
 ug/kg = micrograms per kilogram
 mg/kg = milligrams per kilogram
 < = below detection limit for test methods used
 --- = not tested

APPENDIX A

PROJECT NO. S8119-06-01

| DEPTH IN FEET | PENETRAT. RESIST. BLWS/FT. | SAMPLE NO. | LITHOLOGY | BORING/WELL NO. <u> R 1 </u> | | WELL CONSTRUCTION | HEADSPACE (PPH) |
|---------------------|----------------------------------|---------------|-----------|--|---|----------------------|--------------------|
| | | | | DATE DRILLED <u> 4/11/96 </u> | WATER LEVEL (ATD) <u> </u> | | |
| | | | | EQUIPMENT <u> CME 75 </u> DRILLER <u>WEST HAZMAT</u> | | | |
| | | | | SOIL DESCRIPTION | | | |
| 1 | | | | 3 INCHES ASPHALT | | | |
| 2 | | | | RIVERBANK FORMATION | | | |
| 3 | | | | Medium dense, moist, brown, Clayey, fine SAND with silt (SC) | | | |
| 4 | | | | Dense, moist, brown, Clayey SILT (ML) | | | |
| 5 | | | | | | | |
| 6 | | | | | | | |
| 7 | | | | | | | |
| 8 | | | | | | | |
| 9 | | | | | | | |
| 10 | | | | | | | |
| 11 | | | | Stiff, moist, olive brown, Silty CLAY | | | |
| 12 | 128/10' | B1-11.5 | | Dense, moist, reddish-brown, fine to medium SAND with trace silt (SM) | | | 0 |
| 13 | | | | -Cuttings have a mild odor | | | |
| 14 | | | | | | | |
| 15 | | | | | | | |
| 16 | 103 | B1-15 | | Stiff, moist, reddish-brown, Sandy CLAY (CL) | | | 0 |
| 17 | | | | | | | |
| 18 | | | | | | | |
| 19 | | | | | | | |
| 20 | 40 | B1-19 | | Dense, moist, olive-brown, Silty, fine SAND (SM) | | | 0 |
| 21 | | | | -Cuttings - mild odor | | | |
| 22 | | | | | | | |
| 23 | | | | | | | |
| 24 | 88 | B1-23.5 | | Dense, moist, olive-brown, Silty, fine SAND with clay (SM) | | | 0 |
| 25 | | | | -No odor | | | |
| 26 | | | | | | | |
| 27 | | | | | | | |
| 28 | 48 | B1-27.5 | | Dense, moist, olive brown, Silty, fine to medium SAND (SM) | | | |
| 29 | | | | | | | |

Figure A-1, log of Boring B 1

Continued Next Page

ANG

| | |
|----------------------------|---|
| CASING ELEVATION: | QUANTITY OF FILTER MATERIAL: |
| DIAMETER & TYPE OF CASING: | WELL SEAL & INTERVAL: |
| CASING INTERVAL: | WELL SEAL QUANTITY: |
| WELL SCREEN: | ANNULUS SEAL/INTERVAL: |
| SCREEN INTERVAL: | ADDITIVES: |
| WELL COVER: | WELL DEPTH: |
| FILTERPACK/INTERVAL: | ENGINEER/GEOLOGIST: ROBERT LORUSSO |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. S8119-06-01

| DEPTH IN FEET | PENETRAT. RESIST. BLWS/FT. | SAMPLE NO. | LITHOLOGY | BORING/WELL NO. <u>B 1</u> | WELL CONSTRUCTION | HEADSPACE (PPH) |
|---------------------|----------------------------------|---------------|-----------|---|----------------------|--------------------|
| | | | | DATE DRILLED <u>4/11/96</u> WATER LEVEL (ATD) _____ EQUIPMENT <u>CME 75</u> DRILLER <u>WEST HAZMAT</u> | | |
| | | | | SOIL DESCRIPTION | | |
| 31 | 43/9" | B1-32 | | | | |
| 32 | | | | Stiff, damp, light brown, fine Sandy CLAY (CL) | | |
| 33 | | | | | | |
| 34 | | | | BORING TERMINATED AT 33 FEET | | |
| 35 | | | | NOTE: ANGLE BORING DRILLED 30 DEGREES | | |
| 36 | | | | FROM VERTICAL DEPTH MEASURED | | |
| 37 | | | | VERTICALLY | | |
| 38 | | | | | | |
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Figure A-2, log of Boring B 1

ANG

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. S8119-06-01

| DEPTH IN FEET | PENETRAT. RESIST. BLWS/FT. | SAMPLE NO. | LITHOLOGY | BORING/WELL NO. <u>B 2</u> | WELL CONSTRUCTION | HEADSPACE (PPH) |
|---------------------|----------------------------------|---------------|-----------|---|----------------------|--------------------|
| | | | | DATE DRILLED <u>4/11/98</u> WATER LEVEL (ATD) _____ EQUIPMENT <u>CME 75</u> DRILLER <u>WEST HAZMAT</u> | | |
| | | | | SOIL DESCRIPTION | | |
| 1 | | | | 3 INCHES ASPHALT | | |
| 2 | | | | AGGREGATE BASE | | |
| 3 | | | | Loose Silty GRAVEL (GM) | | |
| 4 | | | | RIVERBANK FORMATION | | |
| 5 | | | | Very dense, damp, reddish brown, Clayey SILT with fine SAND (ML) | | |
| 6 | | | | -Hand auger to 2.5 feet | | |
| 7 | | | | Medium stiff, damp, reddish-brown, Silty CLAY (CL) | | |
| 8 | | | | | | |
| 9 | | | | | | |
| 10 | 74 | B2-10 | | | | |
| 11 | | | | Hard, damp, light brown, fine Sandy CLAY (CL) | | |
| 12 | | | | | | |
| 13 | | | | Dense, damp, brown, Silty, fine to medium SAND (SM) | | |
| 14 | | | | | | |
| 15 | 77 | B2-15 | | | | |
| 16 | | | | Very dense, damp, reddish-brown, Silty, fine to medium SAND (SM) | | |
| 17 | | | | | | |
| 18 | | | | | | |
| 19 | | | | Stiff, moist, olive brown, CLAY with silt (CL) | | |
| 20 | 82 | B2-20 | | | | |
| 21 | | | | Very dense, damp, olive brown, fine to medium SAND with silt (SM) | | |
| 22 | | | | Very dense, damp, light-brown, fine to medium SAND, low cohesion (SM) | | |
| 23 | | | | | | |
| 24 | | | | | | |
| 25 | 57 | B2-25 | | | | |
| 26 | | | | Very stiff, moist, olive-brown with red streaks, Silty CLAY (CL) | | |
| 27 | | | | | | |
| 28 | | | | BORING TERMINATED AT 26.5 FEET | | |
| 29 | | | | | | |

Figure A-3, log of Boring B 2

ANG

| | |
|----------------------------|---|
| CASING ELEVATION: | QUANTITY OF FILTER MATERIAL: |
| DIAMETER & TYPE OF CASING: | WELL SEAL & INTERVAL: |
| CASING INTERVAL: | WELL SEAL QUANTITY: |
| WELL SCREEN: | ANNULUS SEAL/INTERVAL: |
| SCREEN INTERVAL: | ADDITIVES: |
| WELL COVER: | WELL DEPTH: |
| FILTERPACK/INTERVAL: | ENGINEER/GEOLOGIST: ROBERT LORUSSO |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. S8119-06-01

| DEPTH IN FEET | PENETRAT. RESIST. BLUS/FT. | SAMPLE NO. | LITHOLOGY | BORING/WELL NO. <u>B 3</u> | | WELL CONSTRUCTION | HEADSPACE (PPH) |
|---------------------|----------------------------------|---------------|-----------|--|----------------------------|----------------------|--------------------|
| | | | | DATE DRILLED <u>4/11/96</u> | WATER LEVEL (ATD) _____ | | |
| | | | | EQUIPMENT <u>CME 75</u> | DRILLER <u>WEST HAZMAT</u> | | |
| | | | | SOIL DESCRIPTION | | | |
| 1 | | | | 3 INCHES ASPHALT | | | |
| 2 | | | | AGGREGATE BASE | | | |
| 3 | | | | GRAVEL with silty sand (GM) | | | |
| 4 | | | | RIVERBANK FORMATION | | | |
| 5 | | | | Medium dense, damp, red-brown, fine to coarse Silty | | | |
| 6 | | | | SAND with gravel (SM) | | | |
| 7 | | | | Medium dense, damp, dark brown, SILT with fine | | | |
| 8 | | | | sand (ML) | | | |
| 9 | | | | Medium dense, damp, red-brown, Silty, fine SAND | | | |
| 10 | 55 | B3-10 | | (SM) | | | |
| 11 | | | | Stiff, moist, light olive-brown, CLAY with fine sand | | | |
| 12 | | | | (CL) | | | |
| 13 | | | | Very dense, moist, reddish brown, Silty, fine to | | | |
| 14 | | | | medium SAND with trace clay (SM) | | | |
| 15 | | | | Dense, moist, reddish-brown, Silty, fine to medium | | | |
| 16 | 60 | B3-15 | | SAND with gravel (SM) | | | |
| 17 | | | | Very dense, moist, orange-red, Silty, fine to medium | | | |
| 18 | | | | SAND (SM) | | | |
| 19 | | | | Very dense, moist, dark brown, Silty, fine to medium | | | |
| 20 | | | | SAND (SM) | | | |
| 21 | 56 | B3-20 | | Stiff, moist, olive-brown, CLAY (CL) | | | |
| 22 | | | | Very dense, moist, light brown, fine to medium SAND | | | |
| 23 | | | | (SP) | | | |
| 24 | | | | Very dense, moist, olive-brown, Silty, fine SAND | | | |
| 25 | | | | (SM) | | | |
| 26 | 37 | B3-25 | | Hard, moist, red-orange, Silty CLAY (CL) | | | |
| 27 | | | | Hard, moist, light gray CLAY (CL) | | | |
| 28 | | | | BORING TERMINATED AT 26.5 FEET | | | |
| 29 | | | | | | | |

Figure A-4, log of Boring B 3

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|----------------------------|---|
| CASING ELEVATION: | QUANTITY OF FILTER MATERIAL: |
| DIAMETER & TYPE OF CASING: | WELL SEAL & INTERVAL: |
| CASING INTERVAL: | WELL SEAL QUANTITY: |
| WELL SCREEN: | ANNULUS SEAL/INTERVAL: |
| SCREEN INTERVAL: | ADDITIVES: |
| WELL COVER: | WELL DEPTH: |
| FILTERPACK/INTERVAL: | ENGINEER/GEOLOGIST: ROBERT LORUSSO |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. S8119-06-01

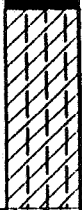






| PROJECT NO. 88-17-06-01 | | | | BORING/WELL NO. <u>B 4</u> | | WELL CONSTRUCTION | HEADSPACE (PPH) |
|-------------------------|----------------------------------|---------------|---|---|-------------------------|----------------------|--------------------|
| DEPTH IN FEET | PENETRAT. RESIST. BLWS/FT. | SAMPLE NO. | LITHOLOGY | DATE DRILLED <u>4/12/96</u> | WATER LEVEL (ATD) _____ | | |
| | | | | EQUIPMENT <u>CME 75</u> DRILLER <u>WEST HAZMAT</u> | | | |
| | | | | SOIL DESCRIPTION | | | |
| 1 | | |  | 3 INCHES ASPHALT | | | |
| 2 | | | | RIVERBANK FORMATION | | | |
| 3 | | | | Firm, moist, dark brown, Silty CLAY (CL) | | | |
| 4 | | | | -Slight odor in cuttings | | | |
| 5 | 75/9" | B4-5 |  | Very dense, moist, red orange, Silty SAND (SM) | | | 20 |
| 6 | | | | | | | |
| 7 | | | | | | | |
| 8 | | | | | | | |
| 9 | | |  | Very dense, moist, light gray, Clayey SILT with sand (ML) | | | 15 |
| 10 | 90/9" | B4-10 | | | | | |
| 11 | | | | | | | |
| 12 | | | | | | | |
| 13 | | |  | Very dense, moist, red orange, Silty, fine to medium SAND (SM) | | | 16 |
| 14 | | | | | | | |
| 15 | 62 | B4-15 | | | | | |
| 16 | | | | | | | |
| 17 | | |  | Hard, moist, olive-brown, Silty CLAY with fine sand (CL) | | | 40 |
| 18 | | | | | | | |
| 19 | | | | | | | |
| 20 | 50 | B4-20 | | | | | |
| 21 | | |  | Dense, moist, red olive brown, Silty, fine to medium SAND (SM) | | | |
| 22 | | | | | | | |
| 23 | | | | | | | |
| 24 | | | | | | | |
| 25 | 59 | B4-25 |  | Very dense, moist, light gray with red orange streaks, fine Sandy SILT (ML) | | | 15 |
| 26 | | | | | | | |
| 27 | | | | | | | |
| 28 | | | | | | | |
| 29 | | | | | | | |

Figure A-5, log of Boring B 4

Continued Next Page

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| | |
|----------------------------|---|
| CASING ELEVATION: | QUANTITY OF FILTER MATERIAL: |
| DIAMETER & TYPE OF CASING: | WELL SEAL & INTERVAL: |
| CASING INTERVAL: | WELL SEAL QUANTITY: |
| WELL SCREEN: | ANNULUS SEAL/INTERVAL: |
| SCREEN INTERVAL: | ADDITIVES: |
| WELL COVER: | WELL DEPTH: |
| FILTERPACK/INTERVAL: | ENGINEER/GEOLOGIST: ROBERT LORUSSO |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. S8119-06-01

| DEPTH IN FEET | PENETRAT. RESIST. BLMS/FT. | SAMPLE NO. | LITHOLOGY | BORING/WELL NO. <u>B 4</u> | | WELL CONSTRUCTION | HEADSPACE (PPH) |
|---------------------|----------------------------------|---------------|-----------|---|----------------------------|----------------------|--------------------|
| | | | | DATE DRILLED <u>4/12/96</u> | WATER LEVEL (ATD) _____ | | |
| | | | | EQUIPMENT _____ | CME 75 DRILLER WEST HAZMAT | | |
| | | | | SOIL DESCRIPTION | | | |
| 31 | 24 | B4-30 | | Dense, moist, red-brown, fine to medium SAND with silt (SM) | | | 18 |
| 32 | | | | | | | |
| 33 | | | | | | | |
| 34 | | | | | | | |
| 35 | 68 | B4-35 | | Dense, moist, red-orange, fine to medium Sandy SILT (ML) | | | 30 |
| 36 | | | | | | | |
| 37 | | | | | | | |
| 38 | | | | | | | |
| 39 | | | | Stiff, moist, olive-brown CLAY (CL) | | | |
| 40 | 48 | B4-40 | | Medium dense, moist, gray and brown, fine to medium SAND (SP) | | | 0 |
| 41 | | | | BORING TERMINATED AT 41.5 FEET | | | |
| 42 | | | | | | | |
| 43 | | | | | | | |
| 44 | | | | | | | |
| 45 | | | | | | | |
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Figure A-6, log of Boring B 4

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NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. S8119-06-01

| DEPTH IN FEET | PENETRAT. RESIST. BLWS/FT. | SAMPLE NO. | LITHOLOGY | BORING/WELL NO. <u>B 5</u> | | WELL CONSTRUCTION | HEADSPACE (PPH) |
|---------------------|----------------------------------|---------------|-----------|--|-----------------------------------|----------------------|--------------------|
| | | | | DATE DRILLED <u>4/12/98</u> | WATER LEVEL (ATD) _____ | | |
| | | | | EQUIPMENT _____ | CME 75 DRILLER <u>WEST HAZMAT</u> | | |
| | | | | SOIL DESCRIPTION | | | |
| 1 | | | | 3 INCHES ASPHALT | | | |
| 2 | | | | AGGREGATE BASE | | | |
| 3 | | | | Loose, moist, dark brown, Sandy GRAVEL with silt (GM) | | | |
| 4 | | | | RIVERBANK FORMATION | | | |
| 5 | 80/10" | B5-5 | | Very dense, moist, red-brown, Clayey SAND (SC) | | | 0 |
| 6 | | | | | | | |
| 7 | | | | | | | |
| 8 | | | | Hard, moist, olive brown, CLAY with silt (CL) | | | |
| 9 | | | | | | | |
| 10 | 90/9" | B5-10 | | Very dense, moist, olive brown, Clayey SILT (ML) | | | 0 |
| 11 | | | | | | | |
| 12 | | | | | | | |
| 13 | | | | | | | |
| 14 | | | | | | | |
| 15 | 93 | B5-15 | | Very dense, damp, reddish-brown, Clayey SILT (ML) | | | 0 |
| 16 | | | | | | | |
| 17 | | | | | | | |
| 18 | | | | Very stiff, moist, olive-brown, CLAY (CL) | | | |
| 19 | | | | | | | |
| 20 | 48 | B5-20 | | Dense, moist, light brown, Silty, fine SAND (SM) | | | 0 |
| 21 | | | | | | | |
| 22 | | | | | | | |
| 23 | | | | Very stiff, moist, olive-brown, Silty CLAY with fine sand (CL) | | | |
| 24 | | | | | | | |
| 25 | 60 | B5-25 | | Very dense, red-orange, fine Sandy SILT (ML) | | | |
| 26 | | | | | | | |
| 27 | | | | BORING TERMINATED AT 26.5 FEET | | | |
| 28 | | | | | | | |
| 29 | | | | | | | |

Figure A-7, log of Boring B 5

ANG

| | |
|----------------------------|---|
| CASING ELEVATION: | QUANTITY OF FILTER MATERIAL: |
| DIAMETER & TYPE OF CASING: | WELL SEAL & INTERVAL: |
| CASING INTERVAL: | WELL SEAL QUANTITY: |
| WELL SCREEN: | ANNULUS SEAL/INTERVAL: |
| SCREEN INTERVAL: | ADDITIVES: |
| WELL COVER: | WELL DEPTH: |
| FILTERPACK/INTERVAL: | ENGINEER/GEOLOGIST: ROBERT LORUSSO |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

APPENDIX B

April 19, 1996

ELAP No.: 1838

Geocon Environmental
3235 Sunrise Blvd. #6
Rancho Cordova, CA 95742

ATTN: Mr. Steve Greenfield

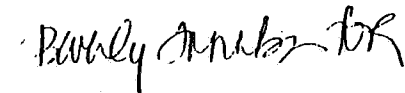
Client's Project: Air National Guard, S8119-06-01
Lab No.: 10842-001/027

Gentlemen:

Enclosed are the results for sample(s) received by Advanced Technology Laboratories and tested for the parameters indicated in the enclosed chain of custody.

Thank you for the opportunity to service the needs of your company. Please feel free to call me at (310) 989 - 4045 if I can be of further assistance to your company.

Sincerely,



Edgar P. Caballero
Laboratory Director
EPC/ms

Enclosures

This cover letter is an integral part of this analytical report.

This report pertains only to the samples investigated and does not necessarily apply to other apparently identical or similar materials. This report is submitted for the exclusive use of the client to whom it is addressed. Any reproduction of this report or use of this Laboratory's name for advertising or publicity purpose without authorization is prohibited.

Attn: Mr. Steve Greenfield

Date Sampled: 04/12/96

Date Extracted: 04/26/96

Date Analyzed: 04/26/96

Extraction Method: 3550

Extraction Material: Methylene Chloride

Client's Project: Air National Guard, S8119-06-01

Matrix: Soil

Analyst Initials: HZ

Date Amended: 05/01/96

Method 8015 (Motor Oil)

| Lab No.: | Sample ID: | Results, mg/kg | DLR, mg/kg | Dilution Factor |
|--------------|------------|----------------|------------|-----------------|
| Method Blank | ---- | ND | 1 | 1 |
| 10842-018 | B4-20 | ND | 1 | 1 |
| 10842-021 | B4-35 | ND | 1 | 1 |
| 10842-022 | B4-40 | ND | 1 | 1 |
| 10842-025 | B5-15 | ND | 1 | 1 |
| 10842-027 | B5-25 | ND | 1 | 1 |
| 10842-022Dup | B4-40 | ND | 1 | 1 |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | % Recovery | Limits | |
| LCS | ---- | 56 | 50-150 | 1 |

MDL = Method Detection Limit
ND = Not Detected (Below DLR).
DLR = MDL X Dilution Factor

Reviewed/Approved By:

Yun Pan

Department Supervisor

Date:

The cover letter is an integral part of this analytical report.

| | |
|-----------------------------|-------------------------------|
| QC Batch #: | 968015DS091 |
| Date Sampled: | 04/11/96 |
| Date Received: | 04/12/96 |
| Date Extracted: | 04/26/96 |
| Date Analyzed: | 04/26/96 |
| Extraction Method: | 3550 |
| Extraction Material: | Methylene Chloride |

Matrix: Soil

Analyst Initials: HZ
Date Amended: 05/01/96

Method 8015 (Motor Oil)

| Lab No.: | Sample ID: | Results, mg/kg | DLR, mg/kg | Dilution Factor |
|---------------|------------|----------------|------------|-----------------|
| Method Blank | ---- | ND | 1 | 1 |
| 10842-001 | B1-11.5 | ND | 1 | 1 |
| 10842-002 | B1-15 | ND | 1 | 1 |
| 10842-003 | B1-19 | ND | 1 | 1 |
| 10842-004 | B1-23.5 | ND | 1 | 1 |
| 10842-005 | B1-27.5 | ND | 1 | 1 |
| 10842-006 | B1-32 | ND | 1 | 1 |
| 10842-008 | B2-15 | ND | 1 | 1 |
| 10842-010 | B2-25 | ND | 1 | 1 |
| 10842-011 | B3-10 | ND | 1 | 1 |
| 10842-014 | B3-25 | ND | 1 | 1 |
| 10842-001 Dup | B1-11.5 | ND | 1 | 1 |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | %Recovery | Limits | |
| LCS | ---- | 59 | 50-150 | 1 |

MDL = Method Detection Limit
ND = Not Detected (Below DLR).
DLR = MDL X Dilution Factor

Reviewed/Approved By:

| | |
|--|--|
| Yun Pan Department Supervisor | |
|--|--|

Date:

The cover letter is an integral part of this analytical report.

Cilent: Geocion Environmental
Attn: Mr. Steve Greenfield

Cilent's Project: Air National Guard, S8119-06-01

Date Received: 04/12/96
Matrix: Soil

METHOD 8015M (Gasoline)/EPA 8020 (BTX)

| Lab No.: | Method Blank | 10842-001 | 10842-002 | 10842-003 | 10842-004 | 10842-005 | 10842-006 | 10842-008 | 10842-010 | 10842-011 |
|---------------------|--------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Client Sample I.D.: | — | B1-11.5 | B1-15 | B1-19 | B1-23.5 | B1-27.5 | B1-32 | B2-15 | B2-25 | B3-10 |
| Date Sampled: | 04/11/96 | 04/11/96 | 04/11/96 | 04/11/96 | 04/11/96 | 04/11/96 | 04/11/96 | 04/11/96 | 04/11/96 | 04/11/96 |
| QC Batch #: | 968G20S095 | 968G20S095 | 968G20S095 | 968G20S095 | 968G20S095 | 968G20S095 | 968G20S095 | 968G20S095 | 968G20S095 | 968G20S095 |
| Date Analyzed: | 04/17/96 | 04/17/96 | 04/17/96 | 04/17/96 | 04/17/96 | 04/17/96 | 04/17/96 | 04/17/96 | 04/17/96 | 04/17/96 |
| Analyst Initials: | DT | DT | DT | DT | DT | DT | DT | DT | DT | DT |
| Dilution Factor: | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Analyte | MDL | Units | DLR | Results | DLR | Results | DLR | Results | DLR | Results |
| TPH (Gas) | 1 | mg/kg | 1 | ND | 1 | ND | 1 | ND | 1 | ND |
| Benzene | 5 | ug/kg | 5 | ND | 5 | ND | 5 | ND | 5 | ND |
| Toluene | 5 | ug/kg | 5 | ND | 5 | ND | 5 | ND | 5 | ND |
| Ethylbenzene | 5 | ug/kg | 5 | ND | 5 | ND | 5 | ND | 5 | ND |
| Xylenes (total) | 5 | ug/kg | 5 | ND | 5 | ND | 5 | ND | 5 | ND |

| Lab No.: | 10842-014 | 10842-018 | 10842-021 | 10842-022 | 10842-025 | 10842-027 | 10842-014Dup | 10842-027Dup | LCS #1 | LCS #2 |
|---------------------|------------|------------|------------|------------|------------|------------|--------------|--------------|------------|------------|
| Client Sample I.D.: | B3-25 | B4-20 | B4-35 | B4-40 | B5-15 | B5-25 | B3-25 | B5-25 | — | — |
| Date Sampled: | 04/12/96 | 04/12/96 | 04/12/96 | 04/12/96 | 04/12/96 | 04/12/96 | 04/11/96 | 04/12/96 | — | — |
| QC Batch #: | 968G20S095 | 968G20S095 | 968G20S095 | 968G20S095 | 968G20S095 | 968G20S095 | 968G20S095 | 968G20S095 | 968G20S095 | 968G20S095 |
| Date Analyzed: | 04/17/96 | 04/17/96 | 04/17/96 | 04/17/96 | 04/17/96 | 04/17/96 | 04/25/96 | 04/25/96 | 04/25/96 | 04/25/96 |
| Analyst Initials: | DT | DT | DT | DT | DT | DT | DT | DT | DT | DT |
| Dilution Factor: | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Analyte | MDL | Units | DLR | Results | DLR | Results | DLR | Results | % Rec. | Limits |
| TPH (Gas) | 1 | mg/kg | 1 | ND | 1 | ND | 1 | ND | 91 | 50-150 |
| Benzene | 5 | ug/kg | 5 | ND | 5 | ND | 5 | ND | 88 | 50-150 |
| Toluene | 5 | ug/kg | 5 | ND | 5 | ND | 5 | ND | 107 | 50-150 |
| Ethylbenzene | 5 | ug/kg | 5 | ND | 5 | ND | 5 | ND | 106 | 50-150 |
| Xylenes (total) | 5 | ug/kg | 5 | ND | 5 | ND | 5 | ND | 102 | 50-150 |

MDL = Method Detection Limit
ND = Not Detected. (Below DLR)
DLR = MDL X Dilution Factor
NA = Not Analyzed

Reviewed/Approved By: _____



Yun Pan
Department Supervisor

4/29/96

Date: _____

The cover letter is an integral part of this analytical report.

| | |
|----------------------|-----------------------|
| QC Batch #: | 968015DS091 |
| Date Sampled: | 04/11/96 |
| Date Received: | 04/12/96 |
| Date Extracted: | 04/26/96 |
| Date Analyzed: | 04/26/96 |
| Extraction Method: | 3550 |
| Extraction Material: | Methylene Chloride |

Date Amended: 05/01/96

| Lab No.: | Sample ID: | Results, mg/kg | DLR, mg/kg | Dilution Factor |
|--------------|------------|----------------|------------|-----------------|
| Method Blank | ---- | ND | 1 | 1 |
| 10842-001 | B1-11.5 | ND | 1 | 1 |
| 10842-002 | B1-15 | ND | 1 | 1 |
| 10842-003 | B1-19 | ND | 1 | 1 |
| 10842-004 | B1-23.5 | ND | 1 | 1 |
| 10842-005 | B1-27.5 | ND | 1 | 1 |
| 10842-006 | B1-32 | ND | 1 | 1 |
| 10842-008 | B2-15 | ND | 1 | 1 |
| 10842-010 | B2-25 | ND | 1 | 1 |
| 10842-011 | B3-10 | ND | 1 | 1 |
| 10842-014 | B3-25 | ND | 1 | 1 |
| 10842-001Dup | B1-11.5 | ND | 1 | 1 |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | %Recovery | Limits | |
| LCS | --- | 59 | 50-150 | 1 |

Reviewed/Approved By:

Date:

1510 E. 33rd Street Signal Hill, CA 90807 Tel: 310 989-4045 Fax: 310 989-4040

Method : C:\HPCHEM\5\METHODS\8025EXT.M
Title : 8015GAS/ 8020 (BTXE)
Last Update : Wed Apr 17 22:15:51 1996
Response via : Initial Calibration

Non-Spiked Sample: V00105.D

Spike
Sample

Spike
Duplicate Sample

| File ID : | VS0107.D | VS0108.D |
|-----------|--------------------|--------------------|
| Sample : | 10842-014 3ppm MS | 10842-014 3ppm MSD |
| Acq Time: | 17 Apr 96 08:57 PM | 17 Apr 96 09:55 PM |

| Compound | | Sample Conc | Spike Added | Spike Res | Dup Res | Spike %Rec | Dup %Rec | RPD | QC Limits RPD % Rec |
|----------|---------|----------------|----------------|--------------|------------|---------------|-------------|-----|------------------------|
| gasoline | (mg/kg) | ND | 3 | 3 | 3 | 95 | 95 | 0 | 12 47-140 |
| Benzene | (ug/kg) | ND | 70 | 56 | 57 | 80 | 80 | 0 | 12 68-121 |
| Toluene | (ug/kg) | ND | 170 | 170 | 167 | 100 | 98 | 2 | 14 62-127 |

QC Batch #:968G20S095

Reviewed and Approved by: _____

Yun Pan

Organics Supervisor

Date: 4/19/96

Method : C:\HPCHEM\5\METHODS\8025EXT.M
Title : 8015GAS/ 8020 (BTXE)
Last Update : Thu Apr 25 16:29:21 1996
Response via : Initial Calibration

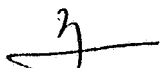
Non-Spiked Sample: V00298.D

| | Spike Sample | Spike Duplicate Sample |
|-----------|------------------------------|-------------------------------|
| File ID : | VS0299.D | VS0300.D |
| Sample : | 10842-027 3ppm MS Gas (BTXE) | 10842-027 3ppm MSD Gas (BTXE) |
| Acq Time: | 25 Apr 96 05:50 PM | 25 Apr 96 06:19 PM |

| Compound | Sample Conc | Spike Added | Spike Res | Dup Res | Spike %Rec | Dup %Rec | RPD | QC Limits RPD % Rec |
|------------------|----------------|----------------|--------------|------------|---------------|-------------|-----|------------------------|
| Gasoline (mg/kg) | ND | 3 | 3 | 3 | 94 | 96 | 2 | 12 47-140 |
| Benzene (ug/kg) | ND | 70 | 68 | 71 | 97 | 101 | 4 | 12 68-121 |
| Toluene (ug/kg) | ND | 170 | 205 | 210 | 120 | 123 | 2 | 14 62-127 |

QC Batch #:958G20S095

Reviewed and Approved by:



Yun Pan

Organics Supervisor

Date: 4/29/96

Spike Recovery and RPD Summary Report - SOIL (MG/KG)

Method : C:\HPCHEM\5\METHODS\DIESEL.M
 Title : Diesel
 Last Update : Fri Apr 26 13:38:43 1996
 Response via : Initial Calibration

Non-Spiked Sample: D6538.D

Spike
Sample

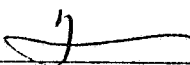
Spike
Duplicate Sample

| | | |
|-----------|---------------------------|----------------------------|
| File ID : | DS6542.D | DS6543.D |
| Sample : | 10842-22 MS SOIL E4-26-96 | 10842-22 MSD SOIL E4-26-96 |
| Acq Time: | 26 Apr 96 08:34 PM | 26 Apr 96 08:55 PM |

| Compound | Sample Conc | Spike Added | Spike Res | Dup Res | Spike %Rec | Dup %Rec | RPD | QC Limits RPD % Rec |
|----------|----------------|----------------|--------------|------------|---------------|-------------|-----|------------------------|
| Diesel | ND | 100 | 92 | 100 | 92 | 100 | 8 | 50 50-150 |

QC Batch #: 968015DS092

Reviewed/Approved By: _____


 Yun Pan
 Organics Supervisor

Date: 4/29/96

Spike Recovery and RPD Summary Report - SOIL (MG/KG)

Method : C:\HPCHEM\5\METHODS\DIESEL.M
 Title : Diesel
 Last Update : Fri Apr 26 13:38:43 1996
 Response via : Initial Calibration

Non-Spiked Sample: D6523.D

Spike
Sample

Spike
Duplicate Sample

File ID : DS6524.D
 Sample : 10842-1 MS SOIL E4-26-96
 Acq Time: 26 Apr 96 02:35 PM

DS6525.D
 10842-1 MSD SOIL E4-26-96
 26 Apr 96 02:54 PM

| Compound | Sample Conc | Spike Added | Spike Res | Dup Res | Spike %Rec | Dup %Rec | RPD | QC Limits RPD % Rec |
|----------|----------------|----------------|--------------|------------|---------------|-------------|-----|------------------------|
| Diesel | ND | 100 | 89 | 85 | 79 | 76 | 5 | 50 50-150 |

QC Batch #: 968015DS091

Reviewed/Approved By: Yun Pan
 Organics Supervisor

Date: 4/29/96

Method: SM 5520F

Analyst: LP

Data File: 6110-1S

Date: 04/19/96

Sample ID: 10842-027

Matrix: Soil

[illegible]

Approved by: Chalrock Sida

Cheryl DeLos Reyes
Inorganics Supervisor

Date: 4/28/96

Attachment 2

Copies of UST Removal Permits

STATE OF CALIFORNIA
STATE WATER RESOURCES CONTROL BOARD
UNDERGROUND STORAGE TANK PERMIT APPLICATION - FORM A
COMPLETE THIS FORM FOR EACH FACILITY/SITE



MARK ONLY ONE ITEM ☐ 1 NEW PERMIT ☐ 3 RENEWAL PERMIT ☐ 5 CHANGE OF INFORMATION ☐ 7 PERMANENTLY CLOSED SITE
☐ 2 INTERIM PERMIT ☐ 4 AMENDED PERMIT ☐ 6 TEMPORARY SITE CLOSURE

I. FACILITY/SITE INFORMATION & ADDRESS - (MUST BE COMPLETED)

| | | | |
|---|--|--|--|
| DBA OR FACILITY NAME NORTH HIGHLANDS ANG STATION | | NAME OF OPERATOR CALIF AIR NATIONAL GUARD | |
| ADDRESS 3900 ROSEVILLE RD | | NEAREST CROSS STREET LONGVIEW DRIVE | |
| CITY NAME NORTH HIGHLAND | | STATE CA | ZIP CODE 95660 |
| BOX TO INDICATE <input type="checkbox"/> CORPORATION <input type="checkbox"/> INDIVIDUAL <input type="checkbox"/> PARTNERSHIP <input type="checkbox"/> LOCAL AGENCY <input type="checkbox"/> COUNTY AGENCY <input type="checkbox"/> STATE AGENCY <input checked="" type="checkbox"/> FEDERAL AGENCY | | FACILITY # (OPTIONAL) -005 SITE PHONE # WITH AREA CODE 240-0330-007 | |
| TYPE OF BUSINESS <input checked="" type="checkbox"/> 1 GAS STATION <input checked="" type="checkbox"/> 2 DISTRIBUTOR <input type="checkbox"/> 3 FARM <input type="checkbox"/> 4 PROCESSOR <input type="checkbox"/> 5 OTHER | | <input type="checkbox"/> IF INDIAN RESERVATION OR TRUST LANDS | # OF TANKS AT SITE 2 E.P.A. I.D.# (optional) CA6570025878 |

EMERGENCY CONTACT PERSON (PRIMARY)

| | |
|--|---|
| DAYS: NAME (LAST, FIRST) LECOL FAGER, EDWARD | PHONE # WITH AREA CODE (916) 569-2280 |
| NIGHTS: NAME (LAST, FIRST) SAME | PHONE # WITH AREA CODE (916) 569-6661 |

EMERGENCY CONTACT PERSON (SECONDARY) - optional

| | |
|--|---|
| DAYS: NAME (LAST, FIRST) MSgt Fleming, Guy | PHONE # WITH AREA CODE (916) 569-2236 |
| NIGHTS: NAME (LAST, FIRST) SAME | PHONE # WITH AREA CODE (916) 268-0474 |

II. PROPERTY OWNER INFORMATION - (MUST BE COMPLETED)

| | |
|---|--|
| NAME CALIF AIR NATIONAL GUARD | CARE OF ADDRESS INFORMATION 162 COMBAT COMMUNICATIONS GROUP |
| MAILING OR STREET ADDRESS SAME AS ABOVE | STATE CA ZIP CODE 95660 |
| CITY NAME | PHONE # WITH AREA CODE (916) 569-2200 |

III. TANK OWNER INFORMATION - (MUST BE COMPLETED)

| | |
|---------------------------------------|---|
| NAME OF OWNER SAME AS ABOVE | CARE OF ADDRESS INFORMATION |
| MAILING OR STREET ADDRESS | <input checked="" type="checkbox"/> box to indicate <input type="checkbox"/> INDIVIDUAL <input type="checkbox"/> LOCAL AGENCY <input type="checkbox"/> STATE AGENCY |
| CITY NAME | <input type="checkbox"/> CORPORATION <input type="checkbox"/> PARTNERSHIP <input type="checkbox"/> COUNTY AGENCY <input type="checkbox"/> FEDERAL AGENCY |
| | STATE CA ZIP CODE 95660 PHONE # WITH AREA CODE |

IV. BOARD OF EQUALIZATION UST STORAGE FEE ACCOUNT NUMBER - Call (916) 322 9659 if questions arise.

TY (TK) HQ **44-**

V. PETROLEUM UST FINANCIAL RESPONSIBILITY - (MUST BE COMPLETED) - IDENTIFY THE METHOD(S) USED

| | | | | |
|---|--|--------------------------------------|--------------------------------------|--|
| <input checked="" type="checkbox"/> box to indicate | <input checked="" type="checkbox"/> 1 SELF INSURED | <input type="checkbox"/> 2 GUARANTEE | <input type="checkbox"/> 3 INSURANCE | <input type="checkbox"/> 4 SURETY BOND |
| | <input type="checkbox"/> 5 LETTER OF CREDIT | <input type="checkbox"/> 6 EXEMPTION | <input type="checkbox"/> 00 OTHER | |

VI. LEGAL NOTIFICATION AND BILLING ADDRESS Legal notification and billing will be sent to the tank owner unless box I or II is checked.

| | |
|--|--|
| CHECK ONE BOX INDICATING WHICH ABOVE ADDRESS SHOULD BE USED FOR LEGAL NOTIFICATION AND BILLING | <input type="checkbox"/> I <input checked="" type="checkbox"/> II <input type="checkbox"/> III |
|--|--|

THIS FORM HAS BEEN COMPLETED UNDER PENALTY OF PERJURY, AND TO THE BEST OF MY KNOWLEDGE, IS TRUE AND CORRECT

| | | |
|---------------------------------|---------------|---------------------|
| OWNER'S NAME (PRINTED & SIGNED) | OWNER'S TITLE | DATE MONTH/DAY/YEAR |
|---------------------------------|---------------|---------------------|

LOCAL AGENCY USE ONLY

| | | |
|--------------------------|---------------------------|---------------------------------------|
| COUNTY # 05 | JURISDICTION # 000 | FACILITY # 000000 |
| LOCATION CODE - OPTIONAL | CENSUS TRACT # - OPTIONAL | SUPERVISOR - DISTRICT CODE - OPTIONAL |

THIS FORM MUST BE ACCOMPANIED BY AT LEAST (1) OR MORE PERMIT APPLICATION - FORM B, UNLESS THIS IS A CHANGE OF SITE INFORMATION ONLY.

OWNER MUST FILE THIS FORM WITH THE LOCAL AGENCY IMPLEMENTING THE UNDERGROUND STORAGE TANK REGULATIONS

STATE OF CALIFORNIA
STATE WATER RESOURCES CONTROL BOARD
UNDERGROUND STORAGE TANK PERMIT APPLICATION - FORM B



COMPLETE A SEPARATE FORM FOR EACH TANK SYSTEM

ARK ONLY ONE ITEM ☐ 1 NEW PERMIT ☐ 2 INTERIM PERMIT ☐ 3 RENEWAL PERMIT ☐ 4 AMENDED PERMIT ☐ 5 CHANGE OF INFORMATION ☐ 6 TEMPORARY TANK CLOSURE ☐ 7 PERMANENTLY CLOSED ON SITE ☐ 8 TANK REMOVED

DBA OR FACILITY NAME WHERE TANK IS INSTALLED:

I. TANK DESCRIPTION COMPLETE ALL ITEMS - SPECIFY IF UNKNOWN

A. OWNER'S TANK I.D.# 00108 B. MANUFACTURED BY: UNIK
C. DATE INSTALLED (MO/DAY/YEAR) JAN 66 D. TANK CAPACITY IN GALLONS: 2000

II. TANK CONTENTS IF A-1 IS MARKED, COMPLETE ITEM C.

A. ☒ 1 MOTOR VEHICLE FUEL ☐ 4 OIL ☐ 16 REGULAR UNLEADED ☐ 5 DIESEL ☐ 8 AVIATION GAS
☐ 2 PETROLEUM ☐ 80 EMPTY ☐ 17 PREMIUM UNLEADED ☐ 4 GASAHOL ☐ 7 METHANOL
☐ 3 CHEMICAL PRODUCT ☐ 95 UNKNOWN ☐ 2 WASTE ☐ 18 JET FUEL ☐ 99 OTHER (DESCRIBE IN ITEM D. BELOW)
D. IF (A.1) IS NOT MARKED, ENTER NAME OF SUBSTANCE STORED C.A.S.#:

III. TANK CONSTRUCTION MARK ONE ITEM ONLY IN BOXES A, B, AND C, AND ALL THAT APPLIES IN BOX D

A. TYPE OF SYSTEM ☐ 1 DOUBLE WALL ☐ 3 SINGLE WALL WITH EXTERIOR LINER ☐ 95 UNKNOWN
☒ 2 SINGLE WALL ☐ 4 SECONDARY CONTAINMENT (VAULTED TANK) ☐ 99 OTHER
B. TANK MATERIAL (Primary Tank) ☒ 1 BARE STEEL ☐ 2 STAINLESS STEEL ☐ 3 FIBERGLASS ☐ 4 STEEL CLAD W/ FIBERGLASS REINFORCED PLASTIC
☐ 5 CONCRETE ☐ 6 POLYVINYL CHLORIDE ☐ 7 ALUMINUM ☐ 8 100% METHANOL COMPATIBLE W/FRP
☐ 9 BRONZE ☐ 10 GALVANIZED STEEL ☐ 96 UNKNOWN ☐ 99 OTHER
C. INTERIOR LINING ☐ 1 RUBBER LINED ☐ 2 ALKYL LINED ☐ 3 EPOXY LINING ☐ 4 PHENOLIC LINING
☐ 5 GLASS LINING ☐ 6 UNLINED ☒ 95 UNKNOWN ☐ 99 OTHER
D. LINING MATERIAL COMPATIBLE WITH 100% METHANOL? YES ☐ NO ☐
CORROSION PROTECTION ☐ 1 POLYETHYLENE WRAP ☐ 2 COATING ☐ 3 VINYL WRAP ☐ 4 FIBERGLASS REINFORCED PLASTIC
☐ 5 CATHODIC PROTECTION ☐ 91 NONE ☒ 95 UNKNOWN ☐ 99 OTHER

IV. PIPING INFORMATION CIRCLE A IF ABOVE GROUND OR U IF UNDERGROUND, BOTH IF APPLICABLE

A. SYSTEM TYPE A U 1 SUCTION A U 2 PRESSURE A U 3 GRAVITY A U 99 OTHER
B. CONSTRUCTION A U 1 SINGLE WALL A U 2 DOUBLE WALL A U 3 LINED TRENCH A U 95 UNKNOWN A U 99 OTHER
C. MATERIAL AND CORROSION PROTECTION A U 1 BARE STEEL A U 2 STAINLESS STEEL A U 3 POLYVINYL CHLORIDE (PVC) A U 4 FIBERGLASS PIPE
A U 5 ALUMINUM A U 6 CONCRETE A U 7 STEEL W/ COATING A U 8 100% METHANOL COMPATIBLE W/FRP
A U 9 GALVANIZED STEEL A U 10 CATHODIC PROTECTION A U 95 UNKNOWN A U 99 OTHER
D. LEAK DETECTION ☐ 1 AUTOMATIC LINE LEAK DETECTOR ☒ 2 LINE TIGHTNESS TESTING ☐ 3 INTERSTITIAL MONITORING ☐ 99 OTHER

V. TANK LEAK DETECTION

☒ 1 VISUAL CHECK ☐ 2 INVENTORY RECONCILIATION ☐ 3 VAPOR MONITORING ☐ 4 AUTOMATIC TANK GAUGING ☐ 5 GROUND WATER MONITORING
☒ 6 TANK TESTING ☐ 7 INTERSTITIAL MONITORING ☐ 91 NONE ☐ 95 UNKNOWN ☐ 99 OTHER

VI. TANK CLOSURE INFORMATION

1. ESTIMATED DATE LAST USED (MO/DAY/YR) Aug 93 2. ESTIMATED QUANTITY OF SUBSTANCE REMAINING 40 GALLONS 3. WAS TANK FILLED WITH INERT MATERIAL? YES ☐ NO ☒

THIS FORM HAS BEEN COMPLETED UNDER PENALTY OF PERJURY, AND TO THE BEST OF MY KNOWLEDGE, IS TRUE AND CORRECT

APPLICANT'S NAME
(PRINTED & SIGNATURE)

DATE

LOCAL AGENCY USE ONLY THE STATE I.D. NUMBER IS COMPOSED OF THE FOUR NUMBERS BELOW

STATE I.D.# 00108 COUNTY # 00 JURISDICTION # 00 FACILITY # 00 TANK # 00
PERMIT NUMBER 00108 PERMIT APPROVED BY/DATE 00108 PERMIT EXPIRATION DATE 00108

STATE OF CALIFORNIA
STATE WATER RESOURCES CONTROL BOARD
UNDERGROUND STORAGE TANK PERMIT APPLICATION - FORM B



COMPLETE A SEPARATE FORM FOR EACH TANK SYSTEM.

MARK ONLY ONE ITEM ☐ 1 NEW PERMIT ☐ 3 RENEWAL PERMIT ☐ 5 CHANGE OF INFORMATION ☐ 7 PERMANENTLY CLOSED ON SITE
☐ 2 INTERIM PERMIT ☐ 4 AMENDED PERMIT ☐ 6 TEMPORARY TANK CLOSURE ☐ 8 TANK REMOVED

DBA OR FACILITY NAME WHERE TANK IS INSTALLED:

I. TANK DESCRIPTION COMPLETE ALL ITEMS - SPECIFY IF UNKNOWN

A. OWNER'S TANK I.D.# 00107 B. MANUFACTURED BY: UNK
C. DATE INSTALLED (MO/DAY/YEAR) Jan 61 D. TANK CAPACITY IN GALLONS: 3100

II. TANK CONTENTS IF A-1 IS MARKED, COMPLETE ITEM C.

A. ☒ 1 MOTOR VEHICLE FUEL ☐ 4 OIL ☐ 8 AVIATION GAS
☐ 2 PETROLEUM ☐ 60 EMPTY ☒ 1 PRODUCT ☐ 3 DIESEL ☐ 4 GASOLIN ☐ 7 METHANOL
☐ 3 CHEMICAL PRODUCT ☐ 95 UNKNOWN ☐ 2 WASTE ☐ 16 REGULAR UNLEADED ☐ 5 JET FUEL ☐ 99 OTHER (DESCRIBE IN ITEM D. BELOW)
D. IF (A 1) IS NOT MARKED, ENTER NAME OF SUBSTANCE STORED C.A.B.#:

III. TANK CONSTRUCTION MARK ONE ITEM ONLY IN BOXES A, B, AND C, AND ALL THAT APPLIES IN BOX D

A. TYPE OF SYSTEM ☐ 1 DOUBLE WALL ☐ 3 SINGLE WALL WITH EXTERIOR LINER ☐ 95 UNKNOWN
☒ 2 SINGLE WALL ☐ 4 SECONDARY CONTAINMENT (VAULTED TANK) ☐ 99 OTHER
B. TANK MATERIAL (Primary Tank) ☒ 1 BARE STEEL ☐ 2 STAINLESS STEEL ☐ 3 FIBERGLASS ☐ 4 STEEL CLAD W/ FIBERGLASS REINFORCED PLASTIC
☐ 5 CONCRETE ☐ 6 POLYVINYL CHLORIDE ☐ 7 ALUMINUM ☐ 8 100% METHANOL COMPATIBLE W/FRP
☐ 9 BRONZE ☒ 10 GALVANIZED STEEL ☐ 95 UNKNOWN ☐ 99 OTHER
C. INTERIOR LINING ☐ 1 RUBBER LINED ☐ 2 ALKYL LINED ☐ 3 EPOXY LINING ☐ 4 PHENOLIC LINING
☐ 5 GLASS LINING ☐ 6 UNLINED ☒ 95 UNKNOWN ☐ 99 OTHER
IS LINING MATERIAL COMPATIBLE WITH 100% METHANOL? YES ___ NO ___
CORROSION PROTECTION ☐ 1 POLYETHYLENE WRAP ☐ 2 COATING ☐ 3 VINYL WRAP ☐ 4 FIBERGLASS REINFORCED PLASTIC
☐ 5 CATHODIC PROTECTION ☐ 91 NONE ☒ 95 UNKNOWN ☐ 99 OTHER

IV. PIPING INFORMATION CIRCLE A IF ABOVE GROUND OR U IF UNDERGROUND, BOTH IF APPLICABLE

A. SYSTEM TYPE A ☒ 1 SUCTION A ☒ 2 PRESSURE A ☐ 3 GRAVITY A ☐ 99 OTHER
B. CONSTRUCTION A ☒ 1 SINGLE WALL A ☐ 2 DOUBLE WALL A ☐ 3 LINED TRENCH A ☐ 95 UNKNOWN A ☐ 99 OTHER
C. MATERIAL AND CORROSION PROTECTION A ☐ 1 BARE STEEL A ☐ 2 STAINLESS STEEL A ☐ 3 POLYVINYL CHLORIDE (PVC) A ☐ 4 FIBERGLASS PIPE
A ☐ 5 ALUMINUM A ☐ 6 CONCRETE A ☐ 7 STEEL W/ COATING A ☐ 8 100% METHANOL COMPATIBLE W/FRP
A ☒ 9 GALVANIZED STEEL A ☐ 10 CATHODIC PROTECTION A ☐ 95 UNKNOWN A ☐ 99 OTHER
D. LEAK DETECTION ☐ 1 AUTOMATIC LINE LEAK DETECTOR ☒ 2 LINE TIGHTNESS TESTING ☐ 3 INTERSTITIAL MONITORING ☐ 99 OTHER

V. TANK LEAK DETECTION

☒ 1 VISUAL CHECK ☐ 2 INVENTORY RECONCILIATION ☐ 3 VAPOR MONITORING ☐ 4 AUTOMATIC TANK GAUGING ☐ 5 GROUND WATER MONITORING
☒ 6 TANK TESTING ☐ 7 INTERSTITIAL MONITORING ☐ 91 NONE ☐ 95 UNKNOWN ☐ 99 OTHER

VI. TANK CLOSURE INFORMATION

1. ESTIMATED DATE LAST USED (MO/DAY/YR) Aug 93 2. ESTIMATED QUANTITY OF SUBSTANCE REMAINING 1200 GALLONS 3. WAS TANK FILLED WITH HAZARDOUS MATERIAL? YES ☐ NO ☒

THIS FORM HAS BEEN COMPLETED UNDER PENALTY OF PERJURY, AND TO THE BEST OF MY KNOWLEDGE, IS TRUE AND CORRECT

APPLICANT'S NAME
(PRINTED & SIGNATURE)

DATE

LOCAL AGENCY USE ONLY THE STATE I.D. NUMBER IS COMPOSED OF THE FOUR NUMBERS BELOW

STATE I.D.#

COUNTY #

JURISDICTION #

FACILITY #

TANK #

PERMIT NUMBER

PERMIT APPROVED BY/DATE

PERMIT EXPIRATION DATE

STATE OF CALIFORNIA
STATE WATER RESOURCES CONTROL BOARD
UNDERGROUND STORAGE TANK PERMIT APPLICATION - FORM B



COMPLETE A SEPARATE FORM FOR EACH TANK SYSTEM.

MARK ONLY ONE ITEM ☐ 1 NEW PERMIT ☐ 3 RENEWAL PERMIT ☐ 5 CHANGE OF INFORMATION ☐ 7 PERMANENTLY CLOSED ON SITE
☐ 2 INTERIM PERMIT ☐ 4 AMENDED PERMIT ☐ 6 TEMPORARY TANK CLOSURE ☐ 8 TANK REMOVED

OWNER OR FACILITY NAME WHERE TANK IS INSTALLED:

I. TANK DESCRIPTION COMPLETE ALL ITEMS - SPECIFY IF UNKNOWN

A. OWNER'S TANK I.D.# 00115 B. MANUFACTURED BY: UNK
C. DATE INSTALLED (MO/DAY/YEAR) JAN 81 D. TANK CAPACITY IN GALLONS: 686

II. TANK CONTENTS IF A-1 IS MARKED, COMPLETE ITEM C.

A. ☐ 1 MOTOR VEHICLE FUEL ☒ 4 OIL ☐ 2 PETROLEUM ☐ 99 EMPTY ☐ 3 CHEMICAL PRODUCT ☐ 99 UNKNOWN
B. ☐ 1 PRODUCT ☒ 2 WASTE
C. ☒ 1 REGULAR UNLEADED ☒ 3 DIESEL ☐ 8 AVIATION GAS
☒ 16 PREMIUM UNLEADED ☐ 4 GASOLINE ☐ 7 METHANOL
☒ 2 LEADED ☐ 5 JET FUEL ☐ 99 OTHER (DESCRIBE IN ITEM D. BELOW)
D. IF (A.1) IS NOT MARKED, ENTER NAME OF SUBSTANCE STORED C.A.B.#:

III. TANK CONSTRUCTION MARK ONE ITEM ONLY IN BOXES A, B, AND C, AND ALL THAT APPLIES IN BOX D

A. TYPE OF SYSTEM ☐ 1 DOUBLE WALL ☐ 3 SINGLE WALL WITH EXTERIOR LINER ☐ 99 UNKNOWN
☒ 2 SINGLE WALL ☐ 4 SECONDARY CONTAINMENT (VAULTED TANK) ☐ 99 OTHER
B. TANK MATERIAL (Primary Tank) ☐ 1 BARE STEEL ☐ 2 STAINLESS STEEL ☐ 3 FIBERGLASS ☐ 4 STEEL CLAD W/ FIBERGLASS REINFORCED PLASTIC
☒ 5 CONCRETE ☐ 6 POLYVINYL CHLORIDE ☐ 7 ALUMINUM ☐ 8 100% METHANOL COMPATIBLE W/FRP
☐ 9 BRONZE ☐ 10 GALVANIZED STEEL ☐ 99 UNKNOWN ☐ 99 OTHER
C. INTERIOR LINING ☐ 1 RUBBER LINED ☐ 2 ALKYL LINED ☐ 3 EPOXY LINING ☐ 4 PHENOLIC LINING
☐ 5 GLASS LINING ☒ 6 UNLINED ☐ 99 UNKNOWN ☐ 99 OTHER
IS LINING MATERIAL COMPATIBLE WITH 100% METHANOL? YES NO
D. CORROSION PROTECTION ☐ 1 POLYETHYLENE WRAP ☐ 2 COATING ☐ 3 VINYL WRAP ☐ 4 FIBERGLASS REINFORCED PLASTIC
☐ 5 CATHODIC PROTECTION ☒ 6 NONE ☐ 99 UNKNOWN ☐ 99 OTHER

IV. PIPING INFORMATION CIRCLE A IF ABOVE GROUND OR U IF UNDERGROUND, BOTH IF APPLICABLE

A. SYSTEM TYPE A U 1 SUCTION A U 2 PRESSURE A U 3 GRAVITY A U 99 OTHER
B. CONSTRUCTION A U 1 SINGLE WALL A U 2 DOUBLE WALL A U 3 LINED TRENCH A U 99 UNKNOWN A U 99 OTHER
C. MATERIAL AND CORROSION PROTECTION A U 1 BARE STEEL A U 2 STAINLESS STEEL A U 3 POLYVINYL CHLORIDE (PVC) A U 4 FIBERGLASS PIPE
A U 5 ALUMINUM A U 6 CONCRETE A U 7 STEEL W/ COATING A U 8 100% METHANOL COMPATIBLE W/FRP
A U 9 GALVANIZED STEEL A U 10 CATHODIC PROTECTION A U 95 UNKNOWN A U 99 OTHER
D. LEAK DETECTION ☐ 1 AUTOMATIC LINE LEAK DETECTOR ☐ 2 LINE TIGHTNESS TESTING ☐ 3 INTERSTITIAL MONITORING ☒ 4 OTHER N/A

V. TANK LEAK DETECTION

☒ 1 VISUAL CHECK ☐ 2 INVENTORY RECONCILIATION ☐ 3 VAPOR MONITORING ☐ 4 AUTOMATIC TANK GAUGING ☐ 5 GROUND WATER MONITORING
☐ 6 TANK TESTING ☐ 7 INTERSTITIAL MONITORING ☐ 8 NONE ☐ 99 UNKNOWN ☐ 99 OTHER

VI. TANK CLOSURE INFORMATION

1. ESTIMATED DATE LAST USED (MO/DAY/YR) 12 USE
2. ESTIMATED QUANTITY OF SUBSTANCE REMAINING 686 GALLONS
3. WAS TANK FILLED WITH INERT MATERIAL? YES ☐ NO ☒

THIS FORM HAS BEEN COMPLETED UNDER PENALTY OF PERJURY, AND TO THE BEST OF MY KNOWLEDGE, IS TRUE AND CORRECT

APPLICANT'S NAME
(PRINTED & SIGNATURE)

DATE

LOCAL AGENCY USE ONLY THE STATE I.D. NUMBER IS COMPOSED OF THE FOUR NUMBERS BELOW

STATE I.D.#

COUNTY #

JURISDICTION #

FACILITY #

TANK #

PERMIT NUMBER

PERMIT APPROVED BY/DATE

PERMIT EXPIRATION DATE

STATE WATER RESOURCES CONTROL BOARD
UNDERGROUND STORAGE TANK PERMIT APPLICATION - FORM B



COMPLETE A SEPARATE FORM FOR EACH TANK SYSTEM.

| | | | | |
|-----------------------|---|---|---|---|
| MARK ONLY ONE ITEM | <input type="checkbox"/> 1 NEW PERMIT | <input type="checkbox"/> 3 RENEWAL PERMIT | <input type="checkbox"/> 5 CHANGE OF INFORMATION | <input type="checkbox"/> 7 PERMANENTLY CLOSED OR RITE |
| | <input type="checkbox"/> 2 INTERIM PERMIT | <input type="checkbox"/> 4 AMENDED PERMIT | <input type="checkbox"/> 6 TEMPORARY TANK CLOSURE | <input type="checkbox"/> 8 TANK REMOVED |

DBA OR FACILITY NAME WHERE TANK IS INSTALLED:

I. TANK DESCRIPTION COMPLETE ALL ITEMS - SPECIFY IF UNKNOWN

| | |
|---|---|
| A. OWNER'S TANK I.D.# <u>00207</u> | B. MANUFACTURED BY: <u>UNK</u> |
| C. DATE INSTALLED (MO/DAY/YEAR) <u>JAN 73</u> | D. TANK CAPACITY IN GALLONS: <u>375</u> |

II. TANK CONTENTS IF A-1 IS MARKED, COMPLETE ITEM C. CLARIFIED

| | | | | | |
|---|---|---|---|--|---|
| A. <input type="checkbox"/> 1 MOTOR VEHICLE FUEL | <input checked="" type="checkbox"/> 4 OIL | B. <input type="checkbox"/> 1 PRODUCT | C. <input type="checkbox"/> 1a REGULAR UNLEADED | <input checked="" type="checkbox"/> 3 DIESEL | <input type="checkbox"/> 6 AVIATION GAS |
| <input type="checkbox"/> 2 PETROLEUM | <input type="checkbox"/> 5 EMPTY | <input checked="" type="checkbox"/> 2 WASTE | <input type="checkbox"/> 1b PREMIUM UNLEADED | <input type="checkbox"/> 4 GASOLINE | <input type="checkbox"/> 7 METHANOL |
| <input type="checkbox"/> 3 CHEMICAL PRODUCT | <input type="checkbox"/> 6 UNKNOWN | | <input type="checkbox"/> 2 LEADED | <input type="checkbox"/> 5 JET FUEL | |
| D. IF (A.1) IS NOT MARKED, ENTER NAME OF SUBSTANCE STORED | | | | | |

C.A.S.#:

III. TANK CONSTRUCTION MARK ONE ITEM ONLY IN BOXES A, B, AND C, AND ALL THAT APPLIES IN BOX D

| | | | |
|---------------------------------|--|---|---|
| A. TYPE OF SYSTEM | <input type="checkbox"/> 1 DOUBLE WALL | <input type="checkbox"/> 3 SINGLE WALL WITH EXTERIOR LINER | <input type="checkbox"/> 5 UNKNOWN |
| | <input checked="" type="checkbox"/> 2 SINGLE WALL | <input type="checkbox"/> 4 SECONDARY CONTAINMENT (VAULTED TANK) | <input type="checkbox"/> 6 OTHER |
| B. TANK MATERIAL (Primary Tank) | <input type="checkbox"/> 1 BARE STEEL | <input type="checkbox"/> 2 STAINLESS STEEL | <input type="checkbox"/> 3 FIBERGLASS |
| | <input checked="" type="checkbox"/> 5 CONCRETE | <input type="checkbox"/> 6 POLYVINYL CHLORIDE | <input type="checkbox"/> 7 ALUMINUM |
| | <input type="checkbox"/> 9 BRONZE | <input type="checkbox"/> 10 GALVANIZED STEEL | <input type="checkbox"/> 15 UNKNOWN |
| C. INTERIOR LINING | <input type="checkbox"/> 1 RUBBER LINED | <input type="checkbox"/> 2 ALKYL LINO | <input type="checkbox"/> 3 EPOXY LINING |
| | <input type="checkbox"/> 5 GLASS LINING | <input checked="" type="checkbox"/> 6 UNLINED | <input type="checkbox"/> 15 UNKNOWN |
| | IS LINING MATERIAL COMPATIBLE WITH 100% METHANOL? YES <input type="checkbox"/> NO <input type="checkbox"/> | | |
| D. CORROSION PROTECTION | <input type="checkbox"/> 1 POLYETHYLENE WRAP | <input type="checkbox"/> 2 COATING | <input type="checkbox"/> 3 VINYL WRAP |
| | <input type="checkbox"/> 5 CATHODIC PROTECTION | <input checked="" type="checkbox"/> 6 NONE | <input type="checkbox"/> 15 UNKNOWN |
| | <input type="checkbox"/> 4 FIBERGLASS REINFORCED PLASTIC | | |
| | <input type="checkbox"/> 99 OTHER | | |

IV. PIPING INFORMATION CIRCLE A IF ABOVE GROUND OR U IF UNDERGROUND, BOTH IF APPLICABLE

| | | | | |
|--------------------------------------|---|---|--|-------------------------------------|
| A. SYSTEM TYPE | A U 1 SUCTION | A U 2 PRESSURE | <u>A</u> 3 GRAVITY | A U 99 OTHER |
| B. CONSTRUCTION | <u>A</u> 1 SINGLE WALL | A U 2 DOUBLE WALL | A U 3 LINED TRENCH | A U 15 UNKNOWN |
| C. MATERIAL AND CORROSION PROTECTION | A U 1 BARE STEEL | A U 2 STAINLESS STEEL | A U 3 POLYVINYL CHLORIDE (PVC) | A U 4 FIBERGLASS PIPE |
| | A U 5 ALUMINUM | A U 6 CONCRETE | A U 7 STEEL W/ COATING | A U 8 100% METHANOL COMPATIBLE W/FP |
| | A U 9 GALVANIZED STEEL | A U 10 CATHODIC PROTECTION | <u>A</u> 15 UNKNOWN | A U 99 OTHER |
| D. LEAK DETECTION | <input type="checkbox"/> 1 AUTOMATIC LINE LEAK DETECTOR | <input type="checkbox"/> 2 LINE TIGHTNESS TESTING | <input type="checkbox"/> 3 INTERSTITIAL MONITORING | <input type="checkbox"/> 99 OTHER |

V. TANK LEAK DETECTION

| | | | | |
|--|---|---|---|--|
| <input checked="" type="checkbox"/> 1 VISUAL CHECK | <input type="checkbox"/> 2 INVENTORY RECONCILIATION | <input type="checkbox"/> 3 VAPOR MONITORING | <input type="checkbox"/> 4 AUTOMATIC TANK GAUGING | <input type="checkbox"/> 5 GROUND WATER MONITORING |
| <input type="checkbox"/> 6 TANK TESTING | <input type="checkbox"/> 7 INTERSTITIAL MONITORING | <input type="checkbox"/> 8 NONE | <input type="checkbox"/> 15 UNKNOWN | <input type="checkbox"/> 99 OTHER |

VI. TANK CLOSURE INFORMATION

| | | |
|--|--|--|
| 1. ESTIMATED DATE LAST USED (MO/DAY/YR) <u>IN USE</u> | 2. ESTIMATED QUANTITY OF SUBSTANCE REMAINING <u>375</u> GALLONS | 3. WAS TANK FILLED WITH INERT MATERIAL? YES <input type="checkbox"/> NO <input type="checkbox"/> |
|--|--|--|

THIS FORM HAS BEEN COMPLETED UNDER PENALTY OF PERJURY, AND TO THE BEST OF MY KNOWLEDGE, IS TRUE AND CORRECT

APPLICANT'S NAME
(PRINTED & SIGNATURE)

DATE

LOCAL AGENCY USE ONLY THE STATE I.D. NUMBER IS COMPOSED OF THE FOUR NUMBERS BELOW

| | | | | |
|---------------|-------------------------|----------------|------------------------|--------|
| STATE I.D.# | COUNTY # | JURISDICTION # | FACILITY # | TANK # |
| | | | | |
| PERMIT NUMBER | PERMIT APPROVED BY/DATE | | PERMIT EXPIRATION DATE | |

Attachment 3

Hazardous Waste Manifest and Certificate of Destruction for USTs

**UNIFORM HAZARDOUS
WASTE MANIFEST**

1. Generator's US EPA ID No.

Manifest Document No.

2. Page 1

Information in the shaded areas
is not required by Federal law.

CA 6570025878 93606

1 of 1

3. Generator's Name and Mailing Address
NORTH HIGHLANDS ANG STATION
3900 ROSEVILLE ROAD, NORTH HIGHLANDS, CA 95660

A. State Manifest Document Number
95893606

4. Generator's Phone (916) 569-2238

B. State Generator's ID

5. Transporter 1 Company Name

6. US EPA ID Number

ERICKSON INC

CAD009466392

C. State Transporter's ID
616587

D. Transporter's Phone 510-235-1393

7. Transporter 2 Company Name

8. US EPA ID Number

E. State Transporter's ID

9. Designated Facility Name and Site Address

10. US EPA ID Number

ERICKSON, Inc.
255 Parr Blvd.
Richmond, CA. 94801

CAD009466392

F. Transporter's Phone

G. State Facility's ID

H. Facility's Phone (510) 235-1393

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)

12. Containers
No. Type

13. Total
Quantity

14. Unit
Wt/Vol

15. Waste Number

NON-RCRA Hazardous Waste Solid

Waste Empty Storage Tank.

02TP

5000P

512

EPA/RCRA

b.

State

EPA/Other

c.

State

EPA/Other

d.

State

EPA/Other

Additional Descriptions for Materials Listed Above

Qty 02 Empty Storage Tank(s) #1707, 1708
Tank(s) have been inerted with 15
lbs Dry Ice Per 1000 Gallon Capacity

K. Handling Codes for Wastes Listed Above

a. b.

c. d.

15. Special Handling Instructions and Additional Information

Keep away from sources of ignition. Always wear hardhats when working around
U.G.S.T.'s 24 Hr. Contact Name GUY FLEMING Phone (916) 569-2236 or 268-0474

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified,
packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be
economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future
threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best
waste management method that is available to me and that I can afford.

Printed/Typed Name

CARL H. FERICKE

Signature

Carl H. Fericke

Month 12 Day 05 Year 95

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name

CHARLEY ELMORE

Signature

Charley Elmore

Month 12 Day 05 Year 95

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name

Signature

Month Day Year

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name

Signature

Month Day Year

DO NOT WRITE BELOW THIS LINE.

DAY OR NIGHT
TELEPHONE
(415) 235-1393

CERTIFICATE
CERTIFIED SERVICES COMPANY
255 Parr Boulevard • Richmond, California 94801

NO. 17866

CUSTOMER
AZTECA CONSTRUCTION
JOB NO.
967175

FOR: ERICKSON INC. TANK NO. 17007

LOCATION: RICHMOND DATE: 12/18/85 TIME: 08:53 AM

TEST METHOD VISUAL/GASTECH (O2/LEL METER) LAST PRODUCT DIESEL

This is to certify that I have personally determined that this tank is in accordance with the American Petroleum Institute and have found the condition to be in accordance with its assigned designation. This certificate is based on conditions existing at the time the inspection herein set forth was completed and is issued subject to compliance with all qualifications and instructions.

TANK SIZE 3000 GALLON CONDITION SAFE FOR FIRE

REMARKS: OXYGEN 20.9%, LOWER EXPLOSIVE LIMIT (LEL) LESS THAN 0.1%.
ERICKSON INC. HEREBY CERTIFIES THAT THE ABOVE NUMBERED TANK HAS BEEN
CUT OPEN, PROCESSED AND THEREFORE DESTROYED AT OUR PERMITTED HAZARDOUS
WASTE FACILITY.
ERICKSON INC. HAS THE APPROPRIATE PERMITS FOR AND HAS ACCEPTED THE TANK
SHIPPED TO US FOR PROCESSING.

In the event of any physical or atmospheric changes affecting the gas-free conditions of the above tanks, or if in any doubt, immediately stop all hot work and contact the undersigned. This permit is valid for 24 hours if no physical or atmospheric changes occur.

STANDARD SAFETY DESIGNATION

SAFE FOR MEN: Means that in the compartment or space so designated (a) The oxygen content of the atmosphere is at least 19.5 percent by volume; and that (b) Toxic materials in the atmosphere are within permissible concentrations; and (c) In the judgment of the Inspector, the residues are not capable of producing toxic materials under existing atmospheric conditions while maintained as directed on the Inspector's certificate.

SAFE FOR FIRE: Means that in the compartment so designated (a) The concentration of flammable materials in the atmosphere is below 10 percent of the lower explosive limit; and that (b) In the judgment of the Inspector, the residues are not capable of producing a higher concentration that permitted under existing atmospheric conditions in the presence of fire and while maintained as directed on the Inspector's certificate, and further, (c) All adjacent spaces have either been cleaned sufficiently to prevent the spread of fire, are satisfactorily inerted, or in the case of fuel tanks, have been treated as deemed necessary by the Inspector.

The undersigned representative acknowledges receipt of this certificate and understands the conditions and limitations under which it was issued.

REPRESENTATIVE

TITLE

INSPECTOR

DAY OR NIGHT
TELEPHONE
(510) 235-1393

CERTIFICATE CERTIFIED SERVICES COMPANY

255 Parr Boulevard • Richmond, California 94801

NO.17867

CUSTOMER
AZTECA CONSTRUCTION
JOB NO.
967175

FOR: ERICKSON INC. TANK NO. 17008

LOCATION: RICHMOND DATE: 12/18/95 TIME: 08:54 AM

TEST METHOD VISUAL/GASTECH (O2/LEL METER) LAST PRODUCT DIESEL

This is to certify that I have personally determined that this tank is in accordance with the American Petroleum Institute and have found the condition to be in accordance with its assigned designation. This certificate is based on conditions existing at the time the inspection herein set forth was completed and is issued subject to compliance with all qualifications and instructions.

TANK SIZE 2000 GALLON CONDITION SAFE FOR FIRE

REMARKS: OXYGEN 20.9%, LOWER EXPLOSIVE LIMIT (LEL) LESS THAN 0.1%.

ERICKSON INC. HEREBY CERTIFIES THAT THE ABOVE NUMBERED TANK HAS BEEN

CUT OPEN, PROCESSED AND THEREFORE DESTROYED AT OUR PERMITTED HAZARDOUS

WASTE FACILITY.

ERICKSON INC. HAS THE APPROPRIATE PERMITS FOR AND HAS ACCEPTED THE TANK

SHIPPED TO US FOR PROCESSING.

In the event of any physical or atmospheric changes affecting the gas-free conditions of the above tanks, or if in any doubt, immediately stop all hot work and contact the undersigned. This permit is valid for 24 hours if no physical or atmospheric changes occur.

STANDARD SAFETY DESIGNATION

SAFE FOR MEN: Means that in the compartment or space so designated (a) The oxygen content of the atmosphere is at least 19.5 percent by volume; and that (b) Toxic materials in the atmosphere are within permissible concentrations; and (c) In the judgment of the Inspector, the residues are not capable of producing toxic materials under existing atmospheric conditions while maintained as directed on the Inspector's certificate.

SAFE FOR FIRE: Means that in the compartment so designated (a) The concentration of flammable materials in the atmosphere is below 10 percent of the lower explosive limit; and that (b) In the judgment of the Inspector, the residues are not capable of producing a higher concentration that permitted under existing atmospheric conditions in the presence of fire and while maintained as directed on the Inspector's certificate, and further, (c) All adjacent spaces have either been cleaned sufficiently to prevent the spread of fire, are satisfactorily inerted, or in the case of fuel tanks, have been treated as deemed necessary by the Inspector.

The undersigned representative acknowledges receipt of this certificate and understands the conditions and limitations under

Attachment 4

Laboratory Reports from UST Removal

500 Giuseppe Court, Suite 9
Roseville, Ca. 95678
(916) 773-3664

CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST

Project Manager's

Phor

Phone #: 997 3172

ANALYSIS REQUEST

III

Company/Address:

FAX #: 251 927 0

Company/Address: APTZ 3871 S. CUN. TZ PARK DE BAYAMON CORADO
FAX #: 351 9270

Project Number:

陳國治

Project Name:

McClellan Aug.

Project Location:

Project Location: 3900 Roxville Rd

Sampler Signature:

Sampler Signature: 

[illegible]

Reinquisitioned by

Date _____ Time _____

Received by:

Remarks:

Reinquired by

Date
Time

Received by:

Reinquired by

Date _____ Time _____

Received by Laboratory

Bill To:

500 Giuseppe Court, Suite 9
Roseville, Ca. 95678
(916) 773-3664

CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST

Project Manager:

Manager:

Phone #: 997 3172

Company/Address:

FAX #: 331 9270

ARTEZA 3871 SEWELL PARCERBATHCO.

Project Number:

注：○、△

Project Name:

WHEELMAN A/V

Project Location:

Sampler Signature

3900 Roseville Rd
N. Hix Houns
K. D. D. D.
Signature: [illegible]

[illegible]

Belindingshad bv

1

2

10

Retained by

100

Described by:

Zeitliche Aspekte

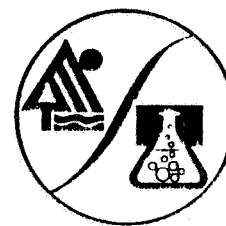
100

7-11

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**EXCELCHEM
ENVIRONMENTAL LABS**

500 Giuseppe Court, Suite 9
Roseville, CA 95678
Phone#: (916) 773-3664 Fax#: (916) 773-4784



ANALYSIS REPORT

| | | | |
|------------|--------------------------|----------------|----------|
| Attention: | Mr. Dale Tobiassen | Date Sampled : | 12-05-95 |
| | AZTECA | Date Received: | 12-05-95 |
| | 3871 Security Park Drive | BTEX Analyzed: | 12-08-95 |
| | Rancho Cordova, CA 95670 | TPHg Analyzed: | 12-08-95 |
| Project #: | 95146 / McClellan A.N.G. | Matrix: | Soil |

| | <u>Benzene</u> <u>PPM</u> | <u>Toluene</u> <u>PPM</u> | <u>Ethyl-</u> <u>benzene</u> <u>PPM</u> | <u>Total</u> <u>Xylenes</u> <u>PPM</u> | <u>TPHg</u> <u>PPM</u> |
|------------------|------------------------------|------------------------------|---|--|---------------------------|
| Reporting Limit: | 0.025 | 0.025 | 0.025 | 0.025 | 5.0 |

SAMPLE

Laboratory Identification:

| | | | | | |
|------------------|----|------|------|------|-----|
| 107S S1295069 | ND | ND | 0.16 | 0.42 | 78* |
| 108E S1295071 | ND | 0.15 | 0.18 | 1.5 | 44* |

ppm = Parts per million = mg/Kg = milligram per Kilogram

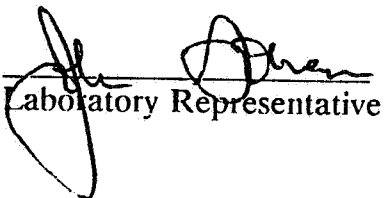
ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

* = Peaks in gasoline range, however, does not look like our gasoline standard chromatography.

ANALYTICAL PROCEDURES

BTEX-- Benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction using EPA Method 5030 followed by analysis using EPA Method 8020 which utilizes a gas chromatograph (GC) equipped with a photoionization detector (PID).

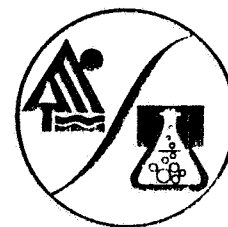
TPHg--Total petroleum hydrocarbons as gasoline (low-to-medium boiling points) are measured by extraction using EPA Method 5030, followed by modified EPA Method 8015, which utilizes a GC equipped with an FID.


Laboratory Representative

12-11-95
Date Reported

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ANALYSIS REPORT

| | | | |
|------------|--------------------------|----------------|----------|
| Attention: | Mr. Dale Tobiasen | Date Sampled : | 12-05-95 |
| | AZTECA | Date Received: | 12-05-95 |
| | 3871 Security Park Drive | BTEX Analyzed: | 12-08-95 |
| | Rancho Cordova, CA 95670 | TPHg Analyzed: | 12-08-95 |
| Project #: | 95146 / McClellan A.N.G. | Matrix: | Soil |

| | Benzene PPM | Toluene PPM | Ethyl- benzene PPM | Total Xylenes PPM | TPHg PPM |
|------------------|----------------|----------------|--------------------------|-------------------------|-------------|
| Reporting Limit: | 0.010 | 0.010 | 0.010 | 0.010 | 2.0 |

SAMPLE

Laboratory Identification:

| | | | | | |
|----------|----|----|-------|------|-----|
| 108W | ND | ND | 0.024 | 0.15 | 11* |
| S1295070 | | | | | |

ppm = Parts per million = mg/Kg = milligram per Kilogram

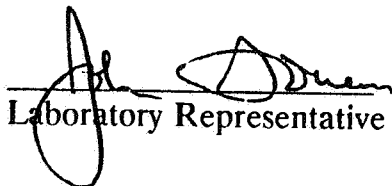
ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

* = Peaks in gasoline range, however, does not look like our gasoline standard chromatography.

ANALYTICAL PROCEDURES

BTEX-- Benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction using EPA Method 5030 followed by analysis using EPA Method 8020 which utilizes a gas chromatograph (GC) equipped with a photoionization detector (PID).

TPHg--Total petroleum hydrocarbons as gasoline (low-to-medium boiling points) are measured by extraction using EPA Method 5030, followed by modified EPA Method 8015, which utilizes a GC equipped with an FID.


Laboratory Representative

12-11-95
Date Reported

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ANALYSIS REPORT

Attention: Mr. Dale Tobiassen
AZTECA
3871 Security Park Drive
Rancho Cordova, CA 95670
Project #: 95146 / McClellan A.N.G.

Date Sampled : 12-05-95
Date Received: 12-05-95
BTEX Analyzed: 12-08-95
Matrix: Soil

| | Benzene PPM | Toluene PPM | Ethyl- benzene PPM | Total Xylenes PPM |
|------------------|----------------|----------------|--------------------------|-------------------------|
| Reporting Limit: | 0.005 | 0.005 | 0.005 | 0.005 |

SAMPLE

Laboratory Identification:

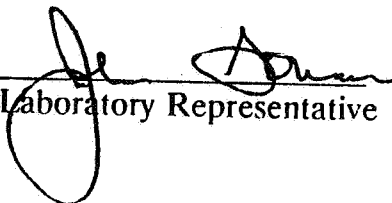
| | | | | |
|---|----|----|-------|-------|
| 3 Com A,B,C,D S1295080,081,082,083 Composite | ND | ND | 0.007 | 0.082 |
| 4 Com A,B,C,D S1295084,085,086,087 Composite | ND | ND | 0.006 | 0.022 |
| 5 Com A,B,C,D S1295088,089,090,091 Composite | ND | ND | ND | 0.034 |

ppm = Parts per million = mg/Kg = milligram per Kilogram

ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

ANALYTICAL PROCEDURES

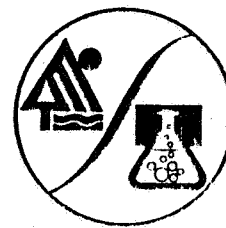
BTEX-- Benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction using EPA Method 5030 followed by analysis using EPA Method 8020 which utilizes a gas chromatograph (GC) equipped with a photoionization detector (PID).


Laboratory Representative

12-11-95
Date Reported

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ANALYSIS REPORT

Attention: Mr. Dale Tobiasen
AZTECA
3871 Security Park Drive
Rancho Cordova, CA 95670
Project #: 95146 / McClellan A.N.G.

Date Sampled : 12-05-95
Date Received: 12-05-95
BTEX Analyzed: 12-08-95

Matrix: Soil

| | Benzene PPM | Toluene PPM | Ethyl- benzene PPM | Total Xylenes PPM |
|------------------|----------------|----------------|--------------------------|-------------------------|
| Reporting Limit: | 0.010 | 0.010 | 0.010 | 0.010 |

SAMPLE
Laboratory Identification:

| | | | | |
|------------------|----|----|-------|------|
| 107N S1295068 | ND | ND | 0.030 | 0.18 |
|------------------|----|----|-------|------|

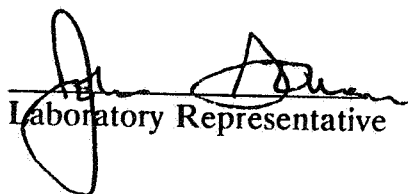
| | | | | |
|---|----|----|-------|------|
| 6 Com A,B,C,D S1295092,093,094,095 Composite | ND | ND | 0.020 | 0.19 |
|---|----|----|-------|------|

ppm = Parts per million = mg/Kg = milligram per Kilogram

ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

ANALYTICAL PROCEDURES

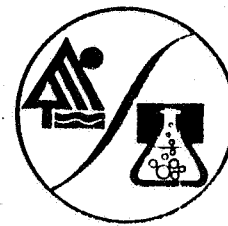
BTEX-- Benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction using EPA Method 5030 followed by analysis using EPA Method 8020 which utilizes a gas chromatograph (GC) equipped with a photoionization detector (PID).


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ANALYSIS REPORT

Attention: Mr. Dale Tobiasen
AZTECA
3871 Security Park Drive
Rancho Cordova, CA 95670
Project #: 95146 / McClellan A.N.G.

Date Sampled : 12-05-95
Date Received: 12-05-95
TPHd Analyzed: 12-07-95

Matrix: Soil

Reporting Limit: TPHd
PPM
10


**SAMPLE
Laboratory Identification**

| | |
|---|-----|
| 2 Com A,B,C,D Composite S1295076,077,078,079 | 220 |
| 3 Com A,B,C,D Composite S1295080,081,082,083 | 270 |
| 4 Com A,B,C,D Composite S1295084,085,086,087 | 110 |

PPM = Parts per million = mg/Kg = milligram per kilogram
ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

ANALYTICAL PROCEDURES

TPHd--Total petroleum hydrocarbons as diesel (high boiling points) are measured by extraction using EPA Method 3510 followed by modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.


Laboratory Representative

12-08-95
Date Reported

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ANALYSIS REPORT

Attention: Mr. Dale Tobiasen
AZTECA
3871 Security Park Drive
Rancho Cordova, CA 95670
Project #: 95146 / McClellan A.N.G.

Date Sampled : 12-05-95
Date Received: 12-05-95
TPHd Analyzed: 12-07-95

Matrix: Soil

Reporting Limit:

TPHd
PPM
10

SAMPLE

Laboratory Identification

5 Com A,B,C,D Composite
S1295088,089,090,091

300

6 Com A,B,C,D Composite
S1295092,093,094,095

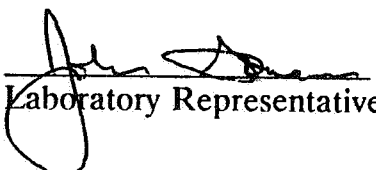
1,900

PPM = Parts per million = mg/Kg = milligram per kilogram

ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

ANALYTICAL PROCEDURES

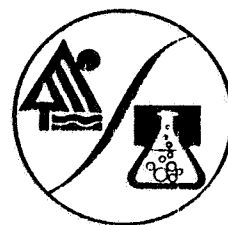
TPHd--Total petroleum hydrocarbons as diesel (high boiling points) are measured by extraction using EPA Method 3510 followed by modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.


Laboratory Representative

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ANALYSIS REPORT

| | | |
|------------|---|---|
| Attention: | Mr. Dale Tobiasen AZTECA 3871 Security Park Drive Rancho Cordova, CA 95670 | Date Sampled : 12-05-95 Date Received: 12-05-95 TPHd Analyzed: 12-07-95 |
| Project #: | 95146 / McClellan A.N.G. | Matrix: Soil |

Reporting Limit:

TPHd
PPM
20

**SAMPLE
Laboratory Identification**

108W
S1295070

1,100

PPM = Parts per million = mg/Kg = milligram per kilogram

ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

ANALYTICAL PROCEDURES

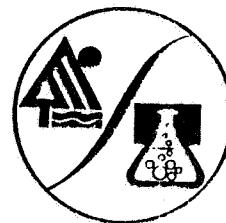
TPHd--Total petroleum hydrocarbons as diesel (high boiling points) are measured by extraction using EPA Method 3510 followed by modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.


Laboratory Representative

12-08-95
Date Reported

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ANALYSIS REPORT

Attention: Mr. Dale Tobiasen
AZTECA
3871 Security Park Drive
Rancho Cordova, CA 95670
Project #: 95146 / McClellan A.N.G.

Date Sampled : 12-05-95
Date Received: 12-05-95
TPHd Analyzed: 12-07-95

Matrix: Soil

Reporting Limit:

TPHd
PPM
50

**SAMPLE
Laboratory Identification**

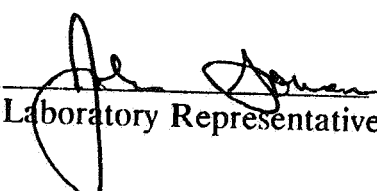
108E
S1295071

2,600

PPM = Parts per million = mg/Kg = milligram per kilogram
ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

ANALYTICAL PROCEDURES

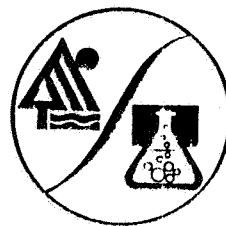
TPHd--Total petroleum hydrocarbons as diesel (high boiling points) are measured by extraction using EPA Method 3510 followed by modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.


Laboratory Representative

12-08-95
Date Reported

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ANALYSIS REPORT

Attention: Mr. Dale Tobiasen
AZTECA
3871 Security Park Drive
Rancho Cordova, CA 95670
Project #: 95146 / McClellan A.N.G.

Date Sampled : 12-05-95
Date Received: 12-05-95
TPHd Analyzed: 12-07-95

Matrix: Soil

Reporting Limit:

TPHd
PPM
100

SAMPLE
Laboratory Identification

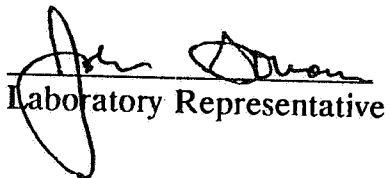
107N
S1295068

4,400

PPM = Parts per million = mg/Kg = milligram per kilogram
ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

ANALYTICAL PROCEDURES

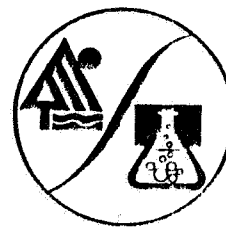
TPHd--Total petroleum hydrocarbons as diesel (high boiling points) are measured by extraction using EPA Method 3510 followed by modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.


Laboratory Representative

12-08-95
Date Reported

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ANALYSIS REPORT

| | | | |
|------------|---|----------------|----------|
| Attention: | Mr. Dale Tobiasen AZTECA 3871 Security Park Drive Rancho Cordova, CA 95670 | Date Sampled : | 12-05-95 |
| | | Date Received: | 12-05-95 |
| | | TPHd Analyzed: | 12-08-95 |
| Project #: | 95146 / McClellan A.N.G. | Matrix: | Soil |

Reporting Limit:

TPHd
PPM
10

SAMPLE

Laboratory Identification

1 Com A,B,C,D Composite
S1295072,073,074,075

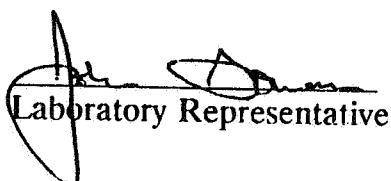
260

PPM = Parts per million = mg/Kg = milligram per kilogram

ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

ANALYTICAL PROCEDURES

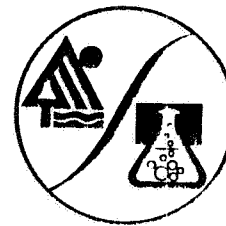
TPHd--Total petroleum hydrocarbons as diesel (high boiling points) are measured by extraction using EPA Method 3510 followed by modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.


Laboratory Representative

12-08-95
Date Reported

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ANALYSIS REPORT

| | | |
|------------|---|---|
| Attention: | Mr. Dale Tobiasen AZTECA 3871 Security Park Drive Rancho Cordova, CA 95670 | Date Sampled : 12-05-95 Date Received: 12-05-95 TPHd Analyzed: 12-08-95 |
| Project #: | 95146 / McClellan A.N.G. | Matrix: Soil |

Reporting Limit:

TPHd
PPM
50

**SAMPLE
Laboratory Identification**

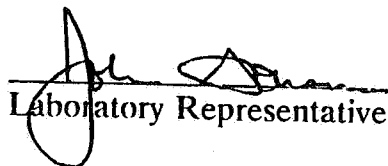
107S
S1295069

3,100

PPM = Parts per million = mg/Kg = milligram per kilogram
ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

ANALYTICAL PROCEDURES

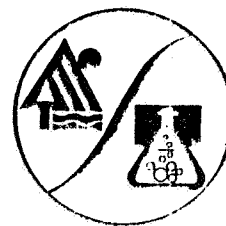
TPHd--Total petroleum hydrocarbons as diesel (high boiling points) are measured by extraction using EPA Method 3510 followed by modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.


Laboratory Representative

12-08-95
Date Reported

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ANALYSIS REPORT

Attention: Mr. Dale Tobiasen
AZTECA
3871 Security Park Drive
Rancho Cordova, CA 95670
Project #: 95146 / McClellan A.N.G.

Date Sampled : 12-05-95
Date Received: 12-05-95
Date Extracted: 12-07-95
Date Analyzed: 12-11-95
Matrix: Soil

Reporting Limit: STLC Lead
PPM
0.15

SAMPLE
Laboratory Identification

108W ND
S1295070

108E ND
S1295071

1 Com A,B,C,D ND
S1295072,073,074,075 Composite


2 Com A,B,C,D ND
S1295076,077,078,079 Composite

PPM = Parts per million = mg/L = milligram per Liter

ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

ANALYTICAL PROCEDURES

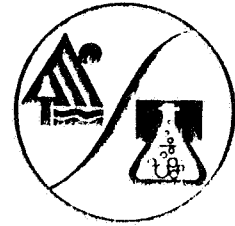
LEAD-- is measured by extraction using Titic 22, WET followed by EPA Method 7120.


Laboratory Representative

12-12-95
Date Reported

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QA/QC REPORT

Attention: Mr. Dale Tobiasen
AZTECA
3871 Security Park Drive
Rancho Cordova, CA 95670
Project #: 95146 / McClellan A.N.G.

Date Analyzed: 12-08-95
Matrix: Soil

| | Benzene PPM | Toluene PPM | Ethyl- benzene PPM | Total Xylenes PPM |
|------------------|----------------|----------------|--------------------------|-------------------------|
| Reporting Limit: | 0.005 | 0.005 | 0.005 | 0.005 |

QA/QC PARAMETER

| | | | | |
|--------------|----|----|----|----|
| Matrix Blank | ND | ND | ND | ND |
|--------------|----|----|----|----|

PERCENT RECOVERIES

| | | | | |
|------------------------|------|------|------|------|
| Matrix Spike | 109% | 106% | 102% | 103% |
| Matrix Spike Duplicate | 107% | 104% | 100% | 101% |

ppm = parts per million = mg/Kg = milligram per kilogram

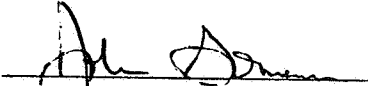
ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

All surrogate recoveries were within 30% of target values.

Spikes & Spike Duplicates were each spiked with 250 ng BTEX standard.

ANALYTICAL PROCEDURES

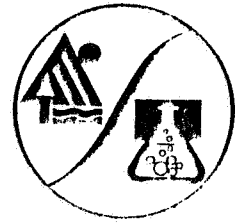
BTEX-- Benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction using EPA Method 5030 followed by analysis using EPA Method 8020 which utilizes a gas chromatograph (GC) equipped with a photoionization detector (PID).


Laboratory Representative

12-11-95
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QA/QC REPORT

Attention: Mr. Dale Tobiasen
AZTECA
3871 Security Park Drive
Rancho Cordova, CA 95670
Project #: 95146 / McClellan A.N.G.

Date Analyzed: 12-07-95
Matrix: Soil

Reporting Limit: TPHd
PPM
1.0

QA/QC PARAMETER

Matrix Blank ND

PERCENT RECOVERIES

Laboratory Control Spike 78%

Laboratory Control Spike Duplicate 70%

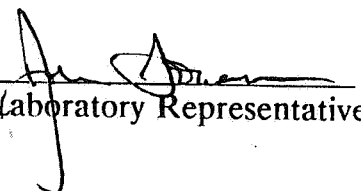
ppm = parts per million = mg/Kg = milligram per kilogram

ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

Spikes & Spike Duplicates were each spiked with 5000 ug of diesel standard.

ANALYTICAL PROCEDURES

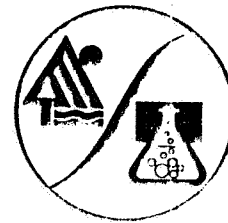
TPHd--Total petroleum hydrocarbons as diesel (high boiling points) are measured by extraction using EPA Method 3550, followed by modified EPA Method 8015, with direct sample injection into a GC equipped with an FID.


Laboratory Representative

12-11-95
Date Reported

EXCEL CHEM
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QA/QC REPORT

Attention: Mr. Dale Tobiasen
AZTECA
3871 Security Park Drive
Rancho Cordova, CA 95670
Project #: 95146 / McClellan A.N.G.

Date Analyzed: 12-11-95
Matrix: Soil

Reporting Limit: STLC Lead
PPM
0.15

QA/QC PARAMETER

Matrix Blank ND

PERCENT RECOVERIES

Matrix Spike 85%

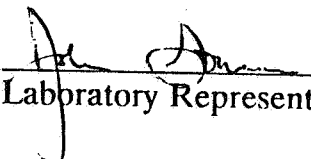
Matrix Spike Duplicate 82%

ppm = parts per million = mg/L = milligram per liter

ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

ANALYTICAL PROCEDURES

LEAD-- is measured by extraction using Title 22, WET followed by EPA Method 7420.


Laboratory Representative

12-12-95
Date Reported

**500 Giuseppe Court, Suite 9
Roseville, Ca. 95678
(916) 773-3664**

Project Manager:

Phone #: 351 0811

Company/Address:

FAX #: 351 6275

SECURITY

Project Number: P.O.#:

Project Name:

915146

$$W \sim C \sqrt{1/\lambda}$$

Project Location:

Sampler Signature

3900 Roselle Rd

Richard

| |
|---------------------------------------|
| BTEX (602/8020) |
| BTEX/TPH as Gasoline (602/8020/8015) |
| TPH as Diesel (8015) |
| TPH as Oil (8015) |
| Total Oil & Grease(5520 B/E,F) |
| Total Oil & Grease IR (5520 B/E,F,C) |
| 96 - Hour Fish Bioassay |
| EPA 601/8010 |
| EPA 602/8020 |
| EPA 615/8150 |
| EPA 608/8080 - Pesticides |
| EPA 608/8080-PCBs |
| EPA 624/8240 |
| EPA 625/8270 |
| ORGANIC LEAD |
| Reactivity, Corrosivity, Ignitibility |
| CAM - 17 Metals |
| EPA - Priority Pollutant Metals |
| EAD(7420/7421/239.2) |
| Cd, Cr, Pb, Zn, Ni |
| |
| |
| |
| |
| |
| EXPEDITED SERVICE (48 hr) or (1 wk) |

[illegible]

8-11-19

Reinquished by: _____
Date _____ Time _____

Received by:

Relinquished by

Date Time

Received by:

Relinquished by

Date _____ Time _____

Received by Laboratory:

Bill To:

Remarks:

marks: 1941 through 1949 war—
 decided to run ahead. 1950

EXCELCHEM
ENVIRONMENTAL LABS

500 Giuseppe Court, Suite 9
Roseville, CA 95678
Phone#: (916) 773-3664 Fax#: (916) 773-4784



ANALYSIS REPORT

Attention: Mr. Dale Tobiassen
AZTECA
3871 Security Park Drive
Rancho Cordova, CA 95670

Date Sampled : 12-19-95
Date Received: 12-19-95
BTEX Analyzed: 12-20-95
TPHg Analyzed: 12-20-95
Matrix: Water

Project : 95146 / McClellan

| | Benzene PPB | Toluene PPB | Ethyl- benzene PPB | Total Xylenes PPB | TPHg PPB |
|------------------|----------------|----------------|--------------------------|-------------------------|-------------|
| Reporting Limit: | 0.5 | 0.5 | 0.5 | 0.5 | 50 |

SAMPLE

Laboratory Identification:

| | | | | | |
|-----------------------|----|----|----|----|----|
| 107 Water W1295287 | ND | ND | ND | ND | ND |
|-----------------------|----|----|----|----|----|


ppb = Parts per billion = ug/l. = micrograms per liter

ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

ANALYTICAL PROCEDURES

BTEX-- Benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are analyzed by using EPA Method 602 which utilizes a gas chromatograph (GC) equipped with a photoionization detector (PID).

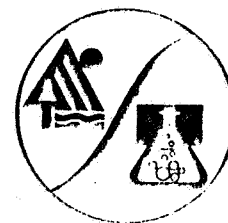
TPHg--Total petroleum hydrocarbons as gasoline (low-to-medium boiling points) are analyzed by using modified EPA Method 8015, which utilizes a GC equipped with an FID.


Laboratory Representative

12-22-95
Date Reported

EXCEL CHEM
ENVIRONMENTAL LABS

500 Giuseppe Court, Suite 9
Roseville, CA 95678
Phone#: (916) 773-3664 Fax#: (916) 773-4784



QA/QC REPORT

Attention: Mr. Dale Tobiassen
AZTECA
3871 Security Park Drive
Rancho Cordova, CA 95670
Project : 95146 / McClellan

Date Analyzed: 12-20-95
Matrix: Water

| | Benzene PPB | Toluene PPB | Ethyl- benzene PPB | Total Xylenes PPB |
|------------------|----------------|----------------|--------------------------|-------------------------|
| Reporting Limit: | 0.5 | 0.5 | 0.5 | 0.5 |

QA/QC PARAMETER

| | | | | |
|--------------|----|----|----|----|
| Matrix Blank | ND | ND | ND | ND |
|--------------|----|----|----|----|

PERCENT RECOVERIES

| | | | | |
|------------------------|------|-----|-----|-----|
| Matrix Spike | 101% | 94% | 94% | 93% |
| Matrix Spike Duplicate | 97% | 90% | 89% | 88% |

ppb = parts per billion = ug/L = microgram per liter

ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

All surrogate recoveries were within 30% of target values.

Spikes & Spike Duplicates were each spiked with 250 ng BTEX standard.

ANALYTICAL PROCEDURES

BTEX-- Benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction using EPA Method 5030 followed by analysis using EPA Method 602 which utilizes a gas chromatograph (GC) equipped with a photoionization detector (PID).


Laboratory Representative

12-22-95
Date Reported

Attachment 5

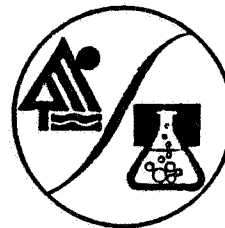
Laboratory Reports from Remedial Excavation

CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST

| Project Manager: Dale Tobiasseu Phone #: 3510202 | | ANALYSIS REQUEST TAT 496088 | | | | | | | | | | | | | | | |
|---|-----------|---|-----------|--------|----------|------------------|-----|------|-----|--------|-------|--|-------------------------------------|------------------------|------|-----------------|--|
| Company/Address: ACTETA CON INC 3519270 P.O.#: 95146 Project Name: CAL ANB | | WET (✓) TOTAL (✓) CAM - 17 Metals EPA - Priority Pollutant Metals LEAD(7420/7421/239.2) Cd, Cr, Pb, Zn, Ni | | | | | | | | | | | | | | | |
| Project Location: DEETH HIGH (Asst) Sampler Signature: [Signature] 3900 Roseville Rd | | Reactivity, Corrosivity, Ignitibility ORGANIC LEAD EPA 625/8270 EPA 624/8240 EPA 608/8080-PCBs EPA 608/8080 - Pesticides EPA 615/8150 EPA 602/8020 EPA 601/8010 96 - Hour Fish Bioassay Total Oil & Grease (5520 B/E, F, C) Total Oil & Grease (5520 B/E, F) TPH as Oil (8015) TPH as Diesel (8015) BTEX/TPH as Gasoline (602/8020/8015) BTEX (602/8020) | | | | | | | | | | | | | | | |
| Sample ID | Sampling | | Container | | | Method Preserved | | | | Matrix | | RUSH SERVICE (12 hr) or (24 hr) | EXPEDITED SERVICE (48 hr) or (1 wk) | STANDARD SERVICE (2wk) | | | |
| | DATE | TIME | VOA | SLEEVE | 1L GLASS | 1L PLASTIC | HCl | HNO3 | ICE | NONE | WATER | | | | SOIL | | |
| NEA-1 | 29 Apr 06 | 1330 | ✓ | | | | | | | | | ✓ | 7 | | ✓ | | |
| NEB A-2 | " | 1340 | ✓ | | | | | | | | | ✓ | 78 | | ✓ | | |
| NW A3 | " | 1405 | ✓ | | | | | | | | | ✓ | 79 | | ✓ | | |
| NW A4 | " | 1412 | ✓ | | | | | | | | | ✓ | 80 | | ✓ | | |
| NW A5 | " | 1420 | ✓ | | | | | | | | | ✓ | 81 | | ✓ | | |
| SWB A6 | " | 1422 | ✓ | | | | | | | | | ✓ | 82 | | ✓ | | |
| SB A7 | " | 1431 | ✓ | | | | | | | | | ✓ | 83 | | ✓ | | |
| SEB A8 | " | 1500 | ✓ | | | | | | | | | ✓ | 84 | | ✓ | | |
| Relinquished by: | | | | | | | | | | | | Received by: | | | | Remarks: | |
| Relinquished by: | | | | | | | | | | | | Received by: | | | | | |
| Relinquished by: [Signature] | | | | | | | | | | | | Received by Laboratory: [Signature] | | | | Bill To: | |

EXCELCHEM
ENVIRONMENTAL LABS

500 Giuseppe Court, Suite 9
Roseville, CA 95678
Phone#: (916) 773-3664 Fax#: (916) 773-4784



ANALYSIS REPORT

Attention: Mr. Dale Tobiasen
AZTECA CONSTRUCTION
3871 Security Park Drive
Rancho Cordova, CA 95670

Date Sampled : 04-29-96
Date Received: 04-29-96
TPHg Analyzed: 04-30-96
BTEX Analyzed: 04-29-96
TPHd Analyzed: 04-30-96
Matrix: Soil

Project : 95146

| | Benzene PPM | Toluene PPM | Ethyl- benzene PPM | Total Xylenes PPM | TPHg PPM | TPHd PPM |
|------------------|----------------|----------------|--------------------------|-------------------------|-------------|-------------|
| Reporting Limit: | 0.005 | 0.005 | 0.005 | 0.005 | 5.0 | 100 |

SAMPLE

Laboratory Identification:

| | | | | | | |
|----------|----|----|-------|-------|-------|------|
| NWA3 | ND | ND | 0.010 | 0.086 | 64.3* | 6940 |
| S0496479 | | | | | | |

ppm= Parts per million = mg/Kg= milligrams per Kilogram

ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

* = Peaks in gasoline range, however, does not resemble our gasoline standard chromatography.

ANALYTICAL PROCEDURES

BTEX-- Benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction using EPA Method 5030 followed by analysis using EPA Method 8020 which utilizes a gas chromatograph (GC) equipped with a photoionization detector (PID).

TPHg--Total petroleum hydrocarbons as gasoline (low to medium boiling points) are measured by extraction using EPA Method 5030, followed by modified EPA Method 8015 which utilizes a GC equipped with a FID.

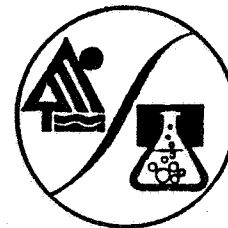
TPHd--Total petroleum hydrocarbons as diesel (high boiling points) are measured by extraction using EPA Method 3550 followed by modified EPA 8015 with direct sample injection into a GC equipped with an FID.


Laboratory Representative

04-30-96
Date Reported

EXCELCHEM
ENVIRONMENTAL LABS

500 Giuseppe Court, Suite 9
Roseville, CA 95678
Phone#: (916) 773-3664 Fax#: (916) 773-4784



ANALYSIS REPORT

Attention: Mr. Dale Tobiasen
AZTECA CONSTRUCTION
3871 Security Park Drive
Rancho Cordova, CA 95670

Date Sampled : 04-29-96
Date Received: 04-29-96
TPHg Analyzed: 04-29-96
BTEX Analyzed: 04-29-96
TPHd Analyzed: 04-29-96
Matrix: Soil

Project : 95146

| | Benzene | Toluene | Ethyl- benzene | Total Xylenes | TPHg | TPHd |
|------------------|------------|------------|-------------------|------------------|------------|------------|
| | <u>PPM</u> | <u>PPM</u> | <u>PPM</u> | <u>PPM</u> | <u>PPM</u> | <u>PPM</u> |
| Reporting Limit: | 0.005 | 0.005 | 0.005 | 0.005 | 1.0 | 1.0 |

SAMPLE

Laboratory Identification:

| | | | | | | |
|--------------------|----|----|----|-------|----|------|
| NEA-1 S0496477 | ND | ND | ND | ND | ND | ND |
| NEBA-2 S0496478 | ND | ND | ND | 0.006 | ND | 79.2 |
| WA4 S0496480 | ND | ND | ND | ND | ND | ND |

ppm= Parts per million = mg/Kg= milligrams per Kilogram

ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

ANALYTICAL PROCEDURES

BTEX-- Benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction using EPA Method 5030 followed by analysis using EPA Method 8020 which utilizes a gas chromatograph (GC) equipped with a photoionization detector (PID).

TPHg--Total petroleum hydrocarbons as gasoline (low to medium boiling points) are measured by extraction using EPA Method 5030, followed by modified EPA Method 8015 which utilizes a GC equipped with a FID.

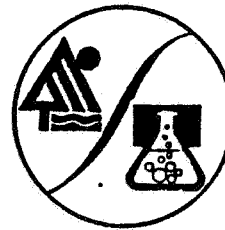
TPHd--Total petroleum hydrocarbons as diesel (high boiling points) are measured by extraction using EPA Method 3550 followed by modified EPA 8015 with direct sample injection into a GC equipped with an FID.


Laboratory Representative

04-30-96
Date Reported

EXCELCHEM
ENVIRONMENTAL LABS

500 Giuseppe Court, Suite 9
Roseville, CA 95678
Phone#: (916) 773-3664 Fax#: (916) 773-4784



ANALYSIS REPORT

Attention: Mr. Dale Tobiasen
AZTECA CONSTRUCTION
3871 Security Park Drive
Rancho Cordova, CA 95670

Date Sampled : 04-29-96
Date Received: 04-29-96
TPHg Analyzed: 04-30-96
BTEX Analyzed: 04-30-96
TPHd Analyzed: 04-30-96
Matrix: Soil

Project : 95146

| | Benzene PPM | Toluene PPM | Ethyl- benzene PPM | Total Xylenes PPM | TPHg PPM | TPHd PPM |
|------------------|----------------|----------------|--------------------------|-------------------------|-------------|-------------|
| Reporting Limit: | 0.005 | 0.005 | 0.005 | 0.005 | 1.0 | 1.0 |

SAMPLE

Laboratory Identification:

| | | | | | | |
|-------------------|----|----|----|----|-------|------|
| WBA5 S0496481 | ND | ND | ND | ND | 1.67* | 121 |
| SWBA6 S0496482 | ND | ND | ND | ND | ND | 21.9 |
| SBA7 S0496483 | ND | ND | ND | ND | ND | ND |
| SEBA8 S0496484 | ND | ND | ND | ND | ND | 91.6 |

ppm= Parts per million = mg/Kg= milligrams per Kilogram

ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

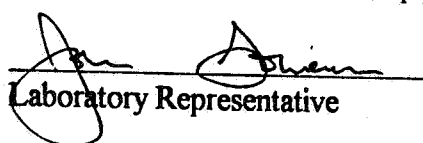
* = Peaks in gasoline range, however, does not resemble our gasoline standard chromatography.

ANALYTICAL PROCEDURES

BTEX— Benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction using EPA Method 5030 followed by analysis using EPA Method 8020 which utilizes a gas chromatograph (GC) equipped with a photoionization detector (PID).

TPHg—Total petroleum hydrocarbons as gasoline (low to medium boiling points) are measured by extraction using EPA Method 5030, followed by modified EPA Method 8015 which utilizes a GC equipped with a FID.

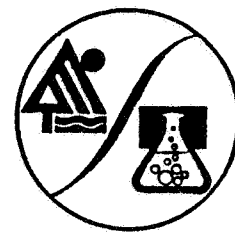
TPHd—Total petroleum hydrocarbons as diesel (high boiling points) are measured by extraction using EPA Method 3550 followed by modified EPA 8015 with direct sample injection into a GC equipped with an FID.


Laboratory Representative

04-30-96
Date Reported

**EXCELICHEM
ENVIRONMENTAL LABS**

500 Giuseppe Court, Suite 9
Roseville, CA 95678
Phone#: (916) 773-3664 Fax#: (916) 773-4784



QA/QC REPORT

Attention: Mr. Dale Tobiassen
AZTECA CONSTRUCTION
3871 Security Park Drive
Rancho Cordova, CA 35670

TPHd Analyzed: 04-30-96
Matrix: Soil

Project #: 95146

| | TPHd PPM |
|-----------------------|-------------|
| Reporting Limit: | 1.0 |
| <hr/> QA/QC PARAMETER | |

| | |
|--------------|----|
| Matrix Blank | ND |
|--------------|----|

PERCENT RECOVERIES

| | |
|------------------------------------|------|
| Matrix Spike | 88% |
| Matrix Spike Duplicate | 100% |
| Laboratory Control Spike | 96% |
| Laboratory Control Spike Duplicate | 72% |

ppm = parts per million = mg/Kg = milligram per kilogram

ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

Spikes & Spike Duplicates were each spiked with 5000 ug of diesel standard.

ANALYTICAL PROCEDURES

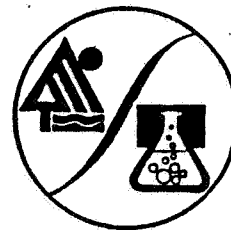
TPHd--Total petroleum hydrocarbons as diesel (high boiling points) are measured by extraction using EPA Method 3550, followed by modified EPA Method 8015, with direct sample injection into a GC equipped with an FID.


Laboratory Representative

04-30-96
Date Reported

EXCEL CHEM
ENVIRONMENTAL LABS

500 Giuseppe Court, Suite 9
Roseville, CA 95678
Phone#: (916) 773-3664 Fax#: (916) 773-4784



QA/QC REPORT

Attention: Mr. Dale Tobiassen
AZTECA CONSTRUCTION
3871 Security Park Drive
Rancho Cordova, CA 35670

BTEX Analyzed:
Matrix:

04-30-96
Soil

Project #: 95146

| | Benzene | Toluene | Ethyl- benzene | Total Xylenes |
|------------------|------------|------------|-------------------|------------------|
| | <u>PPM</u> | <u>PPM</u> | <u>PPM</u> | <u>PPM</u> |
| Reporting Limit: | 0.005 | 0.005 | 0.005 | 0.005 |

QA/QC PARAMETER

| | | | | |
|--------------|----|----|----|----|
| Matrix Blank | ND | ND | ND | ND |
|--------------|----|----|----|----|

PERCENT RECOVERIES

| | | | | |
|---------------------------|------|------|------|------|
| Matrix Spike | 101% | 104% | 103% | 106% |
| Matrix Spike Duplicate | 107% | 108% | 107% | 109% |

ppm = parts per million = mg/Kg = milligram per kilogram

ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

All surrogate recoveries were within 30% of target values.

Spikes & Spike Duplicates were each spiked with 250 ng BTEX standard.

ANALYTICAL PROCEDURES

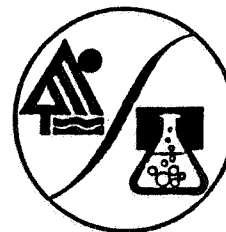
BTEX - Benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction using EPA Method 5030 followed by analysis using EPA Method 8020 which utilizes a gas chromatograph (GC) equipped with a photoionization detector (PID).


Laboratory Representative

04-30-96
Date Reported

EXCELCHEM
ENVIRONMENTAL LABS

500 Giuseppe Court, Suite 9
Roseville, CA 95678
Phone#: (916) 773-3664 Fax#: (916) 773-4784



ANALYSIS REPORT

Attention: Mr. Dale Tobiasen
AZTECA CONSTRUCTION
3871 Security Park Drive
Rancho Cordova, CA 95670

Date Sampled : 05-01-96
Date Received: 05-01-96
TPHg Analyzed: 05-01-96
BTEX Analyzed: 05-01-96
TPHd Analyzed: 05-01-96
Matrix: Soil

Project : 95-146 / CAL ANG

| | Benzene | Toluene | Ethyl- benzene | Total Xylenes | TPHg | TPHd |
|------------------|------------|------------|-------------------|------------------|------------|------------|
| | <u>PPM</u> | <u>PPM</u> | <u>PPM</u> | <u>PPM</u> | <u>PPM</u> | <u>PPM</u> |
| Reporting Limit: | 0.005 | 0.005 | 0.005 | 0.005 | 1.0 | 1.0 |

SAMPLE

Laboratory Identification:

| | | | | | | |
|----------------|----|----|----|----|----|-----|
| B1 S0596001 | ND | ND | ND | ND | ND | ND |
| B2 S0596002 | ND | ND | ND | ND | ND | 106 |
| B3 S0596003 | ND | ND | ND | ND | ND | ND |
| B4 S0596004 | ND | ND | ND | ND | ND | ND |
| B5 S0596005 | ND | ND | ND | ND | ND | ND |

ppm= Parts per million = mg/Kg= milligrams per Kilogram

ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

ANALYTICAL PROCEDURES

BTEX-- Benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction using EPA Method 5030 followed by analysis using EPA Method 8020 which utilizes a gas chromatograph (GC) equipped with a photoionization detector (PID).

TPHg--Total petroleum hydrocarbons as gasoline (low to medium boiling points) are measured by extraction using EPA Method 5030, followed by modified EPA Method 8015 which utilizes a GC equipped with a FID.

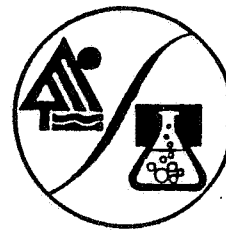
TPHd--Total petroleum hydrocarbons as diesel (high boiling points) are measured by extraction using EPA Method 3550 followed by modified EPA 8015 with direct sample injection into a GC equipped with an FID.


Laboratory Representative

05-01-96
Date Reported

EXCELCHEM
ENVIRONMENTAL LABS

500 Giuseppe Court, Suite 9
Roseville, CA 95678
Phone#: (916) 773-3664 Fax#: (916) 773-4784



QA/QC REPORT

Attention: Mr. Dale Tobiassen
AZTECA CONSTRUCTION
3871 Security Park Drive
Rancho Cordova, CA 95670

BTEX Analyzed: 05-01-96
Matrix: Soil

Project #: 95-146 / CAL ANG

| | Benzene | Toluene | Ethyl- benzene | Total Xylenes |
|------------------|------------|------------|-------------------|------------------|
| | <u>PPM</u> | <u>PPM</u> | <u>PPM</u> | <u>PPM</u> |
| Reporting Limit: | 0.005 | 0.005 | 0.005 | 0.005 |

QA/QC PARAMETER

| | | | | |
|--------------|----|----|----|----|
| Matrix Blank | ND | ND | ND | ND |
|--------------|----|----|----|----|

PERCENT RECOVERIES

| | | | | |
|---------------------------|------|------|------|------|
| Matrix Spike | 113% | 114% | 114% | 117% |
| Matrix Spike Duplicate | 114% | 114% | 113% | 115% |

ppm = parts per million = mg/Kg = milligram per kilogram

ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

All surrogate recoveries were within 30% of target values.

Spikes & Spike Duplicates were each spiked with 250 ng BTEX standard.

ANALYTICAL PROCEDURES

BTEX-- Benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction using EPA Method 5030 followed by analysis using EPA Method 8020 which utilizes a gas chromatograph (GC) equipped with a photoionization detector (PID).

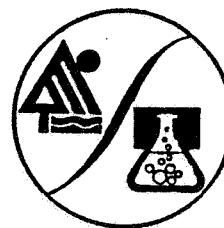

Laboratory Representative

05-01-96
Date Reported

**EXCELCHEM
ENVIRONMENTAL LABS**

500 Giuseppe Court, Suite 9
Roseville, CA 95678

Phone#: (916) 773-3664 Fax#: (916) 773-4784



QA/QC REPORT

Attention: Mr. Dale Tobiasen
AZTECA CONSTRUCTION
3871 Security Park Drive
Rancho Cordova, CA 95670

TPHd Analyzed:
Matrix:

05-01-96
Soil

Project #: 95-146 / CAL ANG

| | TPHd PPM |
|------------------|-------------|
| Reporting Limit: | 1.0 |

QA/QC PARAMETER

| | |
|--------------|----|
| Matrix Blank | ND |
|--------------|----|

PERCENT RECOVERIES

| | |
|--------------|------|
| Matrix Spike | 107% |
|--------------|------|

| | |
|------------------------|------|
| Matrix Spike Duplicate | 117% |
|------------------------|------|

| | |
|--------------------------|-----|
| Laboratory Control Spike | 98% |
|--------------------------|-----|

| | |
|---------------------------------------|-----|
| Laboratory Control Spike Duplicate | 96% |
|---------------------------------------|-----|

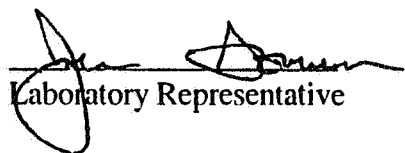
ppm = parts per million = mg/Kg = milligram per kilogram

ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

Spikes & Spike Duplicates were each spiked with 5000 ug of diesel standard.

ANALYTICAL PROCEDURES

TPHd--Total petroleum hydrocarbons as diesel (high boiling points) are measured by extraction using EPA Method 3550, followed by modified EPA Method 8015, with direct sample injection into a GC equipped with an FID.


Laboratory Representative

05-01-96
Date Reported

CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST

4946 Watt Avenue, #38
North Highlands, CA 95660
(916) 334-8661

Phone #: We b: 1-800-947-3172

FAX#:

3519270

P.O.#:

Project Name:

Sampler Signature:

Matrix

WATER
SOIL

BTEX (602/8020)

BTEX/TPH as Gasoline (602/8020/8015)

TPH as Diesel (8015)

TPH as Oil (8015)

Total Oil & Grease (5520 B/E,F)

Total Oil & Grease IR (5520 B/E,F,C)

96 - Hour Fish Bioassay

EPA 601/8010

EPA 602/8020

EPA 615/8150

EPA 608/8080 - Pesticides

EPA 608/8080-PCBs

EPA 624/8240

EPA 625/8270

ORGANIC LEAD

Reactivity, Corrosivity, Ignitibility

CAM - 17 Metals

EPA - Priority Pollutant Metals

LEAD(7420/7421/239.2)

Cd, Cr, Pb, Zn, Ni

RUSH SERVICE (12 hr) or (24 hr)

EXPEDITED SERVICE (48 hr) or (1 wk)

STANDARD SERVICE (2wk)

ANALYSIS REQUEST

TAT

Date Time

Received by:

Remarks:

Date Time

Received by:

Date Time

Received by Laboratory:

Bill To:

596065

EXCELCHEM
ENVIRONMENTAL LABS

500 Giuseppe Court, Suite 9
Roseville, CA 95678

Phone#: (916) 773-3664 Fax#: (916) 773-4784



ANALYSIS REPORT

Attention: Mr. Dale Tobiasen
AZTECA CONSTRUCTION
3871 Security Park Drive
Rancho Cordova, CA 95670

Date Sampled : 05-02-96
Date Received: 05-02-96
TPHg Analyzed: 05-02-96
BTEX Analyzed: 05-02-96
TPHd Analyzed: 05-02-96
Matrix: Soil

Project : 95146 / Cal. Ang.

| | Benzene | Toluene | Ethyl- benzene | Total Xylenes | TPHg | TPHd |
|------------------|------------|------------|-------------------|------------------|------------|------------|
| | <u>PPM</u> | <u>PPM</u> | <u>PPM</u> | <u>PPM</u> | <u>PPM</u> | <u>PPM</u> |
| Reporting Limit: | 0.005 | 0.005 | 0.005 | 0.005 | 1.0 | 1.0 |

SAMPLE

Laboratory Identification:

| | | | | | | |
|----------|----|----|----|----|----|----|
| C-1 | ND | ND | ND | ND | ND | ND |
| S0596023 | | | | | | |

ppm= Parts per million = mg/Kg= milligrams per Kilogram
ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

ANALYTICAL PROCEDURES

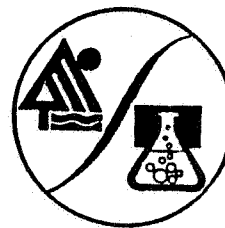
BTEX- Benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction using EPA Method 5030 followed by analysis using EPA Method 8020 which utilizes a gas chromatograph (GC) equipped with a photoionization detector (PID).
TPHlg-Total petroleum hydrocarbons as gasoline (low to medium boiling points) are measured by extraction using EPA Method 5030, followed by modified EPA Method 8015 which utilizes a GC equipped with a FID.
TPHhd-Total petroleum hydrocarbons as diesel (high boiling points) are measured by extraction using EPA Method 3550 followed by modified EPA 8015 with direct sample injection into a GC equipped with an FID.


Laboratory Representative

05-03-96
Date Reported

EXCELCHEM
ENVIRONMENTAL LABS

500 Giuseppe Court, Suite 9
Roseville, CA 95678
Phone#: (916) 773-3664 Fax#: (916) 773-4784



QA/QC REPORT

Attention: Mr. Dale Tobiassen
AZTECA CONSTRUCTION
3871 Security Park Drive
Rancho Cordova, CA 95670

BTEX Analyzed:
Matrix:

05-02-96
Soil

Project #: 95146 / Cal. Ang.

| | Benzene <u>PPM</u> | Toluene <u>PPM</u> | Ethyl- benzene <u>PPM</u> | Total Xylenes <u>PPM</u> |
|------------------|-----------------------|-----------------------|---------------------------------|--------------------------------|
| Reporting Limit: | 0.005 | 0.005 | 0.005 | 0.005 |

QA/QC PARAMETER

| | | | | |
|--------------|----|----|----|----|
| Matrix Blank | ND | ND | ND | ND |
|--------------|----|----|----|----|

PERCENT RECOVERIES

| | | | | |
|---------------------------|------|------|------|------|
| Matrix Spike | 97% | 97% | 96% | 97% |
| Matrix Spike Duplicate | 102% | 102% | 101% | 102% |

ppm = parts per million = mg/Kg = milligram per kilogram

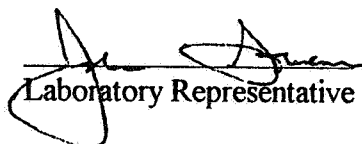
ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

All surrogate recoveries were within 30% of target values.

Spikes & Spike Duplicates were each spiked with 250 ng BTEX standard.

ANALYTICAL PROCEDURES

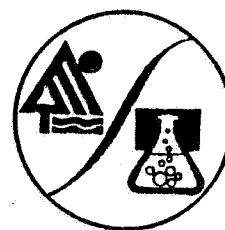
BTEX- Benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction using EPA Method 5030 followed by analysis using EPA Method 8020 which utilizes a gas chromatograph (GC) equipped with a photoionization detector (PID).


Laboratory Representative

05-02-96
Date Reported

EXCELCHEM
ENVIRONMENTAL LABS

500 Giuseppe Court, Suite 9
Roseville, CA 95678
Phone#: (916) 773-3664 Fax#: (916) 773-4784



QA/QC REPORT

Attention: Mr. Dale Tobiassen
AZTECA CONSTRUCTION
3871 Security Park Drive
Rancho Cordova, CA 95670

TPHd Analyzed: 05-02-96
Matrix: Soil

Project #: 95146 / Cal. Ang.

| | TPHd PPM |
|-----------------------|-------------|
| Reporting Limit: | 1.0 |
| <hr/> QA/QC PARAMETER | |

| | |
|--------------|----|
| Matrix Blank | ND |
|--------------|----|

PERCENT RECOVERIES

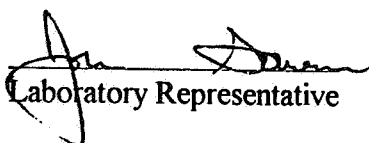
| | |
|------------------------------------|------|
| Matrix Spike | 100% |
| Matrix Spike Duplicate | 105% |
| Laboratory Control Spike | 112% |
| Laboratory Control Spike Duplicate | 114% |

ppm = parts per million = mg/Kg = milligram per kilogram
ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

Spikes & Spike Duplicates were each spiked with 5000 ug of diesel standard.

ANALYTICAL PROCEDURES

TPHd—Total petroleum hydrocarbons as diesel (high boiling points) are measured by extraction using EPA Method 3550, followed by modified EPA Method 8015, with direct sample injection into a GC equipped with an FID.


Laboratory Representative

05-02-96
Date Reported

Attachment 6

Non-hazardous Waste Manifests for the Soil Transported to MST

NON-HAZARDOUS WASTE MANIFEST
ACCEPTANCE #96-0429-1A2T

Generator Name:

Cal. Air National Guard

Mailing Address:

3900 ROSEVILLE Rd
NORTH HIGH LANDS CA

Phone Number:

916 569 2236

Generator's EPA ID Number: (If Applicable)

CA 6570025878

Contact Person:

Col. GERICK

Signature of Authorized Agent/Title:

Date:

X H. O. Tobal for Col. Gerick 4-29-96

Site Location: (Address)

SAME

Site Owner:

SAME

Waste Description:

(diesel contaminated soil, drill cuttings, etc.)

Required Protective Equipment or
Special Handling Procedures?:

NONE

Murieta Soil Technologies, LLC

Murieta Soil Technologies, LLC (MST) shall be under no obligation to accept soil if weather or other conditions impair the safe and effective acceptance or remediation of the soil, if remediation of the soil impairs the safe and effective operation of MST's remediation facility, or if the soil does not fit the profile provided by the generator. MST will not be responsible for costs incurred due to MST's inability to accept the soil.

Transporter Name:

MARTIN Trucking

Mailing Address:

(916) 364-0175

Phone Number:

P.U.C. 172859

State Transporter's ID Number:

Signature of Authorized Agent/Title:

Date:

X Keith W. 4-29-96

Driver's Name:

HECTOR WEBB

US EPA ID Number: (If Applicable)

☒ End Dump

☐ Flat-Bed

☐ Roll Off(s)

☐ Van

☐ Transfer

☐ Drums

Notes:

Scheduling of soil deliveries must be made prior to 4:00 p.m. on the day prior to expected arrival. Any unscheduled loads will be refused. To schedule a Load, Call (916) 354-1321

Quantity Received:

18.63

Weight Ticket No.:

2302

Truck License#:

20

Signature of Authorized Agent/Title:

Date:

X Keith W. 4/29/96

Murieta Soil Technologies, LLC
7879 Van Vleck Road
Rancho Murieta, CA 95683
(916) 354-1321

Remarks:

MANIFEST No.

TO BE COMPLETED BY GENERATOR

CAL Air National Guard

Mailing Address:

3900 Roseville Rd
North Highlands, CA

Phone Number:

916 569 2236

Generator's EPA ID Number: (If Applicable)

CA 6570025878

Contact Person:

Col. GERICK

Signature of Authorized Agent/Title:

Date:

X *[Signature]* FOR Col. GERICK

4-29-96

Site Location: (Address)

SAME

Site Owner:

SAME

Waste Description:

(diesel contaminated soil, drill cuttings, etc.)

Required Protective Equipment or
Special Handling Procedures?:

NONE

Murieta Soil Technologies, LLC

Murieta Soil Technologies, LLC (MST) shall be under no obligation to accept soil if weather or other conditions impair the safe and effective acceptance or remediation of the soil, if remediation of the soil impairs the safe and effective operation of MST's remediation facility, or if the soil does not fit the profile provided by the generator. MST will not be responsible for costs incurred due to MST's inability to accept the soil.

TO BE COMPLETED BY TRANSPORTER

Transporter Name:

N.B.B. Trucking

Mailing Address:

7329 Simon St
Sacramento, CA 95834

Phone Number:

916-383-2536

State Transporter's ID Number:

T-186258

Signature of Authorized Agent/Title:

Date:

X *[Signature]*

4-29-96

Driver's Name:

DONALD BEPES

US EPA ID Number: (If Applicable)

☐ End Dump☐ Flat-Bed☐ Roll Off(s)☐ Van☒ Transfer☐ Drums

Notes:

Scheduling of soil deliveries must be made prior to 4:00 p.m. on the day prior to expected arrival. Any unscheduled loads will be refused. To schedule a Load, Call (916) 354-1321

Quantity Received:

22.66

Weight Ticket No.:

2303

Truck License#:

1P20782

Signature of Authorized Agent/Title:

Date:

X *[Signature]*

4/29/96

Murieta Soil Technologies, LLC
7879 Van Vleck Road
Rancho Murieta, CA 95683
(916) 354-1321

Remarks:

MANIFEST No.

NON-HAZARDOUS WASTE MANIFEST
ACCEPTANCE # 96 - 0429 - 1A2T

TO BE COMPLETED BY GENERATOR

Generator Name:

CA. Ase National Guard

Mailing Address:

3900 ROOSEVELT RD
NORTH HIGH LANDS CA.

Phone Number:

916 569 2236

Generator's EPA ID Number: (If Applicable)

CA 6570025878

Contact Person:

Col. GERICK

Signature of Authorized Agent/Title:

Date:

X *[Signature]* For Col. GERICK 4-29-96

Site Location: (Address)

SAME

Site Owner:

SAME

Waste Description:

(diesel contaminated soil, drill cuttings, etc.)

Required Protective Equipment or
Special Handling Procedures?

NONE

Murieta Soil Technologies, LLC

Murieta Soil Technologies, LLC (MST) shall be under no obligation to accept soil if weather or other conditions impair the safe and effective acceptance or remediation of the soil, if remediation of the soil impairs the safe and effective operation of MST's remediation facility, or if the soil does not fit the profile provided by the generator. MST will not be responsible for costs incurred due to MST's inability to accept the soil.

TO BE COMPLETED BY TRANSPORTER

Transporter Name:

Patron Trucking

Mailing Address:

4645 BALEY BLVD
Sacto, CA 95838

Phone Number:

641-6172

State Transporter's ID Number:

174-469

Signature of Authorized Agent/Title:

Date:

X *[Signature]* 4-29-96

Driver's Name:

DAVID HARVEY

US EPA ID Number: (If Applicable)

☐ End Dump

☐ Flat-Bed

☐ Roll Off(s)

☐ Van

☒ Transfer

☐ Drums

Notes:

Scheduling of soil deliveries must be made prior to 4:00 p.m. on the day prior to expected arrival. Any unscheduled loads will be refused. To schedule a Load, Call (916) 354-1321

Quantity Received:

19.76

Weight Ticket No.:

2304

Truck License#:

3K08476

Signature of Authorized Agent/Title:

Date:

X *[Signature]* 4/29/96

Murieta Soil Technologies, LLC
7879 Van Vleck Road
Rancho Murieta, CA 95683
(916) 354-1321

Remarks:

MANIFEST No.

Murieta Soil Technologies, LLC

NON-HAZARDOUS WASTE MANIFEST

ACCEPTANCE # 96-0429-1A2T

4

| | | |
|---|--|--|
| TO BE COMPLETED BY GENERATOR | Generator Name: <u>CA Air National Guard</u> | Site Location: (Address) <u>SAME</u> |
| | Mailing Address: <u>3900 ROSEVILLE RD</u> | Site Owner: <u>SAME</u> |
| | <u>NORTH HIGHLANDS CA</u> | Waste Description: <u>(Diesel contaminated soil, drill cuttings, etc.)</u> |
| | Phone Number: <u>916 569 2236</u> | Required Protective Equipment or Special Handling Procedures?: <u>NONE</u> |
| | Generator's EPA ID Number: (If Applicable) <u>CA 6570025878</u> | |
| Contact Person: <u>Col. GERICK</u> | | |
| Signature of Authorized Agent/Title: <u>X R D. W. GERICK</u> | Date: <u>4-29-96</u> | |

Murieta Soil Technologies, LLC

Murieta Soil Technologies, LLC (MST) shall be under no obligation to accept soil if weather or other conditions impair the safe and effective acceptance or remediation of the soil, if remediation of the soil impairs the safe and effective operation of MST's remediation facility, or if the soil does not fit the profile provided by the generator. MST will not be responsible for costs incurred due to MST's inability to accept the soil.

| | | |
|--------------------------------|--|---|
| TO BE COMPLETED BY TRANSPORTER | Transporter Name: <u>Walker Trucking</u> | Driver's Name: <u></u> |
| | Mailing Address: <u>2041 35th SAC CA 95817</u> | US EPA ID Number: (If Applicable) <u></u> |
| | Phone Number: <u>916 455-4908</u> | <input type="checkbox"/> End Dump <input type="checkbox"/> Flat-Bed |
| | State Transporter's ID Number: <u>176-745</u> | <input type="checkbox"/> Roll Off(s) <input type="checkbox"/> Van |
| | Signature of Authorized Agent/Title: <u>X R. D. W. GERICK</u> | Date: <u>4-29-96</u> |

Scheduling of soil deliveries must be made prior to 4:00 p.m. on the day prior to expected arrival. Any unscheduled loads will be refused. To schedule a Load, Call (916) 354-1321

| | |
|--|-------------------------|
| Quantity Received: | <u>15.39</u> |
| Weight Ticket No.: | <u>2305</u> |
| Truck License#: | <u>4232984</u> |
| Signature of Authorized Agent/Title: <u>X R. D. W. GERICK</u> | Date: <u>4/29/96</u> |

Murieta Soil Technologies, LLC
7879 Van Vleck Road
Rancho Murieta, CA 95683
(916) 354-1321

Remarks:

Generator Name:

CA Air National Guard

Mailing Address:

3900 ROSEVILLE RD
NORTH HIGHLANDS CA

Phone Number:

916 569 2236

Generator's EPA ID Number: (If Applicable)

CA 6570025878

Contact Person:

Col. GERICKE

Signature of Authorized Agent/Title:

X Col. Gericke FOR Col. GERICKE

Date:

4-27-76

Site Location: (Address)

SAME

Site Owner:

SAME

Waste Description:

(diesel contaminated soil, drill cuttings, etc.)Required Protective Equipment or
Special Handling Procedures?:None**Murieta Soil Technologies, LLC**

Murieta Soil Technologies, LLC (MST) shall be under no obligation to accept soil if weather or other conditions impair the safe and effective acceptance or remediation of the soil, if remediation of the soil impairs the safe and effective operation of MST's remediation facility, or if the soil does not fit the profile provided by the generator. MST will not be responsible for costs incurred due to MST's inability to accept the soil.

Transporter Name:

Chris Lewis Trucking

Mailing Address:

8362 TRIAD CR. SOUT. CA 95628

Phone Number:

916 682-5298

State Transporter's ID Number:

182-077

Signature of Authorized Agent/Title:

X Chris Lewis OWNER

Date:

4-29-65

Driver's Name:

Chris Lewis

US EPA ID Number: (If Applicable)

☐ End Dump☐ Flat-Bed☐ Roll Off(s)☐ Van☒ Transfer☐ Drums

Notes:

Scheduling of soil deliveries must be made prior to 4:00 p.m. on the day prior to expected arrival. Any unscheduled loads will be refused. To schedule a Load, Call (916) 354-1321

Quantity Received:

18.13

Weight Ticket No.:

2306

Truck License#:

2L56252

Signature of Authorized Agent/Title:

X Chris Lewis

Date:

4/29/76

Murieta Soil Technologies, LLC
7879 Van Vleck Road
Rancho Murieta, CA 95683
(916) 354-1321

Remarks:

MANIFEST No.

TO BE COMPLETED BY GENERATOR

Generator Name: **Cal. Air National Guard**
 Mailing Address: **3900 ROSEVILLE RD
 NORTH HIGH LANDS CA.**
 Phone Number: **916 569 2230**
 Generator's EPA ID Number: (If Applicable)
CA 6570825878
 Contact Person: **Col. GERIcke**
 Signature of Authorized Agent/Title: **X [Signature] Col. Gericke** Date: **4-29-96**

Site Location: (Address) **SAME**
 Site Owner: **SAME**
 Waste Description: **(diesel contaminated soil, drill cuttings, etc.)**
 Required Protective Equipment or Special Handling Procedures?: **NONE**

Murieta Soil Technologies, LLC

Murieta Soil Technologies, LLC (MST) shall be under no obligation to accept soil if weather or other conditions impair the safe and effective acceptance or remediation of the soil, if remediation of the soil impairs the safe and effective operation of MST's remediation facility, or if the soil does not fit the profile provided by the generator. MST will not be responsible for costs incurred due to MST's inability to accept the soil.

TO BE COMPLETED BY TRANSPORTER

Transporter Name: **A2TCA CONST.**
 Mailing Address: **3871 SECURITY PARK DR.
 RANCHO CORDOVA, CA**
 Phone Number: **916 351 0202**
 State Transporter's ID Number: **CA 67779**
 Signature of Authorized Agent/Title: **X [Signature]** Date: **4/29/96**

Driver's Name: **TED SANDOVAL**
 US EPA ID Number: (If Applicable)
☒ End Dump ☐ Flat-Bed
☐ Roll Off(s) ☐ Van
☐ Transfer ☐ Drums
 Notes:

Scheduling of soil deliveries must be made prior to 4:00 p.m. on the day prior to expected arrival. Any unscheduled loads will be refused. To schedule a Load, Call (916) 354-1321

Quantity Received: **15.56**
 Weight Ticket No.: **2307**
 Truck License#: **9Z16431**
 Signature of Authorized Agent/Title: **X [Signature]** Date: **4/29/96**

Murieta Soil Technologies, LLC
7879 Van Vleck Road
Rancho Murieta, CA 95683
(916) 354-1321

Remarks:

TO BE COMPLETED BY GENERATOR

Generator Name:

CA Air National Guard

Mailing Address:

3900 Roseville Rd
North Highlands CA

Phone Number:

916 569 2236

Generator's EPA ID Number: (If Applicable)

CA 6570025878

Contact Person:

Col. GERICKE

Signature of Authorized Agent/Title:

XX [Signature] - Col. GERICKE

Date:

4-29-96

Site Location: (Address)

SAME

Site Owner:

SAME

Waste Description:

(diesel contaminated soil, drill cuttings, etc.)

Required Protective Equipment or
Special Handling Procedures?:

NONE

Murieta Soil Technologies, LLC

Murieta Soil Technologies, LLC (MST) shall be under no obligation to accept soil if weather or other conditions impair the safe and effective acceptance or remediation of the soil, if remediation of the soil impairs the safe and effective operation of MST's remediation facility, or if the soil does not fit the profile provided by the generator. MST will not be responsible for costs incurred due to MST's inability to accept the soil.

TO BE COMPLETED BY TRANSPORTER

Transporter Name:

MARTIN TRUCKING

Mailing Address:

9765 Elder Creek Rd.

Phone Number:

(916) 364-0175

State Transporter's ID Number:

172059

Signature of Authorized Agent/Title:

X [Signature]

Date:

4-29-96

Driver's Name:

HECTOR WEBB

US EPA ID Number: (If Applicable)

☒ End Dump☐ Flat-Bed☐ Roll Off(s)☐ Van☐ Transfer☐ Drums

Notes:

TO BE COMPLETED AT FACILITY

Scheduling of soil deliveries must be made prior to 4:00 p.m. on the day prior to expected arrival. Any unscheduled loads will be refused. To schedule a Load, Call (916) 354-1321

Quantity Received:

19.27

Weight Ticket No.:

2309

Truck License#:

5D79643

Signature of Authorized Agent/Title:

X [Signature]

Date:

4/29/96

Murieta Soil Technologies, LLC

7879 Van Vleck Road

Rancho Murieta, CA 95683

(916) 354-1321

Remarks:

TO BE COMPLETED BY GENERATOR

Generator Name: CA Air National Guard
Mailing Address: 3400 Roseville Rd.
NORTH HIGHLANDS CA
Phone Number: 916 569 2230
Generator's EPA ID Number: (If Applicable) CA 6570025878
Contact Person: Col. GERICK
Signature of Authorized Agent/Title: XR. [Signature] - For Col. GERICK
Date: 4-29-96

Site Location: (Address) Same
Site Owner: Same
Waste Description: (diesel contaminated soil, drill cuttings, etc.)
Required Protective Equipment or Special Handling Procedures?: NONE

Murieta Soil Technologies, LLC

Murieta Soil Technologies, LLC (MST) shall be under no obligation to accept soil if weather or other conditions impair the safe and effective acceptance or remediation of the soil, if remediation of the soil impairs the safe and effective operation of MST's remediation facility, or if the soil does not fit the profile provided by the generator. MST will not be responsible for costs incurred due to MST's inability to accept the soil.

TO BE COMPLETED BY TRANSPORTER

Transporter Name: PESB Trucking
Mailing Address: 7224 Simon St
San Jose Ca 95128
Phone Number: 916-383-2536
State Transporter's ID Number: T-186258
Signature of Authorized Agent/Title: X [Signature]
Date:

Driver's Name: RONALD BELL
US EPA ID Number: (If Applicable)
☐ End Dump
☐ Flat-Bed
☐ Roll Off(s)
☒ Transfer
☐ Van
☐ Drums
Notes:

TO BE COMPLETED AT FACILITY

Scheduling of soil deliveries must be made prior to 4:00 p.m. on the day prior to expected arrival. Any unscheduled loads will be refused. To schedule a Load, Call (916) 354-1321.

| | |
|--|---------------|
| Quantity Received: | 16.84 |
| Weight Ticket No.: | 2140 |
| Truck License#: | 1P70782 |
| Signature of Authorized Agent/Title: XR. [Signature] | Date: 4/29/96 |

Murieta Soil Technologies, LLC
7879 Van Vleck Road
Rancho Murieta, CA 95683
(916) 354-1321

Remarks:

NON-HAZARDOUS WASTE MANIFEST
ACCEPTANCE # 96 - 0429-1A2T

TO BE COMPLETED BY GENERATOR

| | | | |
|--|--|---|--|
| Generator Name: CA AIR NATIONAL Guard | | Site Location: (Address) SAME | |
| Mailing Address: 3400 Roseville Rd NORTH HIGH LANDS Ct | | Site Owner: SAME | |
| Phone Number: 916 569 2236 | | Waste Description: (diesel contaminated soil, drill cuttings, etc.) | |
| Generator's EPA ID Number: (If Applicable) CA 6570025878 | | Required Protective Equipment or Special Handling Procedures?: | |
| Contact Person: Col. GERIcke | | Signature of Authorized Agent/Title: X [Signature] FOR Col. GERIcke | |
| Date: 4-29-96 | | None | |

Murieta Soil Technologies, LLC
Murieta Soil Technologies, LLC (MST) shall be under no obligation to accept soil if weather or other conditions impair the safe and effective acceptance or remediation of the soil, if remediation of the soil impairs the safe and effective operation of MST's remediation facility, or if the soil does not fit the profile provided by the generator. MST will not be responsible for costs incurred due to MST's inability to accept the soil.

TO BE COMPLETED BY TRANSPORTER

| | | | |
|--|--|--|--|
| Transporter Name: Walker Trucking | | Driver's Name: Richard Walker | |
| Mailing Address: 2041 35th St Sac Ca 95817 | | US EPA ID Number: (If Applicable) | |
| Phone Number: 916 - 455-4908 | | <input checked="" type="checkbox"/> End Dump <input type="checkbox"/> Roll Off(s) <input type="checkbox"/> Transfer <input type="checkbox"/> Flat-Bed <input type="checkbox"/> Van <input type="checkbox"/> Drums | |
| State Transporter's ID Number: 176-745 | | Notes: | |
| Signature of Authorized Agent/Title: X [Signature] | | Date: 4-29-96 | |

Scheduling of soil deliveries must be made prior to 4:00 p.m. on the day prior to expected arrival. Any unscheduled loads will be refused. To schedule a Load, Call (916) 354-1321

TO BE COMPLETED AT FACILITY

| | | |
|--|-------------------------|---|
| Quantity Received: | 12.99 | Murieta Soil Technologies, LLC 7879 Van Vleck Road Rancho Murieta, CA 95683 (916) 354-1321 |
| Weight Ticket No.: | 2310 | |
| Truck License#: | 4Z 32984 | |
| Signature of Authorized Agent/Title: X [Signature] | Date: 4/29/96 | |
| Remarks: | | |

Generator Name:

CA AIR NATIONAL GUARD

Mailing Address:

3900 ROSELLE RD.
NORTH HIGHLANDS CA

Phone Number:

916 569 2236

Generator's EPA ID Number: (If Applicable)

CA 6578025878

Contact Person:

Col. GERICK

Signature of Authorized Agent/Title:

XX. [Signature] For Col. GERICK

Date:

4-29-96

Site Location: (Address)

Same

Site Owner:

Same

Waste Description:

(diesel contaminated soil, drill cuttings, etc.)

Required Protective Equipment or
Special Handling Procedures?:

None

Murieta Soil Technologies, LLC

Murieta Soil Technologies, LLC (MST) shall be under no obligation to accept soil if weather or other conditions impair the safe and effective acceptance or remediation of the soil, if remediation of the soil impairs the safe and effective operation of MST's remediation facility, or if the soil does not fit the profile provided by the generator. MST will not be responsible for costs incurred due to MST's inability to accept the soil.

Transporter Name:

Patron Trucking

Mailing Address:

4645 Riley Blvd. Sacto, CA 95838

Phone Number:

641-6172

State Transporter's ID Number:

174-469

Signature of Authorized Agent/Title:

X [Signature] Harvey

Date:

4-29-96

Driver's Name:

DAVID HARVEY

US EPA ID Number: (If Applicable)

☐ End Dump☐ Flat-Bed☐ Roll Off(s)☐ Van☒ Transfer☐ Drums

Notes:

Scheduling of soil deliveries must be made prior to 4:00 p.m. on the day prior to expected arrival. Any unscheduled loads will be refused. To schedule a Load, Call (916) 354-1321

Quantity Received:

17.04

Weight Ticket No.:

2311

Truck License#:

8108476

Signature of Authorized Agent/Title:

X [Signature]

Date:

4/29/96

Murieta Soil Technologies, LLC
7879 Van Vleck Road
Rancho Murieta, CA 95683
(916) 354-1321

Remarks:

MANIFEST No.

TO BE COMPLETED BY GENERATOR

Generator Name:

CLL Air National Guard

Mailing Address:

3900 Rowville Rd.
North Highlands CA

Phone Number:

916 569 2236

Generator's EPA ID Number: (If Applicable)

CA 6570025878

Contact Person:

Col. GERICK

Signature of Authorized Agent/Title:

Date:

X *[Signature]* FOR Col. GERICK 4-29-96

Site Location: (Address)

SAME

Site Owner:

SAME

Waste Description:

(diesel contaminated soil, drill cuttings, etc.)

Required Protective Equipment or
Special Handling Procedures?:

NONE

Murieta Soil Technologies, LLC

Murieta Soil Technologies, LLC (MST) shall be under no obligation to accept soil if weather or other conditions impair the safe and effective acceptance or remediation of the soil, if remediation of the soil impairs the safe and effective operation of MST's remediation facility, or if the soil does not fit the profile provided by the generator. MST will not be responsible for costs incurred due to MST's inability to accept the soil.

TO BE COMPLETED BY TRANSPORTER

Transporter Name:

A2TCA CONST.

Mailing Address:

3871 SECURITY PARK DR.
RANCHO CERROSA, CA

Phone Number:

916 351-0202

State Transporter's ID Number:

67779

Signature of Authorized Agent/Title:

Date:

X *[Signature]* 4/29/96

Driver's Name:

TED SANDOVAL

US EPA ID Number: (If Applicable)

☒ End Dump

☐ Flat-Bed

☐ Roll Off(s)

☐ Van

☐ Transfer

☐ Drums

Notes:

TO BE COMPLETED AT FACILITY

Scheduling of soil deliveries must be made prior to 4:00 p.m. on the day prior to expected arrival. Any unscheduled loads will be refused. To schedule a Load, Call (916) 354-1321

Quantity Received:

17.23

Weight Ticket No.:

2312

Truck License#:

9L16431

Signature of Authorized Agent/Title:

Date:

X *[Signature]* 4/29/96

Murieta Soil Technologies, LLC

7879 Van Vleck Road

Rancho Murieta, CA 95683

(916) 354-1321

Remarks:

MANIFEST No.

**NON-HAZARDOUS WASTE MANIFEST
ACCEPTANCE # 96 - 0424-1727**

TO BE COMPLETED BY GENERATOR

Generator Name:

CA. Air National Guard

Mailing Address:

*3900 ROSEVILLE Rd.
NORTH HIGHLANDS CA*

Phone Number:

916 569 2236

Generator's EPA ID Number: (If Applicable)

CA 6570025878

Contact Person:

Col. GERNKE

Signature of Authorized Agent/Title:

X H. V. Johnson FOR Col. GERNKE

Date:

4-29-96

Site Location: (Address)

SAME

Site Owner:

SAME

Waste Description:

(diesel contaminated soil, drill cuttings, etc.)

Required Protective Equipment or Special Handling Procedures?:

NONE

Murieta Soil Technologies, LLC

Murieta Soil Technologies, LLC (MST) shall be under no obligation to accept soil if weather or other conditions impair the safe and effective acceptance or remediation of the soil, if remediation of the soil impairs the safe and effective operation of MST's remediation facility, or if the soil does not fit the profile provided by the generator. MST will not be responsible for costs incurred due to MST's inability to accept the soil.

TO BE COMPLETED BY TRANSPORTER

Transporter Name:

Chris Lewis TRK9

Mailing Address:

8362 Triad Ct. Sacramento CA.

Phone Number:

916-682-5298

State Transporter's ID Number:

182-077

Signature of Authorized Agent/Title:

X Chris Lewis

Date:

4-29-96

Driver's Name:

US EPA ID Number: (If Applicable)

☐ End Dump

☐ Flat-Bed

☐ Roll Off(s)

☐ Van

☒ Transfer

☐ Drums

Notes:

Scheduling of soil deliveries must be made prior to 4:00 p.m. on the day prior to expected arrival. Any unscheduled loads will be refused. To schedule a Load, Call (916) 354-1321

Quantity Received:

15.43

Weight Ticket No.:

2313

Truck License#:

2L56252

Signature of Authorized Agent/Title:

X C. ALLEN

Date:

4/29/96

**Murieta Soil Technologies, LLC
7879 Van Vleck Road
Rancho Murieta, CA 95683
(916) 354-1321**

Remarks:

TO BE COMPLETED AT FACILITY

MANIFEST No.

TO BE COMPLETED BY GENERATOR

Generator Name:

CA. AIR NATIONAL Guard

Mailing Address:

3400 ROSEVILLE Rd
NORTH HIGH LANDS CA.

Phone Number:

916 569 2236

Generator's EPA ID Number: (If Applicable)

CA 65700 25878

Contact Person:

Col. GERICK

Signature of Authorized Agent/Title:

Date:

X *[Signature]* F.R. Col.
GERICK

4-29-96

Site Location: (Address)

SAME

Site Owner:

SAME

Waste Description:

(diesel contaminated soil, drill cuttings, etc.)

Required Protective Equipment or
Special Handling Procedures?:

None

Murieta Soil Technologies, LLC

Murieta Soil Technologies, LLC (MST) shall be under no obligation to accept soil if weather or other conditions impair the safe and effective acceptance or remediation of the soil, if remediation of the soil impairs the safe and effective operation of MST's remediation facility, or if the soil does not fit the profile provided by the generator. MST will not be responsible for costs incurred due to MST's inability to accept the soil.

TO BE COMPLETED BY TRANSPORTER

Transporter Name:

MARTIN TRUCKING

Mailing Address:

9765 Elder creek Rd.

Phone Number:

(916) 364-0175

State Transporter's ID Number:

172059

Signature of Authorized Agent/Title:

Date:

X *[Signature]*

Driver's Name:

HECTOR WEBB

US EPA ID Number: (If Applicable)

☒ End Dump

☐ Flat-Bed

☐ Roll Off(s)

☐ Van

☐ Transfer

☐ Drums

Notes:

Scheduling of soil deliveries must be made prior to 4:00 p.m. on the day prior to expected arrival. Any unscheduled loads will be refused. To schedule a Load, Call (916) 354-1321

Quantity Received:

22.98

Weight Ticket No.:

2314

Truck License#:

SD 79643

Signature of Authorized Agent/Title:

Date:

X *[Signature]*

4/29/96

Murieta Soil Technologies, LLC
7879 Van Vleck Road
Rancho Murieta, CA 95683
(916) 354-1321

Remarks:

TO BE COMPLETED BY GENERATOR

Generator Name:

CA Air National Guard

Mailing Address:

3900 Roseville Rd

NORTH HIGHLAND CA.

Phone Number:

416 569 2236

Generator's EPA ID Number: (If Applicable)

CA 6570025878

Contact Person:

Col. GERIQUE

Signature of Authorized Agent/Title:

X *[Signature]* FOR Col. GERIQUE

Date:

4-29-96

Site Location: (Address)

SAME

Site Owner:

SAME

Waste Description:

(diesel contaminated soil) drill cuttings, etc.)

Required Protective Equipment or Special Handling Procedures?:

NONE

Murieta Soil Technologies, LLC

Murieta Soil Technologies, LLC (MST) shall be under no obligation to accept soil if weather or other conditions impair the safe and effective acceptance or remediation of the soil, if remediation of the soil impairs the safe and effective operation of MST's remediation facility, or if the soil does not fit the profile provided by the generator. MST will not be responsible for costs incurred due to MST's inability to accept the soil.

TO BE COMPLETED BY TRANSPORTER

Transporter Name:

12505 Trucking

Mailing Address:

7229 Simon Rd
Rancho, CA 95828

Phone Number:

916-383-2536

State Transporter's ID Number:

T-186258

Signature of Authorized Agent/Title:

X *[Signature]*

Date:

4-29-96

Driver's Name:

RONALD BEDAL

US EPA ID Number: (If Applicable)

☐ End Dump

☐ Flat-Bed

☐ Roll Off(s)

☐ Van

☒ Transfer

☐ Drums

Notes:

Scheduling of soil deliveries must be made prior to 4:00 p.m. on the day prior to expected arrival. Any unscheduled loads will be refused. To schedule a Load, Call (916) 354-1321

Quantity Received:

20.86

Weight Ticket No.:

2315

Truck License#:

1P70782

Signature of Authorized Agent/Title:

X *[Signature]*

Date:

4/29/96

Murieta Soil Technologies, LLC

7879 Van Vleck Road

Rancho Murieta, CA 95683

(916) 354-1321

Remarks:

MANIFEST No.

Generator Name:

CAL Air National Guard

Mailing Address:

3900 Roseville Rd

North Highlands CA

Phone Number:

916 564 2236

Generator's EPA ID Number: (If Applicable)

CA 6570025878

Contact Person:

Col. Gerick

Signature of Authorized Agent/Title:

Date:

X *[Signature]* Fox Col. Gerick 4-29-96

Site Location: (Address)

Same

Site Owner:

Same

Waste Description:

(diesel contaminated soil, drill cuttings, etc.)

Required Protective Equipment or Special Handling Procedures?:

None

Murieta Soil Technologies, LLC

Murieta Soil Technologies, LLC (MST) shall be under no obligation to accept soil if weather or other conditions impair the safe and effective acceptance or remediation of the soil, if remediation of the soil impairs the safe and effective operation of MST's remediation facility, or if the soil does not fit the profile provided by the generator. MST will not be responsible for costs incurred due to MST's inability to accept the soil.

Transporter Name:

Walker Trucking

Mailing Address:

2041 35th St

Phone Number:

916-455-4908

State Transporter's ID Number:

176-745

Signature of Authorized Agent/Title:

Date:

X *[Signature]* 4-29-96

Driver's Name:

Richard Walker

US EPA ID Number: (If Applicable)

☒ End Dump☐ Flat-Bed☐ Roll Off(s)☐ Van☐ Transfer☐ Drums

Notes:

Scheduling of soil deliveries must be made prior to 4:00 p.m. on the day prior to expected arrival. Any unscheduled loads will be refused. To schedule a Load, Call (916) 354-1321

Quantity Received:

13.95

Weight Ticket No.:

2317

Truck License#:

4Z 32984

Signature of Authorized Agent/Title:

Date:

X *[Signature]* 4/29/96

Murieta Soil Technologies, LLC

7879 Van Vleck Road

Rancho Murieta, CA 95683

(916) 354-1321

Remarks:

MANIFEST No.

**NON-HAZARDOUS WASTE MANIFEST
ACCEPTANCE # 96-0429-1A2T**

TO BE COMPLETED BY GENERATOR

Generator Name:
CAL. AIR NATIONAL Guard

Mailing Address:
3900 ROSEVILLE Rd,
NORTH High LANDS CA

Phone Number:
916 569 2236

Generator's EPA ID Number: (If Applicable)
CA 657002587E

Contact Person:
Col. GERICK

Signature of Authorized Agent/Title:
X [Signature] - For Col. GERICK

Date:
4-29-96

Site Location: (Address)

Site Owner:

Waste Description:
(diesel contaminated soil, drill cuttings, etc.)

Required Protective Equipment or Special Handling Procedures?:

Murieta Soil Technologies, LLC

Murieta Soil Technologies, LLC (MST) shall be under no obligation to accept soil if weather or other conditions impair the safe and effective acceptance or remediation of the soil, if remediation of the soil impairs the safe and effective operation of MST's remediation facility, or if the soil does not fit the profile provided by the generator. MST will not be responsible for costs incurred due to MST's inability to accept the soil.

TO BE COMPLETED BY TRANSPORTER

Transporter Name:
Patron Trucking

Mailing Address:
4645 Riley Blvd Santa, CA 95828

Phone Number:
641-6170

State Transporter's ID Number:
174-469

Signature of Authorized Agent/Title:
X [Signature]

Date:
4-29-96

Driver's Name:
DAVID J. HARVEY

US EPA ID Number: (If Applicable)

☐ End Dump ☐ Flat-Bed
☐ Roll Off(s) ☐ Van
☒ Transfer ☐ Drums

Notes:

TO BE COMPLETED AT FACILITY

Scheduling of soil deliveries must be made prior to 4:00 p.m. on the day prior to expected arrival. Any unscheduled loads will be refused. To schedule a Load, Call (916) 354-1321

| | |
|---|--------------|
| Quantity Received: | 25.17 |
| Weight Ticket No.: | 2318 |
| Truck License#: | 3K08476 |
| Signature of Authorized Agent/Title: | Date: |
| X [Signature] | 4/29/96 |

Murieta Soil Technologies, LLC
7879 Van Vleck Road
Rancho Murieta, CA 95683
(916) 354-1321

Remarks:

TO BE COMPLETED BY GENERATOR

Generator Name:

Cal Air National Guard

Mailing Address:

3900 Roseville Rd
N. Highlands, CA

Phone Number:

916/569-2236

Generator's EPA ID Number: (If Applicable)

CA 6570025878

Contact Person:

Col Gericke

Signature of Authorized Agent/Title:

Date:

X *[Signature]* FOR Col GERICKE 29 Apr 96

Site Location: (Address)

Site Owner:

Waste Description:

(diesel contaminated soil, drill cuttings, etc.)

Required Protective Equipment or
Special Handling Procedures?:

Murieta Soil Technologies, LLC

Murieta Soil Technologies, LLC (MST) shall be under no obligation to accept soil if weather or other conditions impair the safe and effective acceptance or remediation of the soil, if remediation of the soil impairs the safe and effective operation of MST's remediation facility, or if the soil does not fit the profile provided by the generator. MST will not be responsible for costs incurred due to MST's inability to accept the soil.

TO BE COMPLETED BY TRANSPORTER

Transporter Name:

Chris Lewis

Mailing Address:

8362 Triad Cr. Santa CA

Phone Number:

916-682-5298

State Transporter's ID Number:

182-077

Signature of Authorized Agent/Title:

Date:

X *[Signature]* 4-29-96

Driver's Name:

US EPA ID Number: (If Applicable)

☐ End Dump

☐ Flat-Bed

☐ Roll Off(s)

☐ Van

☐ Transfer

☐ Drums

Notes:

Scheduling of soil deliveries must be made prior to 4:00 p.m. on the day prior to expected arrival. Any unscheduled loads will be refused. To schedule a Load, Call (916) 354-1321

Quantity Received:

21.38

Weight Ticket No.:

2319

Truck License#:

2L56252

Signature of Authorized Agent/Title:

Date:

X *[Signature]* 4/29/96

Murieta Soil Technologies, LLC
7879 Van Vleck Road
Rancho Murieta, CA 95683
(916) 354-1321

Remarks:

TO BE COMPLETED AT FACILITY

TO BE COMPLETED BY GENERATOR

Generator Name:

Cal Air National Guard

Mailing Address:

3900 Roseville Rd
N. Highlands, CA

Phone Number:

716/569-2236

Generator's EPA ID Number: (If Applicable)

CA6570025878

Contact Person:

C. Gericke

Signature of Authorized Agent/Title:

Date:

X *[Signature]* FOR Col. Gericke 4-27-96

Site Location: (Address)

Site Owner:

Waste Description:

(diesel contaminated soil, drill cuttings, etc.)

Required Protective Equipment or
Special Handling Procedures?:

Murieta Soil Technologies, LLC

Murieta Soil Technologies, LLC (MST) shall be under no obligation to accept soil if weather or other conditions impair the safe and effective acceptance or remediation of the soil, if remediation of the soil impairs the safe and effective operation of MST's remediation facility, or if the soil does not fit the profile provided by the generator. MST will not be responsible for costs incurred due to MST's inability to accept the soil.

TO BE COMPLETED BY TRANSPORTER

Transporter Name:

MARTIN TRUCKING

Mailing Address:

9765 Elder Cr. Rd.

Phone Number:

(916) 364-0175

State Transporter's ID Number:

172859

Signature of Authorized Agent/Title:

Date:

X *[Signature]* 4/29/96

Driver's Name:

HECTOR WEBB
US EPA ID Number: (If Applicable)

☒ End Dump

☐ Flat-Bed

☐ Roll Off(s)

☐ Van

☐ Transfer

☐ Drums

Notes:

TO BE COMPLETED AT FACILITY

Scheduling of soil deliveries must be made prior to 4:00 p.m. on the day prior to expected arrival. Any unscheduled loads will be refused. To schedule a Load, Call (916) 354-1321

Quantity Received:

21.32

Weight Ticket No.:

2320

Truck License#:

SD79643

Signature of Authorized Agent/Title:

Date:

X *[Signature]* 4/29/96

Murieta Soil Technologies, LLC
7879 Van Vleck Road
Rancho Murieta, CA 95683
(916) 354-1321

Remarks:

**NON-HAZARDOUS WASTE MANIFEST
ACCEPTANCE # 96 - 0429 - 1A2T**

TO BE COMPLETED BY GENERATOR

Generator Name:
Cal Air National Guard

Mailing Address:
3900 Roseville Rd
N. Highlands, CA

Phone Number:
916/569-2236

Generator's EPA ID Number: (If Applicable)
CA 6570025878

Contact Person:
Col Gericke

Signature of Authorized Agent/Title: *XX. [Signature]* For Col. Gericke
Date: 29 Apr 96

Site Location: (Address)

Site Owner:

Waste Description:
(diesel contaminated soil, drill cuttings, etc.)

Required Protective Equipment or Special Handling Procedures?:

Murieta Soil Technologies, LLC

Murieta Soil Technologies, LLC (MST) shall be under no obligation to accept soil if weather or other conditions impair the safe and effective acceptance or remediation of the soil, if remediation of the soil impairs the safe and effective operation of MST's remediation facility, or if the soil does not fit the profile provided by the generator. MST will not be responsible for costs incurred due to MST's inability to accept the soil.

TO BE COMPLETED BY TRANSPORTER

Transporter Name:
P.S.B. Trucking

Mailing Address:
7229 Simon St
Sacramento, CA 95828

Phone Number:
916-383-2536

State Transporter's ID Number:
T-186258

Signature of Authorized Agent/Title: *X [Signature]*
Date: 4-29-96

Driver's Name:
RONALD BECK

US EPA ID Number: (If Applicable)

☐ End Dump ☐ Flat-Bed
☐ Roll Off(s) ☐ Van
☒ Transfer ☐ Drums

Notes:

TO BE COMPLETED AT FACILITY

Scheduling of soil deliveries must be made prior to 4:00 p.m. on the day prior to expected arrival. Any unscheduled loads will be refused. To schedule a Load, Call (916) 354-1321

| | |
|--|----------------------|
| Quantity Received: | 24.38 |
| Weight Ticket No.: | 2321 |
| Truck License#: | 1P70782 |
| Signature of Authorized Agent/Title: <i>X [Signature]</i> | Date: 4/29/96 |

Murieta Soil Technologies, LLC
7879 Van Vleck Road
Rancho Murieta, CA 95683
(916) 354-1321

Remarks:

TO BE COMPLETED BY GENERATOR

Generator Name:

Cal Air National Guard

Mailing Address:

3900 Roseville Rd
N. Highlands, CA

Phone Number:

916/569-2236

Generator's EPA ID Number: (If Applicable)

CA 6570025875

Contact Person:

Col Gericke

Signature of Authorized Agent/Title:

Date:

X *[Signature]* For Col Gericke

29 Apr 96

Site Location: (Address)

Site Owner:

Waste Description:

(diesel contaminated soil, drill cuttings, etc.)

Required Protective Equipment or
Special Handling Procedures?

Murieta Soil Technologies, LLC

Murieta Soil Technologies, LLC (MST) shall be under no obligation to accept soil if weather or other conditions impair the safe and effective acceptance or remediation of the soil, if remediation of the soil impairs the safe and effective operation of MST's remediation facility, or if the soil does not fit the profile provided by the generator. MST will not be responsible for costs incurred due to MST's inability to accept the soil.

TO BE COMPLETED BY TRANSPORTER

Transporter Name:

Walker Trucking

Mailing Address:

2041 35th St Sac Ca 95817

Phone Number:

916-4155-4908

State Transporter's ID Number:

176-745

Signature of Authorized Agent/Title:

Date:

X *[Signature]* 4-29-96

Driver's Name:

Richard Walker
US EPA ID Number: (If Applicable)

☒ End Dump

☐ Flat-Bed

☐ Roll Off(s)

☐ Van

☐ Transfer

☐ Drums

Notes:

TO BE COMPLETED AT FACILITY

Scheduling of soil deliveries must be made prior to 4:00 p.m. on the day prior to expected arrival. Any unscheduled loads will be refused. To schedule a Load, Call (916) 354-1321

Quantity Received:

14.86

Weight Ticket No.:

2322

Truck License#:

4E32984

Signature of Authorized Agent/Title:

Date:

X *[Signature]*

4/29/96

Murieta Soil Technologies, LLC
7879 Van Vleck Road
Rancho Murieta, CA 95683
(916) 354-1321

Remarks:

TO BE COMPLETED BY GENERATOR

Generator Name:

Cal Air National Guard

Mailing Address:

3900 Roseville Rd
N. Highlands, CA

Phone Number:

916/569-2236

Generator's EPA ID Number: (If Applicable)

CA 6570025878

Contact Person:

Col Gericke

Signature of Authorized Agent/Title:

Date:

X *R. Ole Tobias* For Col Gericke

29 Apr 96

Site Location: (Address)

Site Owner:

Waste Description:

(diesel contaminated soil, drill cuttings, etc.)

Required Protective Equipment or
Special Handling Procedures?:

Murieta Soil Technologies, LLC

Murieta Soil Technologies, LLC (MST) shall be under no obligation to accept soil if weather or other conditions impair the safe and effective acceptance or remediation of the soil, if remediation of the soil impairs the safe and effective operation of MST's remediation facility, or if the soil does not fit the profile provided by the generator. MST will not be responsible for costs incurred due to MST's inability to accept the soil.

TO BE COMPLETED BY TRANSPORTER

Transporter Name:

Chris Lewis

Mailing Address:

8362 Triad Ct. Suite CA
95828

Phone Number:

916 682-5298

State Transporter's ID Number:

182-077

Signature of Authorized Agent/Title:

Date:

X *Chris Lewis*

4/29/96

Driver's Name:

US EPA ID Number: (If Applicable)

☐ End Dump

☐ Flat-Bed

☐ Roll Off(s)

☐ Van

☒ Transfer

☐ Drums

Notes:

Scheduling of soil deliveries must be made prior to 4:00 p.m. on the day prior to expected arrival. Any unscheduled loads will be refused. To schedule a Load, Call (916) 354-1321

Quantity Received:

21.47

Weight Ticket No.:

2323

Truck License#:

2L56252

Signature of Authorized Agent/Title:

Date:

X *L. L. L.*

4/29/96

Murieta Soil Technologies, LLC
7879 Van Vleck Road
Rancho Murieta, CA 95683
(916) 354-1321

Remarks:

Murieta Soil Technologies, LLC

NON-HAZARDOUS WASTE MANIFEST
ACCEPTANCE # 96-0429-1A2T

TO BE COMPLETED BY GENERATOR

Generator Name:

CA Air National Guard

Mailing Address:

3900 Roseville Rd
N. Highlands, CA

Phone Number:

916/569-2236

Generator's EPA ID Number: (If Applicable)

CA 6570025878

Contact Person:

Col Gericke

Signature of Authorized Agent/Title:

Date:

X *[Signature]* For Col Gericke

30 Apr 96

Site Location: (Address)

Site Owner:

Waste Description:

(diesel contaminated soil, drill cuttings, etc.)

Required Protective Equipment or
Special Handling Procedures?:

Murieta Soil Technologies, LLC

Murieta Soil Technologies, LLC (MST) shall be under no obligation to accept soil if weather or other conditions impair the safe and effective acceptance or remediation of the soil, if remediation of the soil impairs the safe and effective operation of MST's remediation facility, or if the soil does not fit the profile provided by the generator. MST will not be responsible for costs incurred due to MST's inability to accept the soil.

TO BE COMPLETED BY TRANSPORTER

Transporter Name:

STECO 4 CONST

Mailing Address:

3671 Security Park Dr.
Rancho Cordova, CA

Phone Number:

916-351-0202

State Transporter's ID Number:

CA 67779

Signature of Authorized Agent/Title:

Date:

X *[Signature]*

Driver's Name:

US EPA ID Number: (If Applicable)

☒ End Dump

☐ Flat-Bed

☐ Roll Off(s)

☐ Van

☐ Transfer

☐ Drums

Notes:

[Signature] TED SANDOZ

TO BE COMPLETED AT FACILITY

Scheduling of soil deliveries must be made prior to 4:00 p.m. on the day prior to expected arrival. Any unscheduled loads will be refused. To schedule a Load, Call (916) 354-1321

Quantity Received:

30.08

Weight Ticket No.:

2324

Truck License#:

9216431

Signature of Authorized Agent/Title:

Date:

X *[Signature]*

4/30/96

Murieta Soil Technologies, LLC
7879 Van Vleck Road
Rancho Murieta, CA 95683
(916) 354-1321

Remarks:

MANIFEST No.

NON-HAZARDOUS WASTE MANIFEST

ACCEPTANCE # 96 - 9429-1127

TO BE COMPLETED BY GENERATOR

Generator Name:

C.I. AIR NATIONAL CENTER

Mailing Address:

3900 Roseville Rd
N. Highlands, CA

Phone Number:

916/569-2200

Generator's EPA ID Number: (If Applicable)

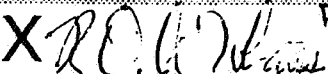
CA 6570025878

Contact Person:

Col. Gericke

Signature of Authorized Agent/Title:

Date:

X  For Col. Gericke
1 Nov 96

Site Location: (Address)

Site Owner:

Waste Description:

(diesel contaminated soil, drill cuttings, etc.)

Required Protective Equipment or
Special Handling Procedures?:

Murieta Soil Technologies, LLC

Murieta Soil Technologies, LLC (MST) shall be under no obligation to accept soil if weather or other conditions impair the safe and effective acceptance or remediation of the soil, if remediation of the soil impairs the safe and effective operation of MST's remediation facility, or if the soil does not fit the profile provided by the generator. MST will not be responsible for costs incurred due to MST's inability to accept the soil.

TO BE COMPLETED BY TRANSPORTER

Transporter Name:

AZTECA CONST. INC.

Mailing Address:

3871 SECURITY PARK DR.
RANCHO CORDOVA, CA

Phone Number:


(916) 987-351-0202

State Transporter's ID Number:

CA 67779

Signature of Authorized Agent/Title:

Date:

X  5/1/96

Driver's Name:

TED SANDOVAL

US EPA ID Number: (If Applicable)

☒ End Dump☐ Flat-Bed☐ Roll Off(s)☐ Van☐ Transfer☐ Drums

Notes:

TO BE COMPLETED AT FACILITY

Scheduling of soil deliveries must be made prior to 4:00 p.m. on the day prior to expected arrival. Any unscheduled loads will be refused. To schedule a Load, Call (916) 354-1321

Quantity Received:

21.27

Weight Ticket No.:

2336

Truck License#:

9C16431

Signature of Authorized Agent/Title:

Date:

X  5/1/96

Murieta Soil Technologies, LLC

7879 Van Vleck Road

Rancho Murieta, CA 95683

(916) 354-1321

Remarks:

MANIFEST No.

**NON-HAZARDOUS WASTE MANIFEST
ACCEPTANCE # 96-0429-1A37**

TO BE COMPLETED BY GENERATOR

| | |
|---|--------------------------|
| Generator Name: CA Air Nat. Guard | |
| Mailing Address: 3900 Roseville Rd N. Highlands, CA | |
| Phone Number: 916/569-2200 | |
| Generator's EPA ID Number: (If Applicable) CA 6570025878 | |
| Contact Person: Col. Gericke | |
| Signature of Authorized Agent/Title: X R Dale Tabrales For Col. Gericke | Date: 1 May 96 |

| |
|---|
| Site Location: (Address) |
| Site Owner: |
| Waste Description: (diesel contaminated soil, drill cuttings, etc.) |
| Required Protective Equipment or Special Handling Procedures?: |

Murieta Soil Technologies, LLC

Murieta Soil Technologies, LLC (MST) shall be under no obligation to accept soil if weather or other conditions impair the safe and effective acceptance or remediation of the soil, if remediation of the soil impairs the safe and effective operation of MST's remediation facility, or if the soil does not fit the profile provided by the generator. MST will not be responsible for costs incurred due to MST's inability to accept the soil.

TO BE COMPLETED BY TRANSPORTER

| | |
|--|------------------------|
| Transporter Name: KSB Trucking | |
| Mailing Address: 7229 Simon St Buck Ca 95828 | |
| Phone Number: 916-383-2536 | |
| State Transporter's ID Number: T-186258 | |
| Signature of Authorized Agent/Title: X [Signature] | Date: 5-1-96 |

| |
|---|
| Driver's Name: [Signature] |
| US EPA ID Number: (If Applicable) |
| <input type="checkbox"/> End Dump <input type="checkbox"/> Flat-Bed <input type="checkbox"/> Roll Off(s) <input type="checkbox"/> Van <input checked="" type="checkbox"/> Transfer <input type="checkbox"/> Drums |
| Notes: |

TO BE COMPLETED AT FACILITY

Scheduling of soil deliveries must be made prior to 4:00 p.m. on the day prior to expected arrival. Any unscheduled loads will be refused. To schedule a Load, Call (916) 354-1321

| | |
|--|------------------------|
| Quantity Received: | 20.57 |
| Weight Ticket No.: | 2337 |
| Truck License#: | 1P70782 |
| Signature of Authorized Agent/Title: X [Signature] | Date: 5/1/96 |

Murieta Soil Technologies, LLC
7879 Van Vleck Road
Rancho Murieta, CA 95683
(916) 354-1321

Remarks:

NON-HAZARDOUS WASTE MANIFEST
ACCEPTANCE # 96-0429-1A2T

Generator Name:

CA Air Nat. Guard

Mailing Address:

3900 Roseville Rd
N. Highlands, CA

Phone Number:

916/567-2200

Generator's EPA ID Number: (If Applicable)

CA 657 0025 878

Contact Person:

Col. Gericke

Signature of Authorized Agent/Title:

X R. D. [Signature]

Date:

For Col. Gericke
1 May 96

Site Location: (Address)

Site Owner:

Waste Description:

(diesel contaminated soil, drill cuttings, etc.)

Required Protective Equipment or
Special Handling Procedures?:

Murieta Soil Technologies, LLC

Murieta Soil Technologies, LLC (MST) shall be under no obligation to accept soil if weather or other conditions impair the safe and effective acceptance or remediation of the soil, if remediation of the soil impairs the safe and effective operation of MST's remediation facility, or if the soil does not fit the profile provided by the generator. MST will not be responsible for costs incurred due to MST's inability to accept the soil.

Transporter Name:

Chris Lewis Trkg.

Mailing Address:

8312 Triad Cr. Sacto CA 95828

Phone Number:

916 682-5298

State Transporter's ID Number:

182-077

Signature of Authorized Agent/Title:

X Chris Lewis [Signature]

Date:

5-1-96

Driver's Name:

US EPA ID Number: (If Applicable)

☐ End Dump

☐ Flat-Bed

☐ Roll Off(s)

☐ Van

☒ Transfer

☐ Drums

Notes:

Scheduling of soil deliveries must be made prior to 4:00 p.m. on the day prior to expected arrival. Any unscheduled loads will be refused. To schedule a Load, Call (916) 354-1321

Quantity Received:

19.39

Weight Ticket No.:

2338

Truck License#:

2L56252

Signature of Authorized Agent/Title:

X [Signature]

Date:

5/1/96

Murieta Soil Technologies, LLC
7879 Van Vleck Road
Rancho Murieta, CA 95683
(916) 354-1321

Remarks:

MANIFEST No.

Attachment 7

Certificate of Contamination Destruction and Releases of Liability

Certificate of Contamination Destruction

This is to certify and warrant that the soil identified by job acceptance number 96-0429-LAZT, property of CA-Air National Guard-Azteca Construction (hereinafter known as the Generator), was accepted by Murieta Soil Technologies, LLC (hereinafter known as the Operator). This soil was originally removed from 3900 Roseville Rd. N. Highlands, CA as non-hazardous petroleum hydrocarbon contaminated soil, thereafter remediated and disposed of. Murieta Soil Technologies, LLC has, by and through the process of bioremediation, caused this soil to now meet or exceed all E.P.A. and State of California requirements for treatment of petroleum contaminated soil and henceforth the above listed batch of earth is considered a **NON-REGULATED SUBSTANCE**, wherein the Operator warrants to the Generator that they have no future liability as to the earth having any petroleum hydrocarbon contaminants.

Certified to by MURIETA SOIL TECHNOLOGIES, LLC

Dated this 12 day of July 1996

By: Edward G. Keenan, Jr.

Title: General Manager, Murieta Soil Technologies, LLC

Murieta Soils Technology, L.L.C.

FORM F

Certificate of Release of Liability (Recycle of non-RCRA Soil/Materials)

Supplier: Azteca Construction, Inc.
3371 Security Park Drive
Rancho Cordova, CA 95742

Generator: California Air National Guard
3900 Roseville Road
North Highlands, CA

Certificate No: 96-0429-1AZT-A

Dated: May 21, 1996

Murieta Soil Technologies, L.L.C. ("MST"), a California company ("Company"), identified as the operator of the "Facility" listed hereby certifies as follows:

- 1) The Company has received from the above "Generator", 392.30 tons of non-RCRA contaminated soil ("Soil") as transported by, on behalf of generator, Azteca Construction et. al., contracted through Azteca Construction, Incorporated, to such facility, and referred to by Job Acceptance No. 96-0429-1AZT, which Soil was received at the Facility on April 29, 1996 (as part of a shipment consisting of 483.63 tons in total). The Company operates its Facility and recycles such Soil pursuant to permits issued by applicable governmental authorities.
- 2) In receiving and processing the Soil and in providing this Certificate, the Company has relied upon and is relying on (a) the representation of the Generator that the Soil does not contain any materials classified as, and is not classified as, "hazardous waste" under the applicable provision of the Federal and State law and has been managed and may be treated as other than "hazardous waste" and (b) the Generator has independent written certifications from applicable government agencies or certified independent testing laboratories that the Soil does not contain any material, nor is it classified as, "RCRA or California hazardous waste" under all applicable laws.
- 3) The Soil will be treated by being introduced into the recycling process at the MST Facility and where recycled materials are produced. Treatment of the Soil will be in accordance with the requirements of the applicable plans and operating permits of the Facility. After the Soil has been processed, a Certificate of Contaminant Destruction will be sent to Azteca Construction.
- 4) Upon completion of the treatment, the Soil has been "recycled", and the end product is a non-hazardous substance which does not constitute a "hazardous waste" or California regulated material under the applicable provisions of Federal and California Law.
- 5) The Company shall indemnify, defend and hold harmless the Generator from and against enforcement actions by government authorities in the event that the representations by the Company set forth in this certificate are materially inaccurate.

This Certificate is executed on this 21st day of May, 1996.

By: [Signature] Title: General Manager

3341 Fitzgerald Road., Suite D, Rancho Cordova, CA 95742
(916) 638 5772

FAX (916) 638-1167

Murieta Soils Technology, L.L.C.

FORM F

Certificate of Release of Liability (Recycle of non-RCRA Soil/Materials)

Supplier: Azteca Construction, Inc.
3371 Security Park Drive
Rancho Cordova, CA 95742

Generator: California Air National Guard
3900 Roseville Road
North Highlands, CA

Certificate No: 96-0429-1AZT-C

Dated: May 21, 1996

Murieta Soil Technologies, L.L.C. ("MST"), a California company ("Company"), identified as the operator of the "Facility" listed hereby certifies as follows:

- 1) The Company has received from the above "Generator", 61.25 tons of non-RCRA contaminated soil ("Soil") as transported by, on behalf of generator, Azteca Construction et. al., contracted through Azteca Construction, Incorporated, to such facility, and referred to by Job Acceptance No. 96-0429-1AZT, which Soil was received at the Facility on May 1, 1996 (as part of a shipment consisting of 483.63 tons in total). The Company operates its Facility and recycles such Soil pursuant to permits issued by applicable governmental authorities.
- 2) In receiving and processing the Soil and in providing this Certificate, the Company has relied upon and is relying on (a) the representation of the Generator that the Soil does not contain any materials classified as, and is not classified as, "hazardous waste" under the applicable provision of the Federal and State law and has been managed and may be treated as other than "hazardous waste" and (b) the Generator has independent written certifications from applicable government agencies or certified independent testing laboratories that the Soil does not contain any material, nor is it classified as, "RCRA or California hazardous waste" under all applicable laws.
- 3) The Soil will be treated by being introduced into the recycling process at the MST Facility and where recycled materials are produced. Treatment of the Soil will be in accordance with the requirements of the applicable plans and operating permits of the Facility. After the Soil has been processed, a Certificate of Contaminant Destruction will be sent to Azteca Construction.
- 4) Upon completion of the treatment, the Soil has been "recycled", and the end product is a non-hazardous substance which does not constitute a "hazardous waste" or California regulated material under the applicable provisions of Federal and California Law.
- 5) The Company shall indemnify, defend and hold harmless the Generator from and against enforcement actions by government authorities in the event that the representations by the Company set forth in this certificate are materially inaccurate.

This Certificate is executed on this 21st day of May, 1996.

By: [Signature] Title: General Manager

3341 Fitzgerald Road., Suite D, Rancho Cordova, CA 95742
(916) 638 5772

FAX (916) 638-1167

Murieta Soils Technology, L.L.C.

FORM F

Certificate of Release of Liability (Recycle of non-RCRA Soil/Materials)

Supplier: Azteca Construction, Inc.
3371 Security Park Drive
Rancho Cordova, CA 95742

Generator: California Air National Guard
3900 Roseville Road
North Highlands, CA

Certificate No: 96-0429-1AZT-B

Dated: May 21, 1996

Murieta Soil Technologies, L.L.C. ("MST"), a California company ("Company"), identified as the operator of the "Facility" listed hereby certifies as follows:

- 1) The Company has received from the above "Generator", 30.08 tons of non-RCRA contaminated soil ("Soil") as transported by, on behalf of generator, Azteca Construction et. al., contracted through Azteca Construction, Incorporated, to such facility, and referred to by Job Acceptance No. 96-0429-1AZT, which Soil was received at the Facility on April 30, 1996 (as part of a shipment consisting of 483.63 tons in total). The Company operates its Facility and recycles such Soil pursuant to permits issued by applicable governmental authorities.
- 2) In receiving and processing the Soil and in providing this Certificate, the Company has relied upon and is relying on (a) the representation of the Generator that the Soil does not contain any materials classified as, and is not classified as, "hazardous waste" under the applicable provision of the Federal and State law and has been managed and may be treated as other than "hazardous waste" and (b) the Generator has independent written certifications from applicable government agencies or certified independent testing laboratories that the Soil does not contain any material, nor is it classified as, "RCRA or California hazardous waste" under all applicable laws.
- 3) The Soil will be treated by being introduced into the recycling process at the MST Facility and where recycled materials are produced. Treatment of the Soil will be in accordance with the requirements of the applicable plans and operating permits of the Facility. After the Soil has been processed, a Certificate of Contaminant Destruction will be sent to Azteca Construction.
- 4) Upon completion of the treatment, the Soil has been "recycled", and the end product is a non-hazardous substance which does not constitute a "hazardous waste" or California regulated material under the applicable provisions of Federal and California Law.
- 5) The Company shall indemnify, defend and hold harmless the Generator from and against enforcement actions by government authorities in the event that the representations by the Company set forth in this certificate are materially inaccurate.

This Certificate is executed on this 21st day of May, 1996.

By: [Signature] Title: General Manager

3341 Fitzgerald Road., Suite D, Rancho Cordova, CA 95742
(916) 638 5772

FAX (916) 638-1167



COUNTY OF SACRAMENTO
Environmental Management Department
Mel Knight, Director

file

Bonnie Coleman, Manager
Administrative Services
Raymond E. Hackett, Manager
Environmental Health
Jeanette M. Siewierski, Manager
Hazardous Materials

October 20, 1999

Colonel Edward Fager
California Air National Guard
3900 Roseville Road
North Highlands, CA 95660

Dear Colonel Fager:

**SUBJECT: UNDERGROUND STORAGE TANK (UST) CASE
CALIFORNIA AIR NATIONAL GUARD
3900 ROSEVILLE ROAD, NORTH HIGHLANDS, CA 95660
LOCAL REMEDIATION PROGRAM SITE NO.: B262**

This letter is being sent to provide you with the No Further Action letter, required by California's Underground Storage Tank Regulations, and the summary package used by the "Site Closure Committee" in approving the No Further Action status.

If there are any questions, please call me at (916) 875-8553.

Sincerely,

A handwritten signature in cursive script that reads "Cris Hamilton".

Cris Hamilton
Hazardous Materials Division

CH:mj

Enclosure: NFA Letter
No Further Action Summary Package

c: Mike Smith, CVRWQCB (with enclosures)

W:\DATA\HAMILTON\3900 ROSEVILLE RD CLOSURE CVR.DOC



COUNTY OF SACRAMENTO
Environmental Management Department
Mel Knight, Director

452

Bonnie Coleman, Manager
Administrative Services
Raymond E. Hackett, Manager
Environmental Health
Jeanette M. Siewierski, Manager
Hazardous Materials

October 5, 1999

Colonel Edward Fager
California Air National Guard
3900 Roseville Road
North Highlands, CA 95660

Dear Colonel Fager:

SUBJECT: UNDERGROUND STORAGE TANK (UST) CASE
CALIFORNIA AIR NATIONAL GUARD
3900 ROSEVILLE ROAD, NORTH HIGHLANDS, CA 95660
LOCAL REMEDIATION PROGRAM SITE NO.: B262

This letter confirms the completion of a site investigation and remedial action for the underground storage tanks formerly located at the above-described location. Thank you for your cooperation throughout this investigation. Your willingness and promptness in responding to our inquiries concerning the former underground storage tanks are greatly appreciated.

Based on information in the above-referenced file and with the provision that the information provided to this agency was accurate and representative of site conditions, no further action related to the underground tank release is required.

This notice is issued pursuant to a regulation contained in Section 2721(e) of the California Code of Regulations.

Please contact our office if you have any questions regarding this matter.

Sincerely,

A handwritten signature in black ink, reading "Jeanette M. Siewierski". The signature is fluid and cursive, with the first name "Jeanette" being the most prominent part.

Jeanette M. Siewierski
Environmental Management Department

JS:CH:mj

c: Tami Trease
Alan Klavans

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Case Closure Summary

Leaking Underground Fuel Storage Tank Program

III. Release and Site Characterization Information (Continued)

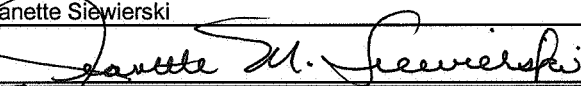
| Maximum Documented Contaminant Concentrations--Before and After Cleanup | | | | | | | | | |
|---|------------|----------|-------------|-------|--------------|------------|-------|-------------|-------|
| Contaminant | Soil (ppm) | | Water (ppb) | | Contaminant | Soil (ppm) | | Water (ppb) | |
| | Before | After | Before | After | | Before | After | Before | After |
| TPH (Gas) | 78 | <1 | NA | NA | Xylene | 1.5 | <.005 | NA | NA |
| TPH (Diesel) | 6940 | <1 | NA | NA | Ethylbenzene | .18 | <.005 | NA | NA |
| Benzene | <.025 | <.005 | NA | NA | Oil & Grease | 320 | <50 | NA | NA |
| Toluene | .15 | <.005 | NA | NA | Heavy metals | <.15 | <.15 | NA | NA |
| VOCs | 0.12 PCE | 0.12 PCE | 41 | 79* | Other | | | | |

Comments (Depth of Remediation, etc.):

IV. Closure

| | | |
|---|------------------------|------------------|
| Does completed corrective action protect existing beneficial uses per the Regional Basin Plan? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO | | |
| Does the completed corrective action protect potential beneficial uses per the Regional Board Basin Plan? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO | | |
| Does corrective action protect public health for current land use? YES | | |
| Site management requirements: None | | |
| Should corrective action be reviewed if land use changes? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | | |
| | | |
| Monitoring/Vapor extraction wells decommissioned: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | No. Decommissioned: NA | No. Retained: NA |
| List Enforcement Actions Taken: Placement into LRP | | |
| List enforcement actions rescinded: None | | |
| | | |

V. Local Agency Representative Data

| | |
|--|------------------------|
| Name: Jeanette Siewierski | Title: Program Manager |
| Signature:  | Date: 10-19-99 |

VI. RWQCB Notification

| | | |
|---|--|-------------------------|
| Date Submitted to RB: November 25, 1999 | RB Response: Concur | |
| RWQCB Staff Name: James Brathovde | Title: Associate Engineering Geologist | Date: November 25, 1999 |

VII. Additional Comments, Data, etc.

| |
|--|
| |
|--|

Case Closure Summary

Leaking Underground Fuel Storage Tank Program

I. AGENCY INFORMATION

DATE: October 5, 1999

| | |
|--|---|
| Agency Name: Sacramento County Environmental Mgmt. Dept. | Address: 8475 Jackson Road, Suite 230 |
| City/State/Zip: Sacramento, CA 95826 | Phone: (916) 875-8550 |
| Responsible staff person: Cris Hamilton | Title: Hazardous Materials Specialist III |

II. Case Information

| | | |
|---|--|-------------------|
| Site Facility Name: North Highlands Air National Guard | | |
| Site Facility Address: 3900 Roseville Road, North Highlands, CA 95660 | | |
| RB LUSTIS Case No: | Local Case No. 10479 | LRP Case No: B262 |
| URF file date: 12-5-95 | SWEEPS No: 007559 | |
| Responsible Parties: | Address: | Phone Numbers: |
| California Air National Guard c/o Colonel Edward C. Fager | 3900 Roseville Road North Highlands, CA 95660 | (916) 569-2236 |

| Tank No. | Size in Gallons | Contents | Closed in-Place/Removed? | Date |
|----------|-----------------|----------|--------------------------|---------|
| 1 | 2000 gallon | Diesel | Removed | 12-5-95 |
| 2 | 3000 gallon | Gasoline | Removed | 12-5-95 |

III. Release and Site Characterization Information

| | | | |
|---|---------------------------|--|--|
| Cause and type of release: Piping release | | | |
| Site characterization complete? (X) YES () NO | | Date approved by oversight agency: | |
| Monitoring Wells Installed? () YES (X) NO | | Number: 0 | Proper screen interval? () YES () NO |
| Highest GW depth below ground surface: 110' | | Lowest Depth: 110' | Flow Direction: N |
| Most Sensitive Current Use: Municipal | | | |
| Are drinking water wells affected? () YES (X) NO | | Aquifer name: Unknown | |
| Is surface water affected? () YES (X) NO | | Nearest/affected SW name: Arcade Creek | |
| Off-site beneficial use impacts (addresses/locations): None | | | |
| Report(s) on file? (X) YES () NO | | Where is report(s) filed? Sacramento County Environmental Management | |
| Treatment and Disposal of Affected Material | | | |
| Materials | Amount (Include Units) | Action (Treatment or Disposal w/Destination) | Date |
| Tanks | 1 x 3000 g and 1 x 2000 g | Removed - Disposal at Erickson Environmental | 12-5-95 |
| Piping | 25 ft | Removed - Disposal at Erickson Environmental | 12-5-95 |
| Free Product | None | | |
| Soil | 484 tons | Disposal at Murieta Soil Technologies | 7-12-95 |
| Groundwater | None | | |
| Barrels | None | | |

STATE WATER RESOURCES CONTROL BOARD
GEOTRACKER

CA AIR NATIONAL GUARD (T0606700890) - ([MAP](#))

3900 ROSEVILLE RD
NORTH HIGHLANDS, CA 95660
SACRAMENTO COUNTY
LUST CLEANUP SITE

CLEANUP OVERSIGHT AGENCIES

SACRAMENTO COUNTY LOP (LEAD) - CASE #: 8262
CENTRAL VALLEY RWQCB (REGION 5S) - CASE #: 341064
CASEWORKER: VERA FISCHER

Regulatory Profile

[PRINTABLE CASE SUMMARY](#)

CLEANUP STATUS - [DEFINITIONS](#)

COMPLETED - CASE CLOSED AS OF 10/5/1999 - [CLEANUP STATUS HISTORY](#)

POTENTIAL CONTAMINANTS OF CONCERN

DIESEL

POTENTIAL MEDIA AFFECTED

SOIL

FILE LOCATION

BENEFICIAL USE

NONE SPECIFIED

Site History

No site history available

Cleanup Action Report

NO CLEANUP ACTIONS EXIST

Regulatory Activities

* Indicates a revised due date

| ACTION TYPE | ACTION | ACTION DATE | RECEIVED / ISSUE DATE |
|-----------------------------|------------------------|-----------------------------|---------------------------------------|
| LEAK ACTION | Leak Discovery | 12/5/1995 | |
| LEAK ACTION | Leak Reported | 12/5/1995 | |
| | | | |
| | | | |
| | | | |
| | | | |

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