



**Quality Assurance Project Plan
Former Fort Ord, California, Volume I
Appendix D, Draft Final Revision 1
Operable Unit 2 Landfills**

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ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
µg/m ³	micrograms per cubic meter
%	percent
%D	percent difference
%R	percent recovery
%v	percent [by] volume
ADR	Automated Data Review
Ahtna	Ahtna Environmental Inc.
ARAR	applicable or relevant and appropriate requirement
Army	U.S. Department of the Army
bgs	below ground surface
BRAC	Base Realignment and Closure
Btu	British thermal unit(s)
Btu/hr	Btu per hour
CAMU	Corrective Action Management Unit
CAS	Chemical Abstracts Service
CCR	California Code of Regulations
CCV	continuing calibration verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CH ₄	methane
CO	carbon monoxide
CO ₂	carbon dioxide
COC	chemical of concern
DoD	Department of Defense
DQI	data quality indicator
DQO	data quality objective
DTSC	California Department of Toxic Substances Control
EDD	electronic data deliverable
ELAP	Environmental Laboratory Accreditation Program
EP	extraction point
EPA	U.S. Environmental Protection Agency
ESD	Explanation of Significant Differences
Eurofins	Eurofins Air Toxics, Inc.
EW	extraction well
FODIS	Fort Ord Data Integration System
FTL	Field Team Lead
GAC	granular activated carbon
GC	gas chromatograph
GCMS	gas chromatograph(y)/mass spectroscop(e/y)
Gilbane	Gilbane Company
HHRA	human health risk assessment
HMP	Habitat Management Plan
ICAL	initial calibration
ICV	initial calibration verification
lb/MMBtu	pounds per million British thermal units

LCS	laboratory control sample
LDC	Laboratory Data Consultants
LFG	landfill gas
LOD	limit of detection
LOQ	limit of quantitation
MBUAPCD	Monterey Bay Unified Air Pollution Control District
MSL	mean sea level
N ₂	nitrogen
NA	not applicable
NELAP	National Environmental Laboratory Accreditation Program
NMOC	non-methane organic compounds
NO	nitrogen oxide
NO _x	nitrogen oxides
O ₂	oxygen
OU2	Operable Unit 2
O&M	operations and maintenance
PARCCS	precision, accuracy, representativeness, comparability, completeness, and sensitivity
PCE	tetrachloroethene
PDL	project decision limit
PM	Project Manager
ppbv	parts per billion by volume
ppmv	parts per million by volume
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
ROD	Record of Decision
RRT	relative retention time
RPD	relative percent difference
RSD	relative standard deviation
RSL	regional screening level
SARA	Superfund Amendment and Reauthorization Act
scfm	standard cubic feet per minute
SL	screening level
SO ₂	sulfur dioxide
SOP	Standard Operating Procedure
SSHO	Site Safety and Health Officer
THC	total hydrocarbons
TTU	thermal treatment unit
UFP	Uniform Federal Policy
USACE	U.S. Army Corps of Engineers
VD	Passive Vent in Area D
VF	Passive Vent in Area F
VOC	volatile organic compound

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP)¹ Appendix D Revision 1 describes the planning, implementation, acquisition, and assessment of data using effective methodologies and thorough quality assurance (QA) and quality control (QC) procedures to be used during sampling and analytical activities so the data generated is accurate, precise, complete, representative of field conditions, and of sufficient quality to support project decisions. Ahtna Environmental Inc. (Ahtna), on behalf of the U.S. Army Corps of Engineers (USACE), will implement the QAPP for sampling and laboratory analysis activities related to operations and maintenance (O&M) of the Operable Unit 2 (OU2) Landfills and landfill gas (LFG) extraction and treatment system at the Former Fort Ord, California (Figure 1). This QAPP also includes information for data management and analysis in support of the sampling program. The O&M activities are in accordance with the Record of Decision (ROD), Operable Unit 2, Fort Ord Landfills, Fort Ord, California (OU2 Landfills ROD; Army, 1994) and the *Operation and Maintenance Plan, Operable Unit 2 Landfills, Former Fort Ord, California* (Shaw, 2008a). This document is intended for use by field operators, supervisors, and data processors and managers responsible for implementing and coordinating field activities for the project.

¹ This document is Appendix D to the *Quality Assurance Project Plan, Superfund Response Actions, Former Fort Ord, California, Volume I*. Volume I is also the governing document for sampling and analysis of groundwater (Appendix A), soil (Appendix B), and soil gas (Appendix C). Volume II of the QAPP pertains to the former Fort Ord military munitions response program.

2.0 PROJECT MANAGEMENT

2.1 Worksheets #1 and #2: Title and Approval Page

Site Name/Project Name: Operable Unit 2 Landfills

Site Location: Former Fort Ord, California

Document Title: Quality Assurance Project Plan, Former Fort Ord, California, Volume I, Appendix D, OU2 Landfills

Lead Organization: U.S. Army Corps of Engineers, Sacramento District

Preparer's Name and Organizational Affiliation: Eric Schmidt, Ahtna

Preparer's Address, Telephone Number, and email Address: 296 12th St, Marina CA 93933; (831) 384-3735; eschmidt@ahtna.net

Preparation Date (Day/Month/Year): 6 JUN 2016

Review Signatures:

Investigative Organization's Project Manager: _____
Signature Date
Printed Name/Organization: Derek S. Lieberman, P.E., Ahtna

Investigative Organization's Program Chemist: _____
Signature Date
Printed Name/Organization: Christopher Ohland, Ahtna

Lead Organization's Technical Lead/Date: _____
Signature Date
Printed Name/Organization: Teresa Rodgers, USACE

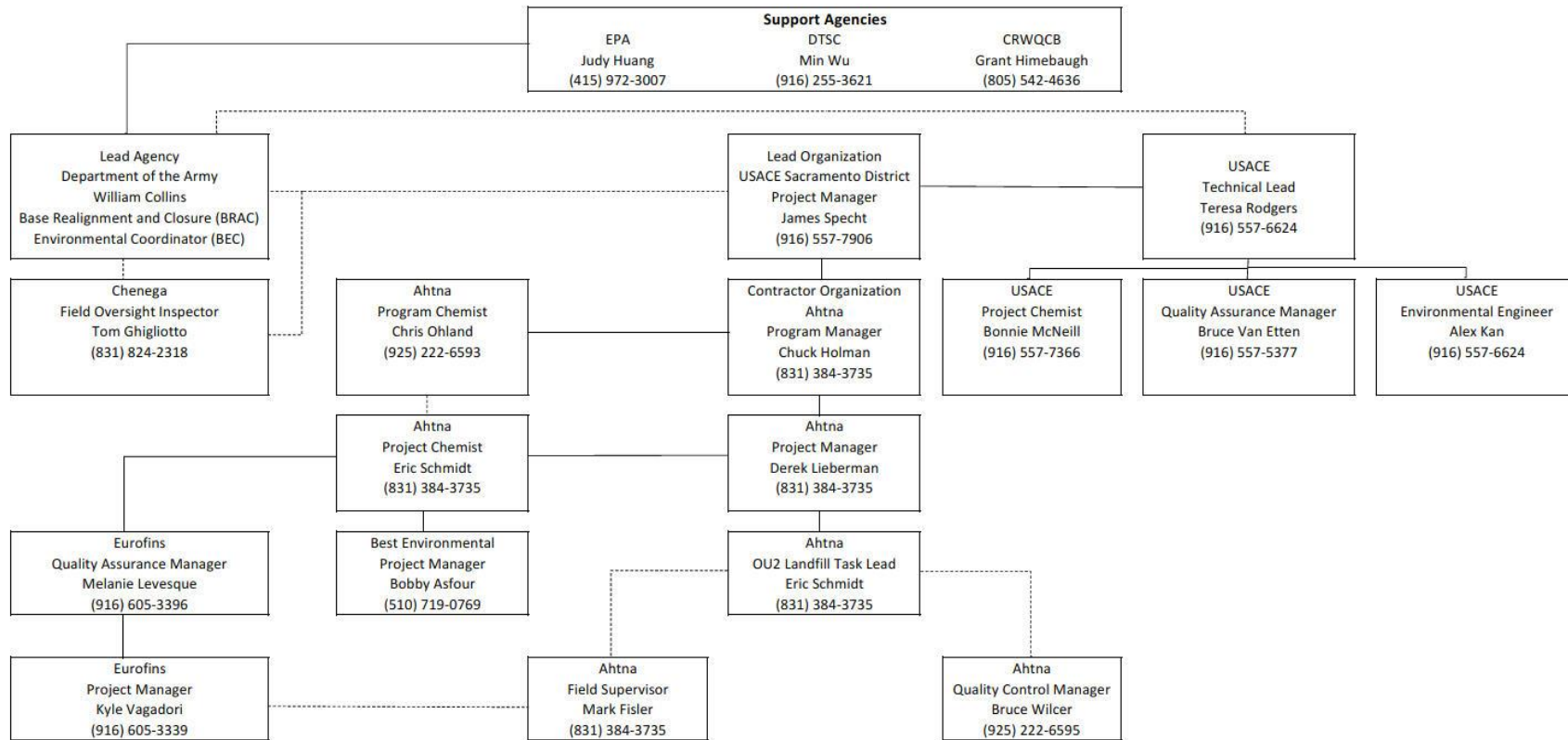
Lead Organization's Project Chemist/Date: _____
Signature Date
Printed Name/Organization: Bonnie McNeill, USACE

Plans and reports from previous investigations relevant to this project:

Title	Company	Date
Record of Decision Operable Unit 2, Fort Ord Landfills Fort Ord, California	U.S. Department of the Army (Army)	07/15/94
Explanation of Significant Differences, Operable Unit 2, Fort Ord Landfill	Army	08/03/95
Operable Unit 2 Explanation of Significant Differences Record of Decision, Corrective Action Management Unit (CAMU), Operable Unit 2 Landfill	Army	01/13/97
Explanation of Significant Differences, No Further Action for Munitions and Explosives of Concern, Landfill Gas Control, Reuse of Treated Groundwater, Designation of Corrective Action Management Unit (CAMU) Requirements as Applicable or Relevant and Appropriate Requirements (ARARs), OU2, Fort Ord Landfills	Army	10/04/06
Operation and Maintenance Plan Operable Unit 2 Landfills Former Fort Ord, California Revision 2	Shaw Environmental, Inc.	Sept. 2008

2.2 Worksheets #3 and #5: Project Organization and QAPP Distribution

Reporting relationships between organizations involved in the project, including the lead organization, contractors, and subcontractor organizations are identified below.



Notes:

----- Line of communication
 _____ Line of authority

2.3 Worksheets #4, #7 and #8: Personnel Qualifications and Sign-off Sheet

Ahtna

Name	Project Title/Role	Education/Experience	Signature/Date
Derek Lieberman	Project Manager	Resume on file	
Brad Clark	Engineer of Record	Resume on file	
Eric Schmidt	Project Chemist/Task Lead and Data Manager	Resume on file	
Mark Fisler	Field Supervisor	Resume on file	
Bruce Wilcer	Quality Control Manager	Resume on file	
Andrew Mauck	Field Technician	Resume on file	

Signatures indicate personnel have read and agree to implement this QAPP as written.

Worksheets #4, #7 and #8: Personnel Qualifications and Sign-off Sheet

Laboratory: Eurofins Air Toxics, Inc. (Eurofins)

Name	Project Title/Role	Education/Experience	Signature/Date
Kyle Vagadori	Project Manager	Resume on file	
Melanie Levesque	QA Manager	Resume on file	

Signatures indicate personnel have read and agree to implement this QAPP as written.

Worksheets #4, #7 and #8: Personnel Qualifications and Sign-off Sheet

Mobile Laboratory: Best Environmental

Name	Project Title/Role	Education/Experience	Signature/Date
Bobby Asfour	Project Manager	Resume on file	

Signatures indicate personnel have read and agree to implement this QAPP as written.

2.4 Worksheet #6: Communication Pathways

Communication Driver	Organization	Name	Contact Information	Procedure (timing, pathways, documentation, etc.)
Regulatory agency interface	Army	William Collins	831-242-7918	Project materials and information will be submitted to EPA, DTSC, and CRWQCB as appropriate by William Collins via email or hardcopy
Point of contact with Army Base Realignment and Closure (BRAC) Office	USACE	Teresa Rodgers	916-557-6624	Materials and information regarding the project will be forwarded to Army BRAC Office through USACE Technical Lead.
Point of contact for the Lead Organization Technical Lead	Ahtna	Derek Lieberman	831-384-3735	Oversees and reviews materials and information about the project.
Status Reports	Ahtna	Derek Lieberman	831-384-3735	Derek Lieberman will provide updates to USACE during weekly status calls.
Stop work due to safety issues	Ahtna	Any person	831-384-3735	Any individual has the ability to stop work based on an unsafe work condition, or a potential for an unsafe work condition.
QAPP variances in the field	Ahtna	Mark Fisler Andrew Mauck	831-384-3735	Notify Eric Schmidt by telephone or email of variances to QAPP made in the field and the reasons within 24 hours.
QAPP modifications and contract compliance	Ahtna	Eric Schmidt	831-384-3735	Prepares QAPP and QAPP amendments; issue valid QAPP variances with input from Project Manager (PM) and Sampling Team Lead. Assures Ahtna compliance with contract requirements.
Field and analytical corrective actions	Ahtna	Chris Ohland	925-222-6593	The need for corrective action for analytical issues will be determined by Chris Ohland.
QC and contract compliance	Ahtna	Bruce Wilcer	925-222-6856	Reviews project plans; assures Ahtna compliance with contract requirements.
Analytical contact with the field staff and laboratory	Ahtna	Eric Schmidt	831-384-3735	Oversees and reviews all analytical materials generated from the field and by the laboratory.

Communication Driver	Organization	Name	Contact Information	Procedure (timing, pathways, documentation, etc.)
Reporting fixed lab data quality issues	Eurofins	Kyle Vagadori Melanie Levesque	800-985-5955	QC issues with project field samples will be reported by the laboratory to Eric Schmidt within 2 business days. Identify required variances from QAPP.
Reporting mobile lab data quality issues	Best Environmental	Bobby Asfour	510-719-0769	QC issues with mobile laboratory analysis will be reported to Eric Schmidt upon discovery. Identify required variances from QAPP.
Data import and export	Ahtna	Eric Schmidt	831-384-3735	Uploads field/fixed lab and data recorder data into the Fort Ord Data Integration System.
Hazardous or unsafe conditions that raise question of stopping work	Ahtna	Eric Schmidt Mark Fisler Andrew Mauck	831-384-3735	Confer with Derek Lieberman and/or the Ahtna Site Safety and Health Officer (SSHO) to determine whether work needs to be stopped; the Ahtna SSHO will report stop-work decision to the Ahtna PM.
Perform field QC checks to ensure proper sampling methods, custody procedures, packaging, and shipment are performed	Ahtna	Bruce Wilcer	925-222-6856	Report result of field checks to Derek Lieberman and Eric Schmidt.
Prepare initial write-up of field generated data to be included in final reports	Ahtna	Eric Schmidt	831-384-3735	Confer with Derek Lieberman on questions and resolutions.
Database setup and data management planning	Ahtna	Eric Schmidt	831-384-3735	Provides information on sample and analytical reporting groups, and types of report tables required for project.
Data verification/data validation	Ahtna / Laboratory Data Consultants	Eric Schmidt	831-384-3735	Report result of analytical QC checks to Chris Ohland.
Data review issues and corrective actions	Ahtna	Eric Schmidt	831-384-3735	Report result of analytical QC corrective action to Chris Ohland and Derek Lieberman.

2.5 Worksheet #9: Project Planning Session Summary

Date of Planning Session #1: May 26, 2015

Purpose: Define contract requirements for QAPP.

Participants:

Name	Title/Role	Affiliation	Telephone	email
Chuck Holman	Program Manager	Ahtna	831-384-3735	cholman@ahtna.net
Kelly O'Meara	Business Manager	Ahtna	831-384-3735	komeara@ahtna.net
Chris Ohland	Program Chemist	Ahtna	925-222-6593	cohland@ahtna.net
Derek Lieberman	Project Manager	Ahtna	831-384-3735	dlieberman@ahtna.net
Brad Clark	Project Engineer	Ahtna	831-384-3735	bclark@ahtna.net
Megan Haberman	Project Administrator	Ahtna	831-384-3735	mhaberman@ahtna.net
Megan Gehrke	Field Technician	Ahtna	831-384-3735	mgehrke@ahtna.net
Holly Dillon	SSHO	Ahtna	831-384-3735	hdillon@ahtna.net

Planning Session Summary:

Reviewed contract to determine QAPP requirements.

Action Items:

Based on the review, Ahtna will:

- Update of the QAPP annually;
- Review past OU2 Landfills activities and historical monitoring data;
- Take into account the requirements of OU2 Landfills decision documents and other related guidance documents when updating the QAPP;
- Submit the preliminary draft QAPP update to the Army for review;
- Submit draft and draft final version QAPP updates to the regulatory agencies and the public for review.
- Submit final version after receiving approval from the Army and regulatory agencies.

Date of Planning Session #2: October 23, 2015

Purpose: Initiate annual QAPP update per contract requirements.

Participants:

Name	Title/Role	Affiliation	Telephone	email
Derek Lieberman	Project Manager	Ahtna	831-384-3735	dlieberman@ahtna.net
Eric Schmidt	Project Chemist/Task Lead	Ahtna	831-384-3735	eschmidt@ahtna.net

Planning Session Summary:

- Reviewed contract requirements and QAPP schedule;
- Noted the previous version of the QAPP (Gilbane Company [Gilbane], 2014) was prepared in accordance with U.S. Environmental Protection Agency (EPA) Requirements for Quality Assurance Project Plans (EPA QA/R-5).

Action Items:

Action	Responsible Party	Due Date
Revise QAPP to indicate Ahtna as the Landfills O&M contractor.	Eric Schmidt, Ahtna	October 30, 2015
Review QAPP for inconsistencies or errors and correct as needed.	Eric Schmidt, Ahtna	October 30, 2015
Consult USACE about revising QAPP to UFP format. ²	Derek Lieberman, Ahtna	October 23, 2015

Date of Planning Session #3: November 18, 2015

Purpose: OU2 Landfills and TTU O&M status update.

Participants:

Name	Title/Role	Affiliation	Telephone	email
Alex Kan	Environmental Engineer	USACE	916-557-7578	Alexander.Kan@usace.army.mil
Bonnie McNeill	Project Chemist	USACE	916-557-7366	Bonnie.J.McNeill@usace.army.mil
Tom Ghigliotto	Field Oversight Inspector	Chenega	831-824-2318	Thomas.F.Ghigliotto@usace.army.mil
Derek Lieberman	Project Manager	Ahtna	831-384-3735	dlieberman@ahtna.net
Eric Schmidt	Project Chemist/ Task Lead	Ahtna	831-384-3735	eschmidt@ahtna.net
Mark Fisler	Field Supervisor	Ahtna	831-384-3735	mfisler@ahtna.net
Andrew Mauck	Field Technician	Ahtna	831-384-3735	amauck@ahtna.net
Holly Dillon	SSHO	Ahtna	831-384-3735	hdillon@ahtna.net

Planning Session Summary: Discussed necessity of monitoring all LFG probes at the Landfills and whether monitoring frequency could be reduced for some probes. Eric Schmidt stated he had done this analysis several years ago, but it would have to be reviewed and updated.

Action Items: Ahtna will evaluate historical probe data, recommend probes for sampling frequency reduction, and develop QAPP decision criteria for determining probe monitoring frequency.

² In consultation with the USACE, it was determined the QAPP should be updated to conform to the UFP-QAPP Manual (IDQTF, 2005) and the Optimized UFP-QAPP Worksheets (IDQTF, 2012).

3.0 PROJECT QUALITY OBJECTIVES

3.1 Worksheet #10: Conceptual Site Model

Background and History

The former Fort Ord is located in northwestern Monterey County, California, approximately 80 miles south of San Francisco. The OU2 Landfills formerly included six landfill areas, one area north and five areas south of Imjin Parkway, covering approximately 150 acres, including the immediate surrounding area (Figure 1). The former Area A Landfill, north of Imjin Parkway, was approximately 33 acres separated from the Areas B through F Landfills to the south of Imjin Parkway (Figure 2). The Areas B through F Landfills encompass approximately 120 acres of undeveloped land. The six landfill areas were used for residential and on-base waste disposal. The former Area A was used from 1956 to 1966. Areas B through F were operated from 1960 until 1987, when interim closure of the facility began, which effectively terminated waste disposal activities at the OU2 Landfills (Shaw, 2008a).

The remedial action at the former Area A was conducted from 1996 to 1998 in accordance with the requirements of the OU2 Landfills ROD (Army, 1994) and the *Explanation of Significant Differences, Consolidation of Remediation Waste in a Corrective Action Management Unit (CAMU), Operable Unit 2 Landfill* (CAMU ESD; Army, 1997a). Approximately 585,000 cubic yards of refuse were excavated during the remediation. This material was placed and compacted as part of the general fill in Areas B, C, D, and F of the OU2 Landfills (IT Corporation, 2001). Closure is being completed as a remedial action at the OU2 Landfills in accordance with the OU2 Landfills ROD (Army, 1994).

The selected remedial action presented in the OU2 Landfills ROD includes placing an engineered cover system over buried refuse at the OU2 Landfills. The *Record of Decision, Basewide Remedial Investigation Sites, Fort Ord, California* (RI Sites ROD; Army, 1997b) in conjunction with the CAMU ESD (Army, 1997a) and the *Explanation of Significant Differences, No Further Action for Munitions and Explosives of Concern, Landfill Gas Control, Reuse of Treated Groundwater, Designation of Corrective Action Management Unit (CAMU) Requirements as Applicable or Relevant and Appropriate Requirements (ARARs)* (Army, 2006) designate CAMU regulations as ARARs for the existing boundaries of Areas B through F. Such designation generally allows remediation waste to be placed at the OU2 Landfills and used as a foundation layer without triggering certain disposal regulations. Soil remedies for the RI Sites at the Former Fort Ord utilized the CAMU for placement of excavated soil and/or debris, which are managed, incorporated within the landfill foundation layer, and capped as part of the landfill.

The remedial actions for the debris and soil at the OU2 Landfills include a cover system, collection and removal of LFG (if necessary), institutional controls, and a groundwater extraction and treatment system for volatile organic compounds (VOCs). The Army completed construction of an engineered cover over Areas B through F from 1997 to 2002 (Shaw, 2005a) and began operating the groundwater extraction and treatment system in 1995. In 2001 the Army installed a pilot extraction and treatment system to mitigate LFG migration along the eastern perimeter of Area F where a residential area is located closest to the landfill (Shaw, 2005b). The system began operation on June 4, 2001 and included a series of LFG

extraction wells (EWs) LFG treatment with granular activated carbon (GAC) to remove VOCs, and potassium permanganate to remove vinyl chloride. Two 8-inch diameter perforated collector pipes, approximately 800 feet in total length, were installed in the foundation layer at Area E during construction in 2002 for possible future methane extraction. The collector pipes are collectively referred to as extraction point (EP) EP-36.

Based on the results of the pilot study, the extraction and treatment system was expanded by adding vertical extraction wells (EW) along the perimeter and within the interior of Area F, and replacing the existing treatment system with a thermal treatment unit (TTU), which started operation in April 2006. The TTU, unlike the GAC/potassium permanganate treatment system, removes and treats both VOCs and methane by combustion in an enclosed flare operating in excess of 1,400 degrees Fahrenheit (°F).

In 2008, an EW was installed in Area D to augment the methane output from the Area F extraction system. A conduit from EP-36 to the TTU also was installed as part of the LFG treatment system expansion (Shaw, 2008b). In April 2009, EP-36 was brought online to augment the methane output from the Area F extraction system. As part of Field Work Variance TII-138 to the O&M Plan (Shaw, 2008a), testing was performed on Area F passive vent (VF) VF-4 to determine if it was a viable source of methane that could be used in operation of the TTU. Results of this test determined that a significant increase in methane removal could be achieved through the addition of VF-4 into the extraction network. In June 2009, VF-4 was brought on line to augment the methane output from the Area F extraction system.

In February 2011, four additional passive vents in Areas D and F (VD-2, VD-3, VF-3, and VF-5) were converted to EPs to augment the methane output. These additions were documented in Field Work Variance TII-154 to the O&M Plan (Shaw, 2008a).

System monitoring includes all EPs and the combined collection points at the TTU. Since the remedy is being performed under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA; 42 USC 9601 et seq.), as amended by the Superfund Amendment and Reauthorization Act of 1986 (SARA), the Monterey Bay Unified Air Pollution Control District (MBUAPCD) does not have jurisdiction over these remedial actions, and a permit for the TTU and exhaust stack is not required. However, the MBUAPCD substantive requirements are being implemented.

Due to the need for remediation at the Site 39 Inland Ranges, and the availability of additional remediation waste capacity at Area E, the Army proposed to place contaminated soil from the Site 39 Inland Ranges within the existing footprint of Area E as a vertical expansion. The Army prepared the *Record of Decision Amendment, Site 39 Inland Ranges, Former Fort Ord, California* (Army, 2009) to present the soil cleanup levels and the volume of soil to be addressed under the selected remedial action for the Site 39 Inland Ranges originally identified in the RI Sites ROD (Army, 1997b). Additional capacity at the OU2 Landfills was available by placing remediation waste within the existing Area E footprint on top of the existing engineered cover system. Construction of the vertical expansion involved placing additional remediation waste above the existing geomembrane and installing a new engineered cover consisting of a foundation layer, geomembrane, and vegetative layer over the

remediation waste. The vertical expansion allows for placement of approximately 200,000 cubic yards of remediation waste in at least two phases. When the vertical expansion is complete, the additional remediation waste will be sealed above and below by a geomembrane. Phase 1 was completed in 2013 with approximately 150,000 cubic yards placed in the vertical expansion at Area E. Additional remediation of Site 39 and placement of soil in the Area E vertical expansion may be necessary in the future.

Sources of Known or Suspected Hazardous Waste

No detailed records were kept on the amount or types of wastes disposed of at the OU2 Landfills; however, household and commercial refuse, ash from incinerated infectious wastes, dried sewage sludge, demolition material, and small amounts of chemical waste (such as paint, waste oil, pesticides, electrical equipment, ink and epoxy adhesives) are believed to have been disposed of in the OU2 Landfills (Dames & Moore, 1993).

Known Contaminants

Known contaminants at the OU2 Landfills are methane and VOCs in LFG. For methane, the primary release mechanism is emanation from decomposing organic waste. For VOCs, the primary release mechanisms are emanation (within LFG) and infiltration/percolation to groundwater.

Fate and Transport Considerations

VOCs remaining in waste disposed of at the OU2 Landfills and VOCs detected in LFG have the potential to travel through soil pore space to exposure points via a number of mechanisms:

- Advection: mass transport due to bulk flow of water in which contaminants are dissolved;
- Dispersion: transport due to the groundwater flow whether or not a compound is dissolved;
- Diffusion: spreading of contaminants due to molecular diffusion in response to concentration gradients.
- Volatilization: loss of chemical vapor to the atmosphere.

VOCs naturally undergo biological degradation processes in soil, soil gas and groundwater; however, the rate of such degradation is limited by oxygen and nutrient sources depending upon the type of degradation that is occurring (aerobic vs. anaerobic). Further, degradation of compounds is dependent on the biological pathway available.

Groundwater contamination at OU2 affected the upper three groundwater aquifers as described in the *Final Remedial Investigation/Feasibility Study, Fort Ord, California, Volume II – Remedial Investigation Introduction and Basewide Hydrogeologic Characterization* (HLA, 1995). These three aquifers include the A-Aquifer, the Upper 180-Foot Aquifer, and the Lower 180-Foot Aquifer. In the vicinity of OU2, the tops of each of these aquifers typically are first encountered at depths of about 60 feet bgs, 150 feet bgs, and 250 feet bgs, respectively. In monitoring well MW-OU2-73-A, located at the OU2 Landfills Area F source area, tetrachloroethene and trichloroethene are below their Aquifer Cleanup Levels or not detected, but vinyl chloride is detected at the highest concentrations for the OU2 A-Aquifer. Vinyl chloride is a breakdown product in the natural reductive dechlorination process and may indicate this process is

occurring locally at OU2 Landfills Area F.

With implementation of the remedy as prescribed in the OU2 Landfills ROD (engineered landfill cover system, and groundwater extraction and treatment system) in addition to operation of the LFG extraction and treatment system, impacts to the underlying groundwater from the OU2 Landfills have been greatly mitigated.

Potential Receptors and Exposure Pathways

A residential area is located adjacent to OU2 Landfills Area F, with the closest residence located approximately 368 feet from the OU2 Landfills perimeter. There is a potential for residents to be exposed to VOCs from inhalation of vapors in ambient air, which may enter buildings through open windows or ventilation systems. To evaluate risks associated with this scenario, the Army performed ambient air monitoring in 2000, 2001, 2002 and 2003 to determine landfill gas dispersion in ambient air on the east side of Area F. The data were used to complete a screening-level human health risk assessment (HHRA). The updated HHRA indicated that the OU2 Landfills are not a significant contributor of VOCs in ambient air or a significant risk to downwind receptors (Shaw, 2005c). The HHRA also noted that the LFG collection and treatment system installed at Area F prevents LFG from migrating offsite in the direction of the residential area. Since the onset of TTU operations, the methane concentrations in perimeter monitoring probes have remained below 5 percent (%) per the requirements of Title 27 California Code of Regulations (27CCR) Section 20921(a)(2) (Gilbane, 2014 and 2015).

Land Use Considerations

The OU2 Landfills encompass approximately 120 acres of land that is undeveloped other than use as a landfill. A residential housing area for California State University Monterey Bay is located adjacent to OU2 Landfills Area F, with the closest residence located approximately 368 feet from the OU2 Landfills perimeter.

Other land immediately adjacent to the OU2 Landfills was transferred from the Army to the Fort Ord Reuse Authority in 2004 and 2006 and remains undeveloped. These parcels of land are identified in the *Installation-Wide Habitat Management Plan for Former Fort, California* (HMP) as containing habitat occupied or potentially occupied by several sensitive wildlife and plant species, some of which are listed or proposed for listing as threatened or endangered under the federal Endangered Species Act. Accordingly, this land is categorized as “Development with Reserve Areas or Development with Restrictions” in the HMP. While the land may be developed, there are specific restrictions to protect biological resources as identified in the HMP and the quitclaim deeds associated with the land.

The quitclaim deeds for land within 1,000 feet of the OU2 Landfills also include a notification stating landowners should refer to 27CCR Section 21190, which identifies protective measures for structures built on or within 1,000 feet of a landfill.

Physiography and Topography

Elevations at Fort Ord range from approximately sea level at the beach to 900 feet mean sea level (MSL) at Wildcat Ridge. At the OU2 Landfills, elevations range from approximately 160 feet MSL at the west

end of Area B to 255 feet MSL at the top of the Area E ridgeline. Runoff is minimal due to the high rate of surface water infiltration into the permeable dune sand; consequently, well-developed natural drainages are absent throughout much of this area. However, erosion has been observed primarily where roads were cut into slopes. In these areas, small gullies are present, but generally end shortly after the topography flattens out. Closed drainage depressions typical of dune topography are common.

Geology and Hydrogeology

Remedial investigation at the OU2 Landfills indicated that the landfill materials were buried in relatively uniform sand dune deposits in shallow trenches approximately 30 feet wide, 10 to 15 feet apart, and extending from ground surface to 10 to 30 feet below ground surface (bgs). Soil samples collected below the OU2 Landfills do not contain chemicals associated with the Landfills; however, chemicals associated with landfilled materials have been detected in soil vapor samples obtained from soil overlying the Landfills and in the groundwater collected from beneath the Landfills. The chemicals are believed to have migrated away from the landfilled materials as vapors or as solutes in leachate (Army, 1995).

Groundwater in the uppermost A-Aquifer in the area of the OU2 Landfills generally flows northwest toward the Monterey Bay; however, groundwater east of the OU2 Landfills generally flows northeast toward the Salinas River due to a groundwater divide located east of Area F. Due to extensive local and regional pumping of water from the Upper and Lower 180-Foot Aquifers for agricultural and domestic use, the natural westward flow of groundwater is reversed to the east toward the Salinas Valley. The Upper 180-Foot Aquifer is separated from the A-Aquifer by a relatively impermeable clay layer known as the Salinas Valley Aquitard; however, near the Monterey Bay these two aquifers are connected because the aquitard pinches out in this area. Therefore, chemicals of concern (COCs) in the A-Aquifer can or may migrate into the Upper 180-Foot Aquifer (Army, 1995).

3.2 Worksheet #11: Project/Data Quality Objectives

Data quality objectives (DQOs) are qualitative and quantitative statements that outline the decision-making process and specify the data required to support corrective actions. DQOs specify the level of uncertainty that will be accepted in results derived from data. The DQO process used for developing data quality criteria and performance specifications for decision making is consistent with the *Guidance on Systematic Planning Using the Data Quality Objectives Process*, EPA QA/G-4 (EPA, 2006). The DQO process consists of the following seven steps:

- Step 1: State the problem
- Step 2: Identify the goals of the study
- Step 3: Identify information inputs
- Step 4: Define the boundaries of the study
- Step 5: Develop the analytical approach
- Step 6: Specify performance or acceptance criteria
- Step 7: Develop the plan for obtaining data

There are DQOs for the three types of testing at the OU2 Landfills: (1) TTU source testing, (2) TTU operational influent LFG testing, and (3) LFG monitoring at the Landfills perimeter.

DQO #1: TTU Source Testing

Problem Statement. Even though the MBUAPCD does not have jurisdiction over the TTU and the exhaust stack, the Army will perform annual source testing of the TTU to determine whether it operates efficiently and meets local regulatory standards. The optimum operating conditions, based on permits issued for similar facilities for the type of TTU at the OU2 Landfills, are:

- Minimum destruction efficiency of total hydrocarbons (THC) shall be 98% by weight, or reduction of the outlet non-methane organic compounds (NMOC) concentration to less than 20 parts per million by volume (ppmv), dry basis as hexane, at 3% oxygen (O₂).
- Combustion temperature shall be maintained at a minimum of 1,400 °F within 30 minutes of any start-up; minimum combustion residence time shall be 0.6 seconds.
- Instrumentation shall record combustion temperature continuously during operation.
- Nitrogen oxide (NO) emissions shall not exceed 0.06 pounds per million British thermal units (lb/MMBtu).
- Carbon monoxide (CO) emissions shall not exceed 0.40 lb/MMBtu.
- THC emissions shall not exceed 0.03 lb/MMBtu.
- Sulfur dioxide (SO₂) emissions shall not exceed 0.2% by volume (%v; 2,000 ppmv);
- Inlet sulfur content shall not exceed 50 grains hydrogen sulfide per 100 cubic feet of gas.
- Instrumentation shall continuously record the amount of LFG flow to the flare during operation.
- No air contaminant which is as dark as or darker than Ringlemann 1 or equivalent (20% opacity) shall be discharged for more than an aggregate 3 minutes in any hour.
- No emission shall constitute a public nuisance.

Influent LFG and exhaust emission concentrations and flow rates (measured under maximum available throughput loads) will be used to calculate the mass emission rates of LFG constituents and the mass emission factors for secondary pollutants that result from the combustion process.

Study goals. The goals of the study are to determine whether the TTU operates efficiently under optimal operating conditions and meets local regulatory standards. The system may require adjustments to increase its efficiency and/or to achieve the target operating conditions. The system may require optimization to meet regulatory standards.

Information inputs. To meet the goals of the study, the following inputs will be required:

Stack Emissions (Effluent)

Gas stream volumetric flow rate
Nitrogen oxides (NO_x), CO, O₂, carbon dioxide (CO₂)
NMOCs
SO₂ (calculated)
Methane (CH₄)
VOCs
Flare temperature

Influent LFG

Heating value (calculated based on hydrocarbon content; caloric content of gas)
O₂, CO₂, nitrogen (N₂)
CH₄
VOCs
NMOCs
Reduced sulfur compounds
LFG flow rate

A certified mobile laboratory provided and staffed by Best Environmental will be on site to measure the above parameters (with the exception of VOCs, fixed gases, and reduced sulfur compounds, which will be analyzed in a certified fixed laboratory). Best Environmental is certified by the State of California Air Resources Board to conduct compliance testing pursuant to California Code of Regulations, Title 17, Section 91207. Section 6.0 provides details of the analytical methods to be employed. The LFG flow rate and flare temperature will be measured using a calibrated flow meter and thermocouple on site.

Sample data from stack emissions and influent LFG testing, in combination with gas flow rates and other parameters, will be used to perform calculations to determine whether the TTU achieves the optimum operating conditions.

Study boundaries. Emission samples will be collected from two sampling ports on the TTU stack. The sampling ports are in the same horizontal cross-section of the stack but are 90 degrees apart. Influent LFG samples will be collected from a sampling port located before the TTU.

Analytical approach. TTU stack emissions and the influent LFG concentrations for specific gases are measured to determine the TTU's efficiency, its ability to achieve optimum operating conditions, and its ability to meet regulatory standards.

- If mathematical calculations and direct measurement data obtained from stack emissions and influent LFG testing demonstrate that it meets the target operating conditions, then the TTU will be considered to be operating efficiently.
- If mathematical calculations and direct measurement data obtained from stack emissions and operational influent LFG testing do not demonstrate that it meets the target operating conditions, then the TTU may require adjustments to increase its efficiency and meet target operating conditions.
- If stack emission data show that the system does not achieve regulatory standards, then the TTU may require optimization to achieve the regulatory standards.
- If stack emission data show that the system meets regulatory standards, then the TTU will not require further optimization.
- If a VOC has not been detected in any of the samples associated with the LFG extraction system (TTU influent, extraction legs, stack) for five consecutive annual monitoring events, the VOC will be removed from the TO-15 target analyte list (Worksheet #15) for operational extraction system sampling only.
- The eleven VOCs identified as COCs for groundwater in the OU2 Landfills ROD will remain on the TO-15 target analyte list.
- If the list of VOCs identified as COCs for groundwater is revised in a subsequent OU2 decision document, then the most current list of COCs for groundwater will remain on the TO-15 target analyte list.
- To confirm compliance with regulatory standards, the full TO-15 list of VOCs will be reported once every 5 years³ for samples associated with the TTU system. If a VOC that was previously removed from the TO-15 target analyte list for DQO #1 is detected, this VOC will be added to the TO-15 target analyte list for DQO #1 (Worksheet #15).
- These criteria are applied retroactively to include VOC analytical data collected since TTU operations began in April 2006.

Performance or acceptance criteria. Decisions could be affected adversely by errors in field and/or fixed laboratory measurements. By adhering to standard procedures, and approved methods to obtain the most reliable data, decision errors will be minimized and should not be a factor in making decisions.

³ The full TO-15 list of VOCs was last reported in the *Final Annual Report, 2015, Operations and Maintenance, Operable Unit 2 Landfills, Former Fort Ord, California* (Administrative Record No. OU2-TBD) and will next be reported in the 2019 annual report.

Plan for obtaining data. The TTU should be operated and maintained properly to achieve continuous optimum performance and efficiency. The field test methods, parameters, numbers of tests, durations of tests for stack emission testing, and information inputs for effluent LFG are:

Sample Parameter	Test Method	Number of Runs/Samples	Test Duration	Information Input Source
Flow Rate	EPA Method 19	3	40 minutes	Mobile Laboratory
O ₂ , CO ₂	EPA Method 3A	3	40 minutes	Mobile Laboratory
CH ₄ /NMOC	EPA Method 25A	3	40 minutes	Mobile Laboratory
CO	EPA Method 10	3	40 minutes	Mobile Laboratory
NOx	EPA Method 7E	3	40 minutes	Mobile Laboratory
VOCs	EPA Method TO-15	1	NA	Fixed Laboratory

Access to the stack will be through a shared sample line provided by the source testing contractor. A heated and filtered stainless steel probe will be used to extract the gas sample from the stack. A heated, 3/8-inch Teflon® line will transport the sample from the point of extraction to the non-contact gas conditioning chiller system. The gas conditioning system and all analytical equipment will be provided by the source testing contractor in a self-contained mobile test laboratory. The moisture will be condensed and removed from the gas stream, while the pollutants pass through to the analytical equipment. The analyzer will be located in a temperature-controlled area to minimize thermal effects on the calibration of the instrument used in taking the measurements.

The laboratory test methods, parameters, numbers of tests, and information inputs for influent LFG are as follows:

Sample Parameter	Test Method	Number of Samples	Information Input Source
Heating Value (calculated), O ₂ , CO ₂ , NMOC	ASTM D1945	1	Fixed Laboratory
VOCs	EPA Method TO-15	1	Fixed Laboratory
Total Reduced Sulfurs	ASTM D5504	1	Fixed Laboratory
LFG rate	Field measurement	Continuous	Flow meter
Flare temperature	Field measurement	Continuous	Thermocouple

Source testing will be performed annually to demonstrate that the TTU is operating within the substantive requirements of MBUAPCD emission limits.

DQO #2: Operational Influent LFG Testing

Problem Statement. The composition and concentration of the operation influent gas stream needs to be known in order to operate the TTU efficiently and to establish a schedule of treatment and extraction operations. The composition and characteristics from operational EWs need to be monitored to maintain compliance with 5%v standard at the property boundary. VOC mass extraction rates may need to be adjusted to maximize removal.

Study goals. The principal study goals are to determine the operational influent LFG composition and characteristics so that methane concentrations can be maintained below the lower explosive limit of 5%v; and to determine the composition and characteristics of operational EWs and other wells and probes to prevent adverse acute and chronic exposure to toxic and/or carcinogenic compounds.

Information inputs. To determine trends in composition and characteristics present in the TTU operational influent LFG and the EWs, the following inputs are required using a portable LFG analyzer:

Influent LFG

CH₄

CO₂

O₂

Balance gas (a combination of the remainder of gases, but the majority is N₂)

Temperature

Flow

Vacuum

Input will also come from the analysis of VOCs by EPA Method TO-15 at a fixed-base laboratory.

Study boundaries. The boundaries of the study are the frequency and the locations of monitoring points for the TTU and the compliance perimeter probes and EWs on the Eastern side of Area F, where the OU2 Landfills are closest to a residential housing area.

Analytical approach. The composition of gases from the operational EWs and perimeter probes will be monitored.

- If the concentration of methane is below 40%v, and the flow rate is below 30 standard cubic feet per minute (scfm), or if methane is below 30%v and the flow rate is below 50 scfm as measured in the influent LFG, then the system parameters will be adjusted (e.g., EW flow rates may be adjusted, the TTU may be shut down and operated intermittently, or supplemental fuel may be added to operate the TTU continuously).
- If the concentration of methane is greater than 50%v, and the flow rate is 180 scfm or greater, or if the concentration of methane is greater than 30%v and the flow rate is 300 scfm or greater, resulting in maximum influent conditions greater than 5 million Btu per hour (Btu/hr), then the

system may be adjusted or shut down.

- If the methane concentrations exhibit a downward trend, possibly due to short term over-extraction of the available LFG, then the TTU may be operated intermittently, or shut down, or fuel may be added to avoid permanently damaging the methane-generating potential of the waste and substantially reducing the long-term availability of fuel for self-sustaining TTU operations.
- If methane concentrations in the compliance perimeter monitoring probes associated with the eastern perimeter leg are greater than the regulatory compliance concentration of 5%v, then the eastern perimeter leg will be operated more frequently to maintain compliance.
- If methane concentrations in the eastern perimeter probes are below 5%v, then this leg may be shut down.
- If methane concentrations in the northern or southern perimeter leg are less than 10%v, then these leg(s) may be shut down.
- If methane concentrations in individual interior EWs at Area F are below 40%v, then the individual wells may be shut down.
- If methane concentrations in individual interior EWs at Area D are below 30%v, then the individual wells may be shut down.
- If methane concentrations in the interior legs of Area D or Area F are below 50%v, then operation of the TTU will be intermittent rather than continuous.
- If EW temperatures are greater than 120 °F, then the individual well(s) or the leg will be shut down.
- If a VOC has not been detected in any of the samples collected from the LFG extraction system for five consecutive annual monitoring events, the VOC will be removed from the TO-15 target analyte list (Worksheet #15) for LFG extraction system sampling only.
- The eleven VOCs identified as COCs for groundwater in the OU2 Landfills ROD will remain on the TO-15 target analyte list.
- If the list of VOCs identified as COCs for groundwater is revised in a subsequent OU2 decision document, then the most current list of COCs for groundwater will remain on the TO-15 target analyte list.
- The full TO-15 list of VOCs will be reported once every 5 years⁴ for samples associated with the operational LFG extraction legs. If a VOC that was previously removed from the TO-15 target analyte list for DQO #2 is detected, this VOC will be added to the TO-15 target analyte list for DQO #2 (Worksheet #15).
- These criteria will be applied retroactively to include VOC analytical data collected since TTU

⁴ The full TO-15 list of VOCs was last reported in the *Final Annual Report, 2015, Operations and Maintenance, Operable Unit 2 Landfills, Former Fort Ord, California* (Administrative Record No. OU2-TBD) and will next be reported in the 2019 annual report.

operations began in April 2006.

Performance or acceptance criteria. Decisions could be affected adversely by errors in field and/or fixed laboratory measurements. By adhering to standard procedures and approved methods to obtain the most reliable data, decision errors will be minimized and should not be a factor in making decisions.

Plan for obtaining data. The TTU should be operated and maintained properly to achieve continuous optimum performance and efficiency. As required, field measurements will be performed using a portable LFG analyzer.

Sample Parameter	Location	Test Method	Frequency
CH ₄ , O ₂ , CO ₂ , balance gas, temperature, flow rate, vacuum	Interior Extraction Legs, and points (wells and vents) in operation	Portable LFG analyzer	Biweekly or when system is in operation
	Influent	Portable LFG analyzer	Biweekly or when system is in operation
VOCs	Influent	EPA Method TO-15	Annual (during source testing)
VOCs	Interior Extraction Legs	EPA Method TO-15	Annual

DQO #3: Compliance Perimeter Probes

Problem statement. To provide for the protection of public health and safety and the environment, methane concentrations will not exceed 5%v at the landfill perimeter and trace gases will be controlled to prevent adverse acute and chronic exposure to toxic and/or carcinogenic compounds. Methane and VOCs are measured to determine whether concentrations are in compliance with the regulatory requirements or whether corrective actions need to be implemented.

Goals of the study. The primary decision is whether the concentrations of methane in the compliance perimeter probes meet the regulatory requirement. The secondary decision is whether the trace gas concentrations are at a level where they need to be controlled. The alternative actions that could result from these decisions are:

- Methane concentrations along the perimeter of the landfill do not exceed regulatory requirements, and no corrective actions are required; or methane concentrations along the perimeter of the landfill exceed the regulatory requirements and corrective actions need to be implemented.
- Methane concentrations along the eastern perimeter of Area F, where residential housing is located closest to the OU2 Landfills, are below 5%v and LFG migration is being controlled by operations of the TTU; or methane concentrations along the eastern perimeter of Area F are above 5%v and LFG migration is not being controlled by operations of the TTU and the operational schedule of the TTU needs to be modified.
- Trace gases need to be controlled to prevent adverse acute and chronic exposure to toxic and/or carcinogenic compounds; or trace gases do not need to be controlled.

Identify information inputs. To resolve the decision statement, methane and VOC concentrations will be measured at the compliance perimeter probes.

Twenty-one compliance perimeter probes will be sampled annually for VOCs. Samples will be analyzed using EPA Method TO-15 for VOCs (EPA, 1999). Results will be compared to historical ranges.

Compliance perimeter probes will be monitored quarterly for methane. A portable LFG analyzer will be used in the field to measure CH₄, O₂, CO₂, and balance gas.

Study boundaries. To determine the concentrations of methane and trace gases compliance perimeter probes installed along the perimeter of the OU2 Landfills will be monitored.

Analytical approach. The parameters of interest are the concentrations of the methane and trace gases at the OU2 Landfills perimeter. Compliance perimeter probes (Figure 2) will be monitored quarterly for methane and annually for VOCs.

The following decision rules apply to methane in the compliance perimeter probes:

- If the concentration of methane is less than 5%v, then there is no LFG migration and the OU2 Landfills are in compliance with the regulatory requirements.
- If the concentration of methane is greater than 5%v, then there is a potential for LFG migration, and corrective actions need to be implemented.
- If methane concentrations along the eastern perimeter of Area F, where residential housing is located closest to the OU2 Landfills, are less than 5%v, then LFG migration is being controlled by operations of the TTU.
- If methane concentrations along the eastern perimeter of Area F, where residential housing is located closest to the OU2 Landfills, are greater than 5%v, then LFG migration is not being controlled by operations of the TTU and the operational schedule of the TTU needs to be modified.

The following decision rules relate to VOCs and are based on comparison of current analytical data with historical data since start-up of the pilot LFG extraction and treatment system:

- For compliance perimeter probes with previous measured detections greater than 1,000 times the most current DTSC residential air screening level (DTSC-SL) for:
 - Vinyl chloride (1,000 times the DTSC-SL equals 9.5 micrograms per cubic meter (µg/m³) or 3.7 parts per billion by volume (ppbv) based on the current DTSC-SL (DTSC, 2016)
 - Tetrachloroethene (PCE) (1,000 times the DTSC-SL equals 480 µg/m³ or 71 ppbv based on the current DTSC-SL (DTSC, 2016))

If the concentration of vinyl chloride or PCE exceeds the previous maximum recorded value, the probe will be sampled quarterly until two successive measurements show declining or constant concentrations.

- For compliance perimeter probes with previous measured detections greater than 100 times the

most current EPA Residential Ambient Air Regional Screening Level (EPA-RSL) for chloroform (100 times the EPA-RSL equals $12 \mu\text{g}/\text{m}^3$ or 2.5 ppbv based on the current EPA-RSL (EPA, 2015)): if the concentration of chloroform exceeds the previous maximum recorded value, the probe will be sampled quarterly until two successive measurements show declining or constant concentrations.

- For compliance perimeter probes with no previous measured detections greater than 1,000 times the most current DTSC- SL for vinyl chloride or PCE in gas: if the concentration remains less than 1,000 times the DTSC-SL, then no action is required.
- For compliance perimeter probes with no previous measured detections greater than 100 times the most current EPA-RSL for chloroform in gas: if the concentration remains less than 100 times the EPA-RSL, then no action is required
- For compliance perimeter probes with no previous measured detections greater than 1,000 times the most current DTSC-SL for vinyl chloride or PCE in gas: if the concentration exceeds 1,000 times the DTSC-SL, then the probe will be sampled quarterly until two successive measurements show declining or constant concentrations.
- For compliance perimeter probes with no previous measured detections greater than 100 times the most current EPA-RSL for chloroform in gas: if the concentration exceeds 100 times the EPA-RSL, then the probe will be sampled quarterly until two successive measurements show declining or constant concentrations.
- If a VOC has not been detected in any of the samples collected from compliance perimeter probes for five consecutive annual monitoring events, the VOC will be removed from the TO-15 target analyte list (Worksheet #15) for compliance perimeter probes only.
- The eleven VOCs identified as COCs for groundwater in the OU2 Landfills ROD will remain on the TO-15 target analyte list.
- If the list of VOCs identified as COCs for groundwater is revised in a subsequent OU2 decision document, then the most current list of COCs for groundwater will remain on the TO-15 target analyte list.
- To confirm compliance with regulatory standards, the full TO-15 list of VOCs will be reported once every 5 years⁵ for samples collected from compliance perimeter probes. If a VOC that was previously removed from the TO-15 target analyte list for DQO #3 is detected, this VOC will be added to the TO-15 target analyte list for DQO #3 (Worksheet #15).
- These criteria will be applied retroactively to include VOC analytical data collected since TTU operations began in April 2006.

⁵ The full TO-15 list of VOCs was last reported in the *Final Annual Report, 2015, Operations and Maintenance, Operable Unit 2 Landfills, Former Fort Ord, California* (Administrative Record No. OU2-TBD) and will next be reported in the 2019 annual report.

Performance or acceptance criteria. Decisions could be affected adversely by errors in field and/or fixed laboratory measurements. By adhering to standard procedures and approved methods to obtain the most reliable data, decision errors will be minimized and should not be a factor in making decisions.

Plan for obtaining data. The compliance perimeter probes were installed at approximately 1,000 feet apart at the perimeter of the OU2 Landfills.

DQO #4: Monitoring Probes and Vents

Problem statement. To provide for the protection of public health and safety and the environment, methane concentrations will not exceed 5%v at the landfill perimeter and trace gases will be controlled to prevent adverse acute and chronic exposure to toxic and/or carcinogenic compounds. Methane needs to be measured at monitoring probes and vents to provide additional data to ensure compliance with the regulatory requirements and to determine whether corrective actions need to be implemented.

Goals of the study. The primary decision is whether methane concentrations are exhibiting upward trends in the monitoring probes or landfill vents. The alternative actions that could result from these decisions are:

- Methane concentrations in the compliance perimeter probes adjacent to monitoring locations may be negatively impacted by increasing methane concentrations monitored in perimeter monitoring probes and landfill vents and corrective actions need to be implemented.
- Methane concentrations along the eastern perimeter of Area F, where residential housing is located closest to the OU2 Landfills, are below 5%v and LFG migration is being controlled by operations of the TTU; or methane concentrations along the eastern perimeter of Area F are above 5%v and LFG migration is not being controlled by operations of the TTU and the operational schedule of the TTU needs to be modified.

Identify information inputs. To resolve the decision statement, methane concentrations will be measured at the perimeter monitoring probes and landfill vents.

Forty-six monitoring probes will be sampled quarterly for methane. In addition to the monitoring probes, two shallow probes installed in the utility trench located within the OU2 Landfills also will be monitored. The 12 passive vents installed along the center ridgeline of each landfill area also will be monitored. Methane concentrations in all passive vents consistently are above 5%v; however, there is no regulatory standard for methane concentration in passive vents, nor are there any regulatory actions for methane concentrations exceeding 5%v in passive vents in solid waste landfills. Vents are not intended to be representative sampling locations for LFG conditions in the waste, and monitoring results are used as only a non-quantitative indicator of trends in LFG accumulation in the foundation cover soils. A portable LFG analyzer will be used in the field to measure CH₄, O₂, CO₂, and balance gas.

Additional investigations, such as the installation of permanent or temporary probes, may be conducted to measure methane and/or VOCs. Additional investigations may be prepared and implemented as an

amendment to this QAPP or as a separate plan.

Study boundaries. To determine any upward methane trends, monitoring probes and vents at OU2 Landfills will be monitored.

Analytical approach. The parameters of interest are the concentrations of the methane at the OU2 Landfills.

The following decision rules apply to methane in the perimeter probes:

- If the concentration of methane is greater than 5%v, an upward trend in concentration is observed, then there is a potential for LFG migration, and corrective actions need to be implemented.
- If methane concentrations along the eastern perimeter of Area F, where residential housing is located closest to the OU2 Landfills, are less than 5%v, then LFG migration is being controlled by operations of the TTU.
- If methane concentrations along the eastern perimeter of Area F, where residential housing is located closest to the OU2 Landfills, are greater than 5%v, then LFG migration is not being controlled by operations of the TTU and the operational schedule of the TTU needs to be modified.

The following decision rules apply to monitoring frequency of the perimeter probes:

- Probes designated as Additional LFG Monitoring Probes (Figure 2) will be monitored quarterly for methane except:
 - If methane concentrations in the probe are less than 1%v for 20 consecutive quarterly monitoring events, then the probe will be moved to an annual monitoring schedule.
 - If methane concentrations in the probe are less than 1%v for five consecutive annual monitoring events, then the probe will be removed from the monitoring program.

These decision rules will be applied retroactively to include methane concentration data collected since TTU operations began in April 2006.

- If the TTU is unintentionally nonoperational for technical reasons or other unforeseen circumstances for more than 2 months, additional LFG Monitoring Probes in Area F that are on an annual monitoring schedule will be monitored for methane concentrations in the next quarterly monitoring event. Additional probes may be added to the monitoring program depending upon the results of the additional annual probes added. This data will be used to determine TTU operational parameters when the TTU is online again.

The following decision rules apply to methane in the utility trench probes:

- If the concentration of methane is less than 5%v, then there is no potential for LFG migration via the utility trench and the OU2 Landfills are in compliance with the regulatory requirements.
- If the concentration of methane is greater than 5%v, then there is a potential for LFG migration via the utility trench and corrective actions need to be implemented.

Performance or acceptance criteria. Decisions could be affected adversely by errors in field measurements. By adhering to standard procedures and approved methods to obtain the most reliable data, decision errors will be minimized and should not be a factor in making decisions.

Plan for obtaining data. The probes along the northern and eastern perimeters of Area F, which are closer to residential areas, are spaced a maximum of 500 feet apart due to the landfill proximity to the housing area. Additional investigations, such as the installation of permanent or temporary perimeter probes or ambient air monitoring, also may be conducted to characterize methane and trace gas concentrations.

3.3 Worksheet #12: Measurement Performance Criteria

Analytical Group/Method: Fixed Gases/ASTM D1945

Estimated Concentration Level: Low

Matrix: Gas (ppmv)

Data Quality Indicators (DQIs)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Field Duplicates	Relative Percent Difference (RPD) < 50%
Precision	Laboratory Duplicate	RPD < 25%
Accuracy	Laboratory Control Sample	85-115%
Bias/Sensitivity	Method Blanks	< Limit of Quantitation (LOQ) ¹
Completeness	Data Assessment	≥ 90%
Comparability	Data Review: compare results to previous sampling events.	Same unit of measure and LOQs are consistent with previously collected data

Analytical Group/Method: Sulfur Gases/ASTM D5504

Estimated Concentration Level: Low

Matrix: Gas (ppbv)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Field Duplicates	RPD < 50%
Precision	Laboratory Duplicate	RPD < 25%
Accuracy	Laboratory Control Sample	70-130%
Bias/Sensitivity	Method Blanks	< LOQ ¹
Completeness	Data Assessment	≥ 90%
Comparability	Data Review: compare results to previous sampling events.	Same unit of measure and LOQs meet project decision limits (PDLs) ¹

¹See Worksheet #15 for LOQ values

Analytical Group/Method: Volatile Organic Compounds (VOC)/TO-15

Estimated Concentration Level: Low

Matrix: Gas (ppbv)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria	
Precision	Field Duplicates	RPD < 50%	
Precision	Laboratory Duplicate	RPD < 25%	
Accuracy	Surrogate	1,2-dichloroethane-d4	70-130 %
		Toluene-d8	70-130 %
		4-Bromofluorobenzene	70-130 %
Accuracy	Laboratory Control Sample (LCS) ^{1,2}	Benzene	70-130 %
		Carbon Tetrachloride	70-130 %
		Chloroform	70-130 %
		1,1-Dichloroethane	70-130 %
		1,2-Dichloroethane	70-130 %
		cis-1,2-Dichloroethane	70-130 %
		1,2-Dichloropropane	70-130 %
		Dichloromethane (Methylene chloride)	70-130 %
		Tetrachloroethene	70-130 %
		Trichloroethene	70-130 %
		Vinyl chloride	70-130 %
Bias/Sensitivity	Method Blanks	< ½ LOQ ³	
Completeness	Data Assessment	≥ 90%	
Comparability	Data Review: compare results to previous sampling events.	Same unit of measure and LOQs meet PDLs ³	

Analytical Group/Method: Volatile Organic Compounds (VOC)/TO-15

Notes:

¹Samples will be spiked for all compounds on the TO-15 project reporting list(s); however, only the compounds presented will be controlled per the requirements presented in the table. Compounds presented are those listed as COCs for groundwater in Table 1 of the OU2 Landfills ROD (Army, 1994). VOCs in LFG are not identified as COCs in the OU2 Landfills ROD (Army, 1994); however, ARARs identified in the OU2 Landfills ROD require control of trace gases to prevent adverse acute and chronic exposure to toxic and/or carcinogenic compounds; therefore, the full list of TO-15 analytes is reported to ensure the substantive requirements of these ARARs are met.

²The remaining compounds need to meet the following requirements:

- a. Standard compounds: 70 - 130% for at least 90% of the compounds
- b. Non-standard compounds: 60 - 140% for at least 80% of the compounds
- c. Hexachlorobutadiene: 50-150%

³See Worksheet #15 for LOQs

3.4 Worksheet #13: Secondary Data Uses and Limitations

Secondary data and information that will be used, including originating sources, are identified below. How the secondary data will be used and the limitations on their uses are specified. Data from these documents will be utilized as appropriate.

Data Type	Data Source (originating organization, report title and date)	Data Uses Relative to Current Project	Factors Affecting the Reliability of Data and Limitations on Data Use
Soil Gas, Inspection Reports, Figures, Analytical Data	Gilbane Final Annual Report, 2013, Operations and Maintenance, Operable Unit 2 Landfills June 2014	Trend analysis, design optimization	None
Soil Gas, Inspection Reports, Figures, Analytical Data	Gilbane Final Annual Report, 2014, Operations and Maintenance, Operable Unit 2 Landfills July 2015	Trend analysis, design optimization	None

3.5 Worksheets #14 and #16: Project Tasks & Schedule

Sixty-nine monitoring probes and two utility trench probes are located around Areas B through F (Figure 2). Figure 2 also shows the locations of the probes designated as compliance probes for quarterly methane monitoring and annual VOC monitoring.

Annual monitoring is conducted to collect samples for VOCs for fixed-base laboratory analysis. Annual monitoring generally occurs in the second quarter. Source testing generally is concurrent with the annual VOC sampling.

Activity	Responsible party	Frequency	Deliverable(s)
TTU Monitoring	Ahtna	Biweekly or during TTU operation	Annual Report
Landfill O&M	Ahtna	After major rain events and as needed	Annual Report
TTU Inspection / maintenance	Ahtna	During operation, Quarterly	Annual Report
Landfill methane monitoring	Ahtna	Quarterly	Annual Report
Landfill Inspections	Monterey County Department of Health	Quarterly	Annual Report
Landfill Inspections	Ahtna ²	Annually	Annual Report
VOC Monitoring	Ahtna	Annually ¹	Annual Report

Note:

¹VOC monitoring frequency may be increased to quarterly based on decision rules presented in Worksheet #11, DQO #3.

²The annual landfill inspection will be performed by a California registered professional civil engineer.

3.6 Worksheet #15: Laboratory-Specific Detection/Quantitation Limits^{1,2}

Analytical Group/Method: Fixed Gases/ASTM D1945

Estimated Concentration Level: Low

Matrix: Gas (%)

Analyte	CAS Number	Laboratory LOD	Laboratory LOQ
Acetylene	74-86-2	0.0001	0.001
Butane	106-97-8	0.0001	0.001
NMOC (C6+)	NA	0.0001	0.01
Carbon dioxide	124-38-9	0.007	0.01
Ethane	74-84-0	0.0001	0.001
Ethene	74-85-1	0.0001	0.001
Isobutane	75-28-5	0.0001	0.001
Isopentane	78-78-4	0.0001	0.001
Methane	74-82-8	0.0008	0.0001
Neopentane	463-82-1	0.0001	0.001
Pentane	109-66-0	0.0001	0.001
Propane	74-98-6	0.0001	0.001
Oxygen	7782-44-7	NA ³	0.1
Nitrogen	7727-37-9	NA ³	0.1
Carbon monoxide	630-08-0	0.007	0.01
Hydrogen	1333-74-0	0.004	0.01

Notes:

CAS = Chemical Abstracts Service

LOD = limit of detection

LOQ = limit of quantitation

NMOC = non-methane organic compound (quantified using calibration of hexane and heptane)

¹Project action limits are not listed in Worksheet #15 because there are no action limits for LFG constituents identified in the OU2 Landfills ROD (Army, 1994); however, these analyses are performed to meet the substantive requirements of ARARs identified in the OU2 Landfills ROD.

²The laboratory will report results that are non-detect to the LOQ. Results will be quantified as estimated between the LOD and the LOQ.

³LOD analysis requires dilution of the lowest concentration standard, but O₂ and N₂ cannot be reported from a diluted analysis.

Analytical Group/Method: Sulfur Gases/ASTM D5504

Estimated Concentration Level: Low

Matrix: Gas (ppbv)

Analyte	CAS Number	Laboratory LOD	Laboratory LOQ
Hydrogen sulfide	7783-06-4	3.0	4.0
Carbonyl sulfide	463-58-1	3.0	4.0
Methyl mercaptan	74-93-1	3.0	4.0
Ethyl mercaptan	75-08-1	3.0	4.0
Dimethyl sulfide	75-18-3	3.0	4.0
Carbon disulfide	75-15-0	3.0	20.0
Isopropyl mercaptan	75-33-2	3.0	4.0
tert-Butyl mercaptan	75-66-1	3.0	4.0
n-Propyl mercaptan	107-03-9	3.0	4.0
Ethyl methyl sulfide	624-89-5	3.0	4.0
Thiophene	110-02-1	3.0	4.0
Isobutyl mercaptan	513-44-0	3.0	4.0
Diethyl sulfide	352-93-2	3.0	4.0
n-Butyl mercaptan	109-79-5	3.0	4.0
Dimethyl disulfide	624-92-0	3.0	4.0
3-Methylthiophene	616-44-4	3.0	4.0
Tetrahydrothiophene	110-01-0	3.0	4.0
2-Ethylthiophene	872-55-9	3.0	4.0
2,5-Dimethylthiophene	638-02-8	3.0	4.0
Diethyl disulfide	110-81-6	3.0	4.0

Notes:

CAS = Chemical Abstracts Service

LOD = limit of detection

LOQ = limit of quantitation

Analytical Group/Method: VOC/TO-15 – DQO #1: TTU Source Testing and DQO #2: Operational Influent LFG Testing (see Worksheet #11)

Estimated Concentration Level: Low

Matrix: Gas (ppbv)

Analyte	CAS Number	Laboratory LOD	Laboratory LOQ
1,1,1-Trichloroethane	71-55-6	0.25	0.5
1,1-Dichloroethane	75-34-3	0.25	0.5
1,1-Dichloroethene	75-35-4	0.25	0.5
1,2,4-Trimethylbenzene	95-63-6	0.25	0.5
1,2-Dichlorobenzene	95-50-1	0.25	0.5
1,2-Dichloroethane	107-06-2	0.25	0.5
1,2-Dichloropropane	78-87-5	0.25	0.5
1,3,5-Trimethylbenzene	108-67-8	0.25	0.5
1,3-Butadiene	106-99-0	0.25	0.5
1,3-Dichlorobenzene	541-73-1	0.25	0.5
1,4-Dichlorobenzene	106-46-7	0.25	0.5
1,4-Dioxane	123-91-1	1	2
2-Butanone	78-93-3	1	2
2-Hexanone	591-78-6	1	2
2-Propanol	67-63-0	1	2
4-Ethyltoluene	622-96-8	0.25	0.5
4-Methyl-2-pentanone	108-10-1	0.25	0.5
Acetone	67-64-1	1	5
Benzene	71-43-2	0.25	0.5
Bromodichloromethane	75-27-4	0.25	0.5
Bromomethane	74-83-9	1	5
Carbon disulfide	75-15-0	1	2
Carbon tetrachloride	56-23-5	0.25	0.5
Chlorobenzene	108-90-7	0.25	0.5
Chloroethane	75-00-3	1	2
Chloroform	67-66-3	0.25	0.5
Chloromethane	74-87-3	1	5
cis-1,2-Dichloroethene	156-59-2	0.25	0.5
Cyclohexane	110-82-7	0.25	0.5
Ethanol	64-17-5	1	2
Ethyl benzene	100-41-4	0.25	0.5
Freon 11	75-69-4	0.25	0.5
Freon 113	76-13-1	0.25	0.5

Analyte	CAS Number	Laboratory LOD	Laboratory LOQ
Freon 114	76-14-2	0.25	0.5
Freon 12	75-71-8	0.25	0.5
Heptane	142-82-5	0.25	0.5
Hexane	110-54-3	0.25	0.5
m,p-Xylene	108-38-3	0.25	0.5
Methyl tert-butyl ether	1634-04-4	0.25	0.5
Methylene chloride	75-09-2	1	5
o-Xylene	95-47-6	0.25	0.5
Styrene	100-42-5	0.25	0.5
Tetrachloroethene	127-18-4	0.25	0.5
Tetrahydrofuran	109-99-9	0.25	0.5
Toluene	108-88-3	0.25	0.5
trans-1,2-Dichloroethene	156-60-5	0.25	0.5
trans-1,3-Dichloropropene	10061-02-6	0.25	0.5
Trichloroethene	79-01-6	0.25	0.5
Vinyl chloride	75-01-4	0.25	0.5

Notes:

CAS = Chemical Abstracts Service

LOD = limit of detection

LOQ = limit of quantitation

VOCs in LFG are not identified as COCs in the OU2 Landfills ROD (Army, 1994); however, Title 14 CCR Chapter 3, Article 8 (since superseded by 27CCR Chapter 3, Article 6 [Section 20921]) and MBUAPCD Rule 207 and Rule 1000 are identified as ARARs. These ARARs require control of trace gases to prevent adverse acute and chronic exposure to toxic and/or carcinogenic compounds; therefore, the full list of TO-15 analytes is reported once every 5 years (next in 2019) to ensure the substantive requirements of these ARARs are met.

Analytical Group/Method: VOC/TO-15 – DQO #3: Compliance Perimeter Probes (see Worksheet #11)

Estimated Concentration Level: Low

Matrix: Gas (ppbv)

Analyte	CAS Number	Laboratory LOD	Laboratory LOQ
1,1,1-Trichloroethane	71-55-6	0.25	0.5
1,1-Dichloroethane	75-34-3	0.25	0.5
1,2,4-Trimethylbenzene	95-63-6	0.25	0.5
1,2-Dichloroethane	107-06-2	0.25	0.5
1,3,5-Trimethylbenzene	108-67-8	0.25	0.5
1,4-Dichlorobenzene	106-46-7	0.25	0.5
1,4-Dioxane	123-91-1	1	2
2-Butanone	78-93-3	1	2
2-Hexanone	591-78-6	1	2
2-Propanol	67-63-0	1	2
4-Ethyltoluene	622-96-8	0.25	0.5
4-Methyl-2-pentanone	108-10-1	0.25	0.5
Acetone	67-64-1	1	5
Benzene	71-43-2	0.25	0.5
Bromodichloromethane	75-27-4	0.25	0.5
Bromomethane	74-83-9	1	5
Carbon disulfide	75-15-0	1	2
Carbon tetrachloride	56-23-5	0.25	0.5
Chloroethane	75-00-3	1	2
Chloroform	67-66-3	0.25	0.5
Chloromethane	74-87-3	1	5
cis-1,2-Dichloroethene	156-59-2	0.25	0.5
Cyclohexane	110-82-7	0.25	0.5
Ethanol	64-17-5	1	2
Ethyl benzene	100-41-4	0.25	0.5
Freon 11	75-69-4	0.25	0.5
Freon 113	76-13-1	0.25	0.5
Freon 114	76-14-2	0.25	0.5
Freon 12	75-71-8	0.25	0.5
Heptane	142-82-5	0.25	0.5
Hexane	110-54-3	0.25	0.5
m,p-Xylene	108-38-3	0.25	0.5
Methylene chloride	75-09-2	1	5
o-Xylene	95-47-6	0.25	0.5

Analyte	CAS Number	Laboratory LOD	Laboratory LOQ
Tetrachloroethene	127-18-4	0.25	0.5
Toluene	108-88-3	0.25	0.5
Trichloroethene	79-01-6	0.25	0.5
Vinyl chloride	75-01-4	0.25	0.5

Notes:

CAS = Chemical Abstracts Service

LOD = limit of detection

LOQ = limit of quantitation

VOCs in LFG are not identified as COCs in the OU2 Landfills ROD (Army, 1994); however, Title 14 CCR Chapter 3, Article 8 (since superseded by 27CCR Chapter 3, Article 6 [Section 20921]) and MBUAPCD Rule 207 and Rule 1000 are identified as ARARs. These ARARs require control of trace gases to prevent adverse acute and chronic exposure to toxic and/or carcinogenic compounds; therefore, the full list of TO-15 analytes is reported once every 5 years (next in 2019) to ensure the substantive requirements of these ARARs are met.

4.0 SAMPLE DESIGN

4.1 Worksheet #17: Sampling Design and Rationale

The O&M Plan (Shaw, 2008a) provides procedures for monitoring the operation of the TTU, including vents, probes, and EWs. Section 5.0 of the O&M Plan (Shaw, 2008a) describes the perimeter monitoring system that is used to test the operational influent and effluent LFG.

Passive vents were installed at 19 locations to minimize the potential for gas buildup beneath the geomembrane (Figure 2). Five vents (VD-2, VD-3, VF-3, VF-4, and VF-5) were converted to EPs to provide supplemental methane to the TTU. All other vents, with the exception of VE-7 and VE-8, were capped in 2001 to mitigate a potential fire hazard. VE-7 and VE-8 were placed in the vertical expansion portion of Area E and are left open because this is a sealed area of the landfill. The 14 passive vents are not monitored for compliance, but are monitored quarterly for methane using a portable LFG analyzer. The vents that were converted to EPs are monitored during TTU operations.

To monitor LFG migration, 46 monitoring, 21 compliance, and 2 utility trench probes are located around Areas B through F. Twenty-one compliance probes were installed at a spacing of approximately 1,000 feet around the property boundary as required by 27CCR. The monitoring probes are used to measure CH₄, O₂, CO₂, and balance gas (collectively termed LFG) at additional points around the OU2 Landfills at depths ranging from 12 to 32 feet bgs. A Landtec GEM2000 instrument is used to measure these parameters. The utility trench probes are 4 feet deep. Samples collected from the 21 compliance probes are sent to an off-site laboratory annually for VOC analysis by EPA Method TO-15.

Two types of testing are conducted for the TTU: source testing and operational influent LFG testing. The primary objective of the source testing is to determine whether the TTU operates efficiently. A certified mobile laboratory conducts the source test, which includes analysis of the TTU influent and effluent for the parameters listed below.

Parameter	Monitoring and Analytical Protocols
NO _x , CO, O ₂ , and CO ₂	EPA Methods 7E, 10, and 3A
Outlet Total Hydrocarbons, CH ₄ , and Speciated VOCs	EPA Method 25A and TO-15
Inlet NMOC and Speciated VOCs	ASTM D-1945 and EPA Method TO-15
Inlet Total Reduced Sulfurs	ASTM D-5504
Landfill Gas HHV and Outlet Volumetric Flow Rate	ASTM D-1945 and EPA Method 19

Operational influent LFG testing is used to establish the schedule of operations for optimum operation of the TTU. Operational influent LFG testing also aids in quantifying the amounts of VOCs that are being removed from the OU2 Landfills.

Figure 3 presents the locations of the EWs/vents, the collection system, and the TTU system. Section 3.2 lists the sampling locations and methods.

4.2 Worksheet #18: Sampling Locations and Methods

Operable Unit 2 Landfills

Area	Probe ID	Matrix	Type	Depth (feet)	Analytical Group	Sampling SOP Reference ¹	Frequency	Rationale
B	SGP-1B	LFG	Sample Port	12	Fixed Gases ²	1	NA	Monitoring Point DQO#3
B	SGP-2B	LFG	Sample Port	12	Fixed Gases	1	Quarterly	Monitoring Point DQO#3
B	SGP-3B	LFG	Sample Port	12	Fixed Gases	1	Quarterly	Compliance DQO#3
					VOCs	2	Annually – Fixed Lab	
B	SGP-4B	LFG	Sample Port	12	Fixed Gases	1	Quarterly	Compliance DQO#3
					VOCs	2	Annually – Fixed Lab	
B	SGP-5B	LFG	Sample Port	12	Fixed Gases	1	NA	Monitoring Point DQO#3
C	SGP-1C	LFG	Sample Port	12	Fixed Gases	1	NA	Monitoring Point DQO#3
C	SGP-2C	LFG	Sample Port	12	Fixed Gases	1	Quarterly	Compliance DQO#3
					VOC	2	Annually – Fixed Lab	
C	SGP-3C	LFG	Sample Port	12	Fixed Gases	1	Quarterly	Compliance DQO#3
					VOCs	2	Annually – Fixed Lab	
D	SGP-1D	LFG	Sample Port	12	Fixed Gases	1	Quarterly	Monitoring Point DQO#3

Area	Probe ID	Matrix	Type	Depth (feet)	Analytical Group	Sampling SOP Reference ¹	Frequency	Rationale
D	SGP-1D	LFG	Sample Port	22	Fixed Gases	1	Quarterly	Monitoring Point DQO#3
D	SGP-2D	LFG	Sample Port	12	Fixed Gases	1	NA	Monitoring Point DQO#3
D	SGP-2D	LFG	Sample Port	22	Fixed Gases	1	NA	Monitoring Point DQO#3
D	SGP-3D	LFG	Sample Port	12	Fixed Gases	1	Quarterly	Monitoring Point DQO#3
D	SGP-3D	LFG	Sample Port	22	Fixed Gases	1	Quarterly	Monitoring Point DQO#3
D	SGP-4D	LFG	Sample Port	12	Fixed Gases	1	Quarterly	Compliance DQO#3
					VOCs	2	Annually – Fixed Lab	
D	SGP-4D	LFG	Sample Port	22	Fixed Gases	1	Quarterly	Compliance DQO#3
					VOCs	2	Annually – Fixed Lab	
D	SGP-5D	LFG	Sample Port	4	Fixed Gases	1	NA	Monitoring Point DQO#3
D	SGP-6D	LFG	Sample Port	12	Fixed Gases	1	Quarterly	Compliance DQO#3
					VOCs	2	Annually – Fixed Lab	
D	SGP-6D	LFG	Sample Port	22	Fixed Gases	1	Quarterly	Compliance

Area	Probe ID	Matrix	Type	Depth (feet)	Analytical Group	Sampling SOP Reference ¹	Frequency	Rationale
					VOCs	2	Annually – Fixed Lab	DQO#3
E	SGP-1E	LFG	Sample Port	12	VOCs	2	Fixed Lab	Monitoring Point DQO#3
E	SGP-2E	LFG	Sample Port	12	Fixed Gases	1	Quarterly	Monitoring Point DQO#3
E	SGP-3E	LFG	Sample Port	12	Fixed Gases	1	Quarterly	Monitoring Point DQO#3
E	SGP-4E	LFG	Sample Port	12	Fixed Gases	1	Quarterly	Monitoring Point DQO#3
E	SGP-5E	LFG	Sample Port	12	Fixed Gases	1	NA	Monitoring Point DQO#3
E	SGP-6E	LFG	Sample Port	12	Fixed Gases	1	NA	Monitoring Point DQO#3
E	SGP-7E	LFG	Sample Port	12	Fixed Gases	1	Quarterly	Compliance DQO#3
					VOCs	2	Annually – Fixed Lab	
E	SGP-8E	LFG	Sample Port	12	Fixed Gases	1	Quarterly	Compliance DQO#3
					VOCs	2	Annually – Fixed Lab	
E	SGP-9E	LFG	Sample Port	12	Fixed Gases	1	Quarterly	Compliance DQO#3
					VOCs	2	Annually – Fixed Lab	

Area	Probe ID	Matrix	Type	Depth (feet)	Analytical Group	Sampling SOP Reference ¹	Frequency	Rationale
F	SGP-1F	LFG	Sample Port	12	Fixed Gases	1	Annually	Monitoring Point DQO#3
F	SGP-1F	LFG	Sample Port	22	Fixed Gases	1	Annually	Monitoring Point DQO#3
F	SGP-2F	LFG	Sample Port	12	Fixed Gases	1	Annually	Monitoring Point DQO#3
F	SGP-2F	LFG	Sample Port	32	Fixed Gases	1	Quarterly	Monitoring Point DQO#3
F	SGP-3F	LFG	Sample Port	12	Fixed Gases	1	Annually	Monitoring Point DQO#3
F	SGP-3F	LFG	Sample Port	32	Fixed Gases	1	Annually	Monitoring Point DQO#3
F	SGP-4F	LFG	Sample Port	12	Fixed Gases	1	Quarterly	Monitoring Point DQO#3
F	SGP-4F	LFG	Sample Port	32	Fixed Gases	1	Annually	Monitoring Point DQO#3

Area	Probe ID	Matrix	Type	Depth (feet)	Analytical Group	Sampling SOP Reference ¹	Frequency	Rationale
F	SGP-5F	LFG	Sample Port	12	Fixed Gases	1	Annually	Monitoring Point DQO#3
F	SGP-5F	LFG	Sample Port	32	Fixed Gases	1	Annually	Monitoring Point DQO#3
F	SGP-6F	LFG	Sample Port	12	Fixed Gases	1	Annually	Monitoring Point DQO#3
F	SGP-6F	LFG	Sample Port	32	Fixed Gases	1	Annually	Monitoring Point DQO#3
F	SGP-7F	LFG	Sample Port	12	Fixed Gases	1	Annually	Monitoring Point DQO#3
F	SGP-7F	LFG	Sample Port	32	Fixed Gases	1	Annually	Monitoring Point DQO#3
F	SGP-8F	LFG	Sample Port	12	Fixed Gases	1	Quarterly	Compliance DQO#3
					VOCs	2	Annually – Fixed Lab	
F	SGP-8F	LFG	Sample Port	22	Fixed Gases	1	Quarterly	Compliance DQO#3
					VOCs	2	Annually – Fixed Lab	
F	SGP-9F	LFG	Sample Port	22	Fixed Gases	1	NA	Monitoring Point DQO#3

Area	Probe ID	Matrix	Type	Depth (feet)	Analytical Group	Sampling SOP Reference ¹	Frequency	Rationale
F	SGP-10F	LFG	Sample Port	12	Fixed Gases	1	NA	Monitoring Point DQO#3
F	SGP-10F	LFG	Sample Port	22	Fixed Gases	1	NA	Monitoring Point DQO#3
F	SGP-11F	LFG	Sample Port	12	Fixed Gases	1	NA	Monitoring Point DQO#3
F	SGP-11F	LFG	Sample Port	32	Fixed Gases	1	Quarterly	Monitoring Point DQO#3
F	SGP-12F	LFG	Sample Port	32	Fixed Gases	1	Annually	Monitoring Point DQO#3
F	SGP-13F	LFG	Sample Port	12	Fixed Gases	1	Quarterly	Compliance DQO#3
					VOCs	2	Annually – Fixed Lab	
F	SGP-13F	LFG	Sample Port	32	Fixed Gases	1	Quarterly	Compliance DQO#3
					VOCs	2	Annually – Fixed Lab	
F	SGP-14F	LFG	Sample Port	12	Fixed Gases	1	NA	Monitoring Point DQO#3
F	SGP-14F	LFG	Sample Port	32	Fixed Gases	1	NA	Monitoring Point DQO#3
F	SGP-15F	LFG	Sample Port	12	Fixed Gases	1	Quarterly	Compliance

Area	Probe ID	Matrix	Type	Depth (feet)	Analytical Group	Sampling SOP Reference ¹	Frequency	Rationale
					VOCs	2	Annually – Fixed Lab	DQO#3
F	SGP-15F	LFG	Sample Port	32	Fixed Gases	1	Quarterly	Compliance DQO#3
					VOCs	2	Annually – Fixed Lab	
F	SGP-16F	LFG	Sample Port	4	Fixed Gases	1	NA	Monitoring Point DQO#3
F	SGP-17F	LFG	Sample Port	12	Fixed Gases	1	Quarterly	Compliance DQO#3
					VOCs	2	Annually – Fixed Lab	
F	SGP-17F	LFG	Sample Port	32	Fixed Gases	1	Quarterly	Compliance DQO#3
					VOCs	2	Annually – Fixed Lab	
F	SGP-18F	LFG	Sample Port	12	Fixed Gases	1	NA	Monitoring Point DQO#3
F	SGP-18F	LFG	Sample Port	32	Fixed Gases	1	NA	Monitoring Point DQO#3
F	SGP-19F	LFG	Sample Port	12	Fixed Gases	1	NA	Monitoring Point DQO#3
F	SGP-19F	LFG	Sample Port	22	Fixed Gases	1	NA	Monitoring Point DQO#3
F	SGP-20F	LFG	Sample Port	12	Fixed Gases	1	NA	Monitoring Point DQO#3

Area	Probe ID	Matrix	Type	Depth (feet)	Analytical Group	Sampling SOP Reference ¹	Frequency	Rationale
F	SGP-20F	LFG	Sample Port	32	Fixed Gases	1	NA	Monitoring Point DQO#3
F	SGP-21F	LFG	Sample Port	12	Fixed Gases	1	NA	Monitoring Point DQO#3
F	SGP-21F	LFG	Sample Port	22	Fixed Gases	1	NA	Monitoring Point DQO#3
F	SGP-22F	LFG	Sample Port	12	Fixed Gases	1	Quarterly	Compliance DQO#3
					VOCs	2	Annually – Fixed Lab	
F	SGP-22F	LFG	Sample Port	32	Fixed Gases	1	Quarterly	Compliance DQO#3
					VOCs	2	Annually – Fixed Lab	

Thermal Treatment Unit/Extraction Points

Area	TTU Location	Matrix	Type	Depth (feet)	Analytical Group	Sampling SOP Reference	Frequency	Rationale
D	VD-3	LFG	Sample Port	6	Fixed Gases	1	Biweekly	System Optimization DQO#2
D	EW-35	LFG	Sample Port	75	Fixed Gases	1	Biweekly	System Optimization DQO#2
D	VD-2	LFG	Sample Port	6	Fixed Gases	1	Biweekly	System Optimization DQO#2
F	VF-3	LFG	Sample Port	6	Fixed Gases	1	Biweekly	System Optimization DQO#2
F	EW-34	LFG	Sample Port	60	Fixed Gases	1	Biweekly	System Optimization DQO#2
F	VF-4	LFG	Sample Port	6	Fixed Gases	1	Biweekly	System Optimization DQO#2
F	EW-33	LFG	Sample Port	70	Fixed Gases	1	Biweekly	System Optimization DQO#2
F	EW-32	LFG	Sample Port	60	Fixed Gases	1	Biweekly	System Optimization DQO#2

Area	TTU Location	Matrix	Type	Depth (feet)	Analytical Group	Sampling SOP Reference	Frequency	Rationale
F	VF-5	LFG	Sample Port	6	Fixed Gases	1	Biweekly	System Optimization DQO#2
F	EW-31	LFG	Sample Port	60	Fixed Gases	1	Biweekly	System Optimization DQO#2
F	EW-30	LFG	Sample Port	60	Fixed Gases	1	Biweekly	System Optimization DQO#2
TTU	Area F Header	LFG	Sample Port	NA	Fixed Gases	1	Biweekly	System Optimization DQO#2
TTU	Mixed	LFG	Sample Port	NA	Fixed Gases	1	Biweekly	Source Test Calculation of quantity of VOCs removed DQO#1
					VOCs Fixed Gases Sulfur	2	Annually – Fixed Lab	
TTU	Stack Outlet	LFG	Sample Port	NA	VOCs	1	Annually – Fixed Lab	Source Test DQO#1
TTU	Area D Vents	LFG	Sample Port	NA	Fixed Gases	1	Biweekly	Trend analysis DQO#2
					VOCs	2	Annually – Fixed Lab	
TTU	Area F EWs	LFG	Sample Port	NA	VOCs	2	Annually – Fixed Lab	Trend analysis DQO#2
TTU	Area E Header	LFG	Sample Port	NA	Fixed Gases	1	Biweekly	Trend analysis

Area	TTU Location	Matrix	Type	Depth (feet)	Analytical Group	Sampling SOP Reference	Frequency	Rationale
					VOCs	2	Annually – Fixed Lab	DQO#2
TTU	Area F Extraction Vents	LFG	Sample Port	NA	VOCs	2	Annually – Fixed Lab	Trend analysis DQO#2

Notes:

¹SOPs are listed on Worksheet #21.

²Fixed Gases include CH₄, CO₂, O₂, and balance gas. Barometric pressure data is collected during probe monitoring, and induced vacuum is measured during system monitoring.

The sampling number system that will be employed is as follows: The three digit area location is followed by the source location or probe identifier, followed by a sequential sample numbering system of up to four numbers for each location. For example, the stack outlet sample at the TTU will be recorded as TTU-FO-XXXX, and SGP-15F-depth will be recorded as OU2GMXXXX; where XXXX is the next four-digit sequential number.

LFG = landfill gas

OU = operable unit

SGP = soil gas probe

SOP = standard operating procedure

TTU = thermal treatment unit

NA = not applicable (the probe is no longer monitored per decision criteria presented in Worksheet #11, DQO #3)

5.0 SAMPLING REQUIREMENTS

5.1 Worksheets #19 & #30: Sample Containers, Preservation, and Hold Times

Laboratory: Eurofins

180 Blue Ravine Road, Suite B

Folsom, CA 95630-4719

Telephone: 916-985-1000

Sample Delivery Method: Courier or Hand Delivery

Analytical Group	Matrix	Analytical Method	Accreditation Expiration ¹	Containers (number, size, and type)	Preservation	Analytical Holding Time	Data Package Turnaround
Fixed Gases	Soil Gas	ASTM D1945	Oregon ELAP: 10-17-16; Certification No: CA30005-007 DoD ELAP: 04-27-16; Certificate Number: ADE-1451	Tedlar™ Bag ²	None	72 hours	21 days
VOCs	Soil Gas	TO-15		6L-stainless steel SUMMA™ Canister	None	30 days	21 days
				Tedlar™ Bag	None	48 - 72 hours	21 days
Sulfur Gases	Soil Gas	ASTM D5504	Oregon ELAP: 10-17-16; Certification No: CA30005-007	Tedlar™ Bag	None	24 hours	21 days

Notes:

DoD = Department of Defense

ELAP = Environmental Laboratory Accreditation Program

NELAP = National ELAP

¹ The Oregon ELAP certification satisfies NELAP requirements.

² Tedlar™ bags used only during the annual source test

5.2 Worksheet #20: Field Quality Control Summary

Matrix	Analytical Group	Preparation/ Analysis Reference	Approximate Number of Primary Sampling Locations ¹	No. of Field Duplicates	No. of LCSs	No. of Equipment Blanks	Total Number of Analyses
Soil Gas	Fixed Gases	ASTM D1945	1	1	1	NA	2
Soil Gas	VOCs	TO-15	28	3	3	NA	31
Soil Gas	Sulfur Gases	ASTM D5504	1	1	1	NA	2

Notes:

¹ Samples collected at different depths at the same location are counted as separate sampling locations or stations.

LCS = laboratory control sample

NA = not applicable

5.3 Worksheet #21: Field SOPs/Methods

This worksheet documents specific field procedures and methods that will be implemented for work conducted at the OU2 Landfills. The field SOPs will be readily available to all field personnel responsible for their implementation. The SOPs listed below are included in Attachment A.

SOP Reference No.	Title, Revision, Date	Equipment Type	Modified for Project Work? (Y/N)	Comments
1	GEM™2000 Gas Analyzer and Extraction Monitor, Operation Manual (Landtec, 2013)	Portable landfill gas analyzer	N	Includes instrument calibration procedures.
2	Guide to Air Sampling Canister and Bags (Eurofins, 2014)	SUMMA™ Canister or Tedlar™ Bag	N	Methods for sampling soil gas.
3	EM-200-1-3: Engineering and Design-Requirements for the Preparation of Sampling and Analysis Plans, Feb. 2001, Appendix F “Sample Documentation and Shipment Instructions”	NA	N	Includes sample documentation, packaging, shipping, and chain of custody requirements.

NA = not applicable

5.4 Worksheet #22: Field Equipment Calibration, Maintenance, Testing, and Inspection

Field Instrument specifications for source testing are as follows:

NOx/NO Chemiluminescent Analyzer – Ecophysics Model 70E	
Zero drift	Negligible after 30-minute warmup
Linearity	±1% of full scale
Accuracy	±1% of full scale
Output	0-10 V
Range	0-50, 100 ppmv
O₂ Analyzer, Fuel Type – Teledyne Model 326A	
Accuracy	±1% of scale at constant temperature or ±1% of scale at ±5% of reading, whichever is greater, over the operating temperature range
Output	0-1 V
Range	0-10, 25%
CO Infrared Analyzer – Horiba Model VIA 510	
Zero drift	±1%
Span drift	±1%
Linearity	±1%
Output	0-1 V
Range	0-100 ppmv
THC FID Analyzer – TECO Model 51	
Zero drift	±1%
Span drift	±1%
Linearity	±1%
Output	0-10 V
Range	0-50 ppmv

Field Equipment	Activity	SOP/ Method Reference	Responsible Person	Frequency	Acceptance Criteria	Corrective Action
Gas Analyzer	Calibration	Operations Manual	Field Team Lead (FTL)	Daily during use	Manufacturer's Specifications	Adjust instrument
Infrared Oxygen Analyzer	Calibration	EPA Method 3A		Daily during use prior to and after completion of analytical batch	2% of span	
	Bias Check				5% of span	
	Response time check				< 2 minutes	
Flame ionization detector	Calibration	EPA Method 25A		Daily, prior to and after completion of analytical batch	5% of span	
	Drift Test				3% of span	
Nondispersive infrared sensor CO analyzer	Calibration	EPA Method 10		Daily, prior to and after completion of analytical batch	2% of span	
	Calibration error check				3% of span	
	Bias Check				5% of span	
	Response time check				< 2 minutes	
Chemiluminescent Analyzer	Calibration	EPA Method 7E			2% of span	
	Bias Check				5% of span	
	Response time check				< 2 minutes	

6.0 ANALYTICAL REQUIREMENTS

6.1 Worksheet #23: Analytical SOPs

The SOPs referenced below are the laboratory-specific procedures for the tests for which the laboratory is certified under DoD ELAP and NELAP. Copies of both certifications including the specifically referenced method are included in Attachment B.

SOP Reference Number	Title, Revision Date, and / or Number	Definitive or Screening Data	Matrix/ Analytical Group	Equipment Type	Modified for Project Work? (Y/N)
6	Analysis of Volatile Organic Compounds in SUMMA™ Polished Canisters by Modified EPA Methods TO-14A/TO-15, 03/16/15, Revision 33	Definitive	VOCs	Mass Spectrometer	N
54	Analysis of Natural Gases by Modified ASTM Method D-1945 8/28/14, Revision 20	Definitive	Fixed Gases	Gas Chromatograph	N
13	ASTM D5504 – Sulfur Compounds 9/4/14, Revision 18	Definitive	Sulfur Gases	Sulfur Chemiluminescence Detector	N

6.2 Worksheet #24: Analytical Instrument Calibration

Instrument	Calibration Procedure	Calibration Frequency	Acceptance Criteria	Corrective Action	Responsible Person(s)	SOP Reference ¹
Gas Chromatograph (GC)	Initial Calibration (ICAL)	Prior to sample analysis and annually	< 15% Relative Standard Deviation (RSD)	Correct problem, then repeat Initial Calibration.	Laboratory Analyst/Section Manager	54 ASTM Method D-1945
GC	Initial Calibration Verification and Laboratory Control Sample (ICV and LCS)	After each initial calibration and once per analytical batch	85-115% Recovery (%R)	Check the system and reanalyze the standard. Reprepare the standard if necessary. If the primary standard is found to be in error, reprepare the primary and calibrate the instrument.	Laboratory Analyst/Section Manager	54 ASTM Method D-1945
GC	Continuing Calibration Verification (CCV)	Daily prior to sample analysis and after every 20 reportable samples	Percent Difference (% D) < 15%	Check the system and reanalyze the standard. Recalibrate the instrument if the criteria cannot be met.	Laboratory Analyst/Section Manager	54 ASTM Method D-1945
GC	ICAL	Prior to sample analysis	A minimum of 5 points (3 points may be accepted to meet sample hold times) % RSD ≤ 30	Evaluate system. Reprepare and/or reanalyze calibration points.	Laboratory Analyst/Section Manager	13 ASTM D5504
GC	ICV	With each ICAL; with each analytical batch	70 - 130% of the expected values for all the compounds	Check the system, reprepare and/or reanalyze standard. Recalibrate instrument if CCV shows similar recoveries. If recoveries are high and no detections are expected, sample analysis may proceed. If hold time is at risk, flagging and narration of non-compliance may be appropriate.	Laboratory Analyst/Section Manager	13 ASTM D5504
GC	CCV	Daily prior to sample analysis	%R: 70 - 130%	Check the system, reprepare and/or reanalyze standard. Recalibrate instrument if reanalysis shows similar recoveries. If recoveries are high and no detections are expected, sample analysis may proceed. If hold time is at risk, flagging and narration of non-compliance may be appropriate.	Laboratory Analyst/Section Manager	13 ASTM D5504

Instrument	Calibration Procedure	Calibration Frequency	Acceptance Criteria	Corrective Action	Responsible Person(s)	SOP Reference ¹
Gas Chromatograph/ Mass Spectrometer (GCMS)	Tuning Criteria	Every 24 hours	TO-15 ion abundance criteria	Correct problem then repeat tune.	Laboratory Analyst/Section Manager	6 TO-15
GCMS	Minimum 5-Point ICAL	Prior to sample analysis	% RSD \leq 30 for COCs, with two compounds (non-COCs) allowed out to \leq 40% RSD ²	Correct problem then repeat Initial Calibration Curve.	Laboratory Analyst/Section Manager	6 TO-15
GCMS	ICV	After each initial calibration curve, and daily prior to sample analysis	Percent Difference (%D) \pm 30% for COCs; Corrective action initiated when $>$ 15% of non-COCs exceeds \pm 30% D for ICV or any recovery is $<$ 50%	Check the system and reanalyze the standard. Re-prepare the standard if necessary to determine the source of error. Re-calibrate the instrument if the primary standard is found to be in error.	Laboratory Analyst/Section Manager	6 TO-15
GCMS	CCV	Prior to the analysis of samples and blanks, but after tuning criteria have been met	%D \pm 30% for COCs; Corrective action initiated if more than 2 non-COCs recover outside \pm 30%D.	Check the system and reanalyze the standard. Re-prepare the standard if necessary to determine the source of error. Re-calibrate the instrument if the primary standard is found to be in error.	Laboratory Analyst/Section Manager	6 TO-15

Notes:

¹ SOPs are listed on Worksheet #23.

² Applies only to compounds not listed as COCs for groundwater in Table 1 of the OU2 Landfills ROD (Army, 1994).

6.3 Worksheet #25: Analytical Instrument and Equipment Maintenance, Testing, and Inspection

Analytical instruments used for this project will be maintained in accordance with the requirements presented in the Eurofins QA Manual and the individual analytical method SOPs. The Eurofins QA Manual also presents the documentation requirements for maintenance activities.

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person(s)	SOP Reference ¹
GCMS	Check for leaks, replace gas line filters, replace column, clean injection port/liner	VOC	Monitor instrument performance via tune and CCV	As needed	Calibration and QC criteria met on is required as long as instrument QC meets DoD criteria	Replace connections, clean source, replace gas line filters, replace GC column, clip column, replace injection port liner, clean injection port, replace electron multiplier	Laboratory Analyst/ Section Manager	6
GC- Flame Ionization Detector	Clean injection port and replace liner, clip, or column	Gases	Monitor instrument performance via Continuing Calibration	Daily	Calibration and QC criteria met	Change column instrument maintenance	Laboratory Analyst/ Section Manager	54
Sulfur Chemiluminescence Detector	Inspect the system, clean sample introduction line	Sulfur Gases	Monitor instrument performance via Continuing Calibration	Daily	Calibration and QC criteria met	Evaluate system	Laboratory Analyst/ Section Manager	13

¹SOPs are listed on Worksheet #23.

6.4 Worksheets #26 and #27: Sample Handling, Custody, and Disposal

Sampling Organization: Ahtna

Laboratory: Eurofins

Method of sample delivery (shipper/carrier): Overnight Courier

Activity	Organization and Title or Position of Person Responsible for the Activity	SOP Reference ¹
Chain-of-custody form completion	Ahtna/Field Technician	Field SOP #3
Packaging		Field SOP #3
Shipping coordination		Field SOP #3

¹Field SOPs are listed in Worksheet #21 and included in Attachment A.

6.5 Worksheet #28: Analytical Quality Control and Corrective Action

The following tables provide guidance for the evaluation of QC analyses and the implementation of corrective action for situations outside of acceptance limits. The method-specific acceptance criteria are presented in the applicable table in Worksheet #12 and Worksheet #15.

Analytical Group/Method/SOP: Fixed Gases/ASTM D1945/SOP #54

QC Sample:	Frequency /Number	Method/SOP QC Acceptance Limits	Corrective Action	Responsible Person(s)	Project Measurement Performance Criteria
Method Blank	1 per extraction batch	Target analytes not detected \geq LOQ and $>1/10$ the amount measured in any sample or $1/10$ the regulatory limit (whichever is greater)	Reanalyze samples; qualify as needed	Laboratory Analyst/Section Manager	Representativeness
LCS (Lab QC)	1 per batch	Analyte-specific %R acceptance criteria	Evaluate system; reanalyze	Laboratory Analyst/Section Manager	Accuracy/Bias
Laboratory Duplicate	1 per batch	Analyte-specific RPD acceptance criteria	Evaluate system; reanalyze	Laboratory Analyst/Section Manager	Precision
Relative Retention Time (RRT) Position	Confirmed at method set-up and after major maintenance	RT windows established by calculating the standard deviation of the mean absolute retention time over a 72-hour period. 3 x standard deviation must be <0.08 min for analysis to proceed.	Correct problem; recalibrate instrument; reanalyze results as necessary	Laboratory Analyst/Section Manager	Analyte Identification

Analytical Group/Method/SOP: Sulfur Gases/ASTM D5504/SOP #13

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Responsible Person(s)	Measurement Performance Criteria
Method Blank	1 per extraction batch	Target analytes not detected \geq LOQ and $>1/10$ the amount measured in any sample or $1/10$ the regulatory limit (whichever is greater)	Reanalyze samples; qualify as needed	Laboratory Analyst/Section Manager	Representativeness
LCS (Lab QC)	1 per batch	Analyte-specific %R acceptance criteria	Evaluate system; reanalyze	Laboratory Analyst/Section Manager	Accuracy/Bias
Laboratory Duplicate	1 per batch	Analyte-specific RPD acceptance criteria	Evaluate system; reanalyze	Laboratory Analyst/Section Manager	Precision

Analytical Group/Method/SOP: VOCs/TO-15/SOP #6

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Responsible Person(s)	Measurement Performance Criteria
Method Blank	1 per extraction batch	Target analytes not detected $> \frac{1}{2}$ LOQ and $> 1/10$ the amount measured in any sample or $1/10$ the regulatory limit (whichever is greater)	Reanalyze samples; qualify as needed	Laboratory Analyst/Section Manager	Representativeness
LCS (Lab QC)	1 per batch	See Worksheet #12	Evaluate system; reanalyze	Laboratory Analyst/Section Manager	Accuracy/Bias
Laboratory Duplicate	1 per batch	Analyte-specific RPD acceptance criteria	Evaluate system; reanalyze	Laboratory Analyst/Section Manager	Precision
Surrogate	1 per blank, sample, and standard	Surrogate-specific %R acceptance criteria	Evaluate system and samples; reanalyze.	Laboratory Analyst/Section Manager	Accuracy/Bias
Internal Standard Performance	Every sample	Peak area ± 40 % of the peak area in the corresponding CCV; retention time within ± 20 seconds of the corresponding CCV	Reanalyze or qualify results as necessary	Laboratory Analyst/Section Manager	Accuracy/Bias
RRT Position	Once per initial calibration and at the beginning of the analytical shift	RRT within ± 0.06 RRT units for each analyte and surrogate	Correct problem; recalibrate instrument; reanalyze results as necessary	Laboratory Analyst/Section Manager	Analyte Identification
Mass Spectrometer Results	All positive results must be confirmed	Spectral match to reference spectrum	Analyst must evaluate results to confirm identification if spectral match does not meet criteria; Section Manager must review analyst's determination	Laboratory Analyst/Section Manager	Analyte Identification

7.0 DATA MANAGEMENT AND DATA REVIEW

7.1 Worksheet #29: Project Documents and Records

At a minimum, the following documentation will be used for sample collection and field measurement activities. Examples of field forms are presented in Attachment C.

Sample Collection and Field Records			
Record	Generation	Verification	Storage location/archive
Field notes/logbook	Field Team Lead	Project Manager	Project File*
Chain-of-custody forms	Field Team Lead	Project Manager	Project File
Laboratory raw data package	Eurofins	Project Chemist	Project File
PDF copy of analytical data	Eurofins	Project Chemist	Fort Ord Administrative Record
Audit/assessment checklists/reports	Field Team Lead/Project Chemist	Project Manager	Project File
Corrective action reports	Field Team Lead/Project Chemist	Project Manager	Project File
Laboratory sample custody log	Eurofins	Project Chemist	Project File
Laboratory equipment calibration logs	Eurofins	Project Chemist	Project File
Sample preparation logs	Eurofins	Project Chemist	Project File
Run logs	Eurofins	Project Chemist	Project File
Sample disposal records	Eurofins	Project Chemist	Project File
Validated data	Project Chemist	Program Chemist	Project File
Electronic Validated data	Data Validation Subcontractor	Project Chemist	Fort Ord Data Integration System (FODIS) chemistry database
Data Validation Reports	Project Chemist	Program Chemist	Project File
Annual Report	Task Manager	USACE Project Manager	Fort Ord Administrative Record

*The Project File is maintained on a secure server accessible at the OU2 Groundwater Treatment Plant.

7.2 Worksheets #31, 32, & 33: Assessments and Corrective Action

Assessments:

Assessment Type	Responsible Personnel and Organization	Number and Frequency	Assessment Deliverable	Deliverable Due Date
Review of QAPP, SOPs, and Accident Prevention Plan with Field Staff	FTL/Ahtna	Prior to sampling startup and with all new field staff prior to assignment	Completed acknowledgement signature pages	48 hours following assessment
Work performed in accordance with site-specific QAPPs.	FTL/Ahtna	Ongoing during all phases of fieldwork	Daily progress reports	24 hours following conclusion of business day
Logbook and Field Form Review	FTL/Ahtna	Daily	NA; corrections will be made directly to reviewed documents	24 hours following assessment
Laboratory Assessment for Appropriate Certifications, Capacity, and QAPP Review with Staff	Project Chemist/Ahtna	Prior to sampling mobilization, as new laboratories are contracted	Receipt of copies of certifications. Email traffic concerning lab capacity prior to sampling startup. QAPP sign-off sheet received from laboratory.	48 hours following assessment
Tailgate Safety Meeting	SSHO/Ahtna	Daily	Verbal debriefing and daily sign-off log. If a safety incident occurs, a Supervisor Injury Employee Report is completed.	Weekly; any safety incidents will be reported to the PM and Corporate Health and Safety Officer immediately
Daily Quality Control Reports	FTL/Ahtna	Ongoing during all phases of fieldwork	Three Phase Inspection Forms (Attachment D)	24 hours following conclusion of business day
Field Sampling and Chain-of-Custody Form Review Against QAPP Requirements	Project Chemist/Ahtna	Daily	Corrections will be made directly to reviewed documents; communication may be in the form of email	24 hours following assessment

Assessment Type	Responsible Personnel and Organization	Number and Frequency	Assessment Deliverable	Deliverable Due Date
Data Validation	Data Validation Chemist/ Laboratory Data Consultants	Per Sample Delivery Group	Communication may be in the form of email traffic. Amendment of the analytical report or corrective actions due to deficiencies identified in the validation process.	24 hours following assessment
Laboratory Report Deliverables and Analytical Results Against QAPP Requirements	Project Chemist/Ahtna	As discrepancies are identified in the validation process	Memorandum or email to PM and Project Chemist	72 hours following assessment

Assessment Response and Corrective Action:

Assessment Type	Individual(s) Notified of Findings	Assessment Response Documentation	Time Frame for Response	Responsibility for Implementing Corrective Action	Responsibility for Monitoring Corrective Action
Review of QAPP, SOPs, and Accident Prevention Plan with Field Staff	FTL	Completed acknowledgement signature pages	48 hours following assessment	FTL	PM and QC Manager
Work performed in accordance with site-specific QAPP	PM	Interim CA documented pending final approval	By close of same business day	FTL	PM and QC Manager
Logbook and Field Form Review	FTL	Corrections will be made directly to reviewed documents	NA	FTL	PM
Laboratory Assessment for Appropriate Certifications, Capacity, and QAPP Review with Staff	Project Chemist	Response to email or memorandum	48 hours after notification	Laboratory PM	Project Chemist
Tailgate Safety Meeting	FTL	Included as part of the process of the Supervisor Injury Employee Report	24 hours after notification	Ahtna PM	Corporate H&S Manager

Assessment Type	Individual(s) Notified of Findings	Assessment Response Documentation	Time Frame for Response	Responsibility for Implementing Corrective Action	Responsibility for Monitoring Corrective Action
Daily Quality Control Reports	FTL	Corrections will be made directly to reviewed documents	NA	FTL	PM and QC Manager
Field Sampling and Chain-of-Custody Form Review Against QAPP Requirements	Project Chemist	Response to email	48 hours after notification	FTL	PM and QC Manager
Data Validation	Project Chemist	If required, laboratory reports will be amended and corrections noted in the analytical narrative and contained with the validation report.	1 business week	Data Validation PM	Project Chemist
Laboratory Report Deliverables and Analytical Results Against QAPP Requirements	Project Chemist	If required laboratory reports will be amended and corrections noted in the analytical narrative.	72 hours after notification	Laboratory PM	Laboratory QA Manager/ Project Chemist

7.3 Worksheet #34: Data Verification and Validation Inputs

This worksheet lists the inputs that will be used during data verification and validation. Inputs include planning documents, field records, and laboratory records. Data verification is a check that all specified activities involved in collecting and analyzing samples have been completed and documented and that the necessary records (objective evidence) are available to proceed to data validation. Data validation is the evaluation of conformance to stated requirements, including those in the contract, methods, SOPs and the QAPP.

Item	Description	Verification (completeness)	Validation (conformance to specifications)
Planning Documents/Records			
1	Approved QAPP	X	
2	Contract	X	
4	Field SOPs	X	
5	Laboratory SOPs	X	
Field Records			
6	Field Logbooks	X	X
7	Equipment Calibration Records	X	X
8	Chain-of-Custody Forms	X	X
9	Sampling Diagrams/Surveys	X	X
10	Relevant Correspondence	X	X
11	Change Orders/Deviations	X	X
12	Field Audit Reports	X	X
13	Field CA Reports	X	X
Analytical Data Package			
14	Cover Sheet (laboratory identifying information)	X	X
15	Case Narrative	X	X
16	Internal Laboratory Chain of Custody	X	X
17	Sample Receipt Records	X	X
18	Sample Chronology (e.g., dates and times of receipt, preparation, and analysis)	X	X
19	Communication Records	X	X
20	LOD/LOQ Establishment and Verification	X	X
21	Standards Traceability	X	X
22	Instrument Calibration Records	X	X
23	Definition of Laboratory Qualifiers	X	X
24	Results Reporting Forms	X	X
25	QC Sample Results	X	X
26	CA Reports	X	X
27	Raw Data	X	X
28	Electronic Data Deliverable	X	X

7.4 Worksheet #35: Data Verification Procedures

Records Reviewed	Requirement Documents	Process Description	Responsible Person, Organization
Methods	QAPP, SOP	Records support implementation of the SOP-sampling and analysis.	Project Chemist, Ahtna
Performance Requirements	QAPP, SOP	Verify laboratory method SOPs are sufficient to satisfy DQOs.	Program Chemist, Ahtna
Sampling Locations, Number of Samples	QAPP, SOP	Verify that sample locations and quantities will be sufficient to satisfy DQOs.	Program Chemist, Ahtna
Three phase inspection forms and Other Field Documentation	QAPP, SOP	Review daily sampling activity reports including pertinent field sampling data.	Project Chemist, Ahtna
Chain of Custody	QAPP, SOP	Examine traceability of data from sample collection to generation of project reported data.	Project Chemist, Ahtna
Deviations	QAPP, SOP	Determine impacts of any deviations from methods.	Program Chemist, Ahtna
Sensitivity	QAPP, SOP	Verify that LODs and LOQs are achieved as outlined in the QAPP, and that the laboratory successfully analyzed a standard at the LOD.	Project Chemist, Ahtna
Precision	QAPP, SOP	Review data against performance criteria and determine impact of any result out of criteria.	Project Chemist, Ahtna
Accuracy	QAPP, SOP	Review data against performance criteria and determine impact of any result out of criteria.	Project Chemist, Ahtna
QC samples	QAPP, SOP	Ensure that a sufficient number of QC samples are analyzed, as outlined in the QAPP, to meet DQOs.	Project Chemist, Ahtna
Field Change Requests	QAPP, SOP	Review any change request or corrective action documentation. Determine impact to project objectives.	Project/Program Chemist, Ahtna
Electronic Data Deliverables (EDDs)	QAPP	Verify that acceptable EDDs have been qualified. The Laboratory Data Consultants Automated Data Review (LDC ADR) EDD format files will be uploaded into the FODIS chemistry database, EDD files will be submitted to USACE. EDD File Specifications are provided in Attachment E.	Project Chemist, Ahtna

7.5 Worksheet #36: Data Validation Procedures

Analytical Group/Method:	Volatile Organics – TO-15 (Modified)	Gases – ASTM D1945, D5504
Data deliverable requirements:	LDC ADR	LDC ADR
Analytical specifications:	Worksheet #28	Worksheet #28
Measurement performance criteria:	Worksheet #12	Worksheet #12
Percent of data packages to be validated:	100%	100%
Percent of raw data reviewed:	10%	10%
Percent of results to be recalculated:	10%	10%
Validation procedure:	EM-200-1-10	EM-200-1-10
Validation qualifiers:	See table below	See table below
Electronic validation program:	LDC ADR	LDC ADR

EM-200-1-10 = USACE Guidance for Evaluating Performance-Based Chemical Data (USACE, 2005)

LDC ADR = Laboratory Data Consultants Automated Data Review format

Summary of Data Qualifiers

Qualifier	Definition
J	Estimated (quantitatively) and tentatively usable
J-	Estimated (quantitatively) with low bias
J+	Estimated (quantitatively) with high bias
U	Below reporting limit
N	Qualitatively estimated (tentative detection)
X	Tentatively rejected
R	Rejected
UN	Tentative non-detection
NJ	Quantitatively and qualitatively estimated

7.6 Worksheet #37: Data Usability Assessment

Step 1	<p>Review the project’s objectives and sampling design</p> <p>The goal for O&M activities at Fort Ord is to implement remedies as necessary to protect human health and the environment while maximizing the number of site closures or advance sites as close to site closure as practicable during the Period of Performance in a cost-effective manner. The site-specific QAPPs will indicate the project objectives and sampling design. To that end, the usability assessment will incorporate the activities listed below.</p> <p>Field Certification</p> <p>Field personnel will generate field forms, maps, and notes describing the daily procedures. The three phase inspection forms (Attachment D), generated during sampling, will discuss any successes and/or deviations from the QAPP. The FTL will review all field documentation as it is generated for consistency and errors. Any anomalies identified will be discussed with the project team to determine if any changes to the sampling design are needed. Any changes will be documented in a QAPP amendment.</p> <p>Data Quality Indicators: Precision, Accuracy, Representativeness, Comparability, Completeness, and Sensitivity (PARCCS)</p> <p>The PARCCS parameters will be used to help identify deficiencies in the sample data that would affect the achievement of the project DQOs. Laboratory limits and QC samples will be used as part of the PARCCS assessment to detect anomalies in the dataset. In addition, the laboratory will create trend charts to track variability in laboratory processes and establish in-house precision and accuracy criteria.</p> <p>Laboratory limits used in the sensitivity review consist of the LOD and LOQ. Laboratory QC samples consist of method blanks, LCSs, surrogates, and laboratory duplicates. All samples will be spiked with surrogate compounds where recommended or required by the method.</p> <p>Precision</p> <p>Precision is defined as the degree of mutual agreement between individual measurements of the same property under similar conditions and provides a measurement of the reproducibility of an analytical result. Precision will be evaluated through the analysis of field duplicate samples and LCSs. Field duplicate samples will be collected at a frequency of one per 10 field samples of a given matrix. The duplicate sample will not be reanalyzed when the RPD criteria are not met. Discussion of QC failures will be documented in the laboratory case narrative. The Project Chemist will work with the laboratory to determine the cause of the failure and to determine if any of the QC failures are due to matrix or sampling error and if the failures have an impact on the project objectives.</p> <p>The variance between the samples, in terms of RPD, is calculated according to the following equation:</p>
---------------	---

$$RPD = \frac{|A - B|}{(A + B)/2} \times 100\%$$

where: A = First duplicate concentration

B = Second duplicate concentration

For this project, the goal for precision of field duplicates is listed in Worksheet #12. In the event that both of the duplicate sample results are less than the LOD, the RPD will not be calculated

Accuracy

Accuracy is the degree of agreement between an analytical measurement and a reference accepted as a true value. The accuracy of a measurement system can be affected by errors introduced by field contamination, sample preservation, sample handling, sample preparation, or analytical techniques. A program of sample spiking will be conducted to evaluate laboratory accuracy. Accuracy will be evaluated by the percent recovery of the spiked compounds in the LCSs, surrogates, and proficiency samples (if requested by the PM). LCSs and surrogates will be spiked prior to extraction. LCS samples will be spiked with the method target compounds indicated in this QAPP, and surrogates will be added to every sample and spike. Proficiency samples will be taken through the entire sample preparation and analysis process. LCS or blank spike samples will be analyzed at a frequency of 5%, or one per sample delivery group/analytical batch (sample sets can be up to 20 field samples). Proficiency samples will be analyzed once per sampling event if required. The results of the spiked and proficiency samples are used to calculate the percent recovery for evaluating accuracy, using the following equation:

$$\text{Percent Recovery} = \frac{S - C}{T} \times 100$$

where:

S = Measured spike sample concentration

C = Sample concentration

T = True or actual concentration of the spike or proficiency

Worksheet #12 presents accuracy goals for this investigation based on the percent recovery of LCSs and surrogate spikes. The data reviewer will use the accuracy results to help determine if any of the QC failures are due to matrix or sampling error and if the failures have an impact on the project objectives.

The presence of high levels of target compounds in the sample chosen for spiking may necessitate a dilution of the sample, or may otherwise result in errors in spiked compound recovery. Discussion of laboratory QC failures will be documented in the laboratory case narrative. The Project Chemist will work with the laboratory to determine the cause of the

failure and to determine if any of the QC failures are due to matrix or sampling error and if the failures have an impact on the project objectives.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent the characteristics of a population, variations in a parameter at a sampling point, or an environmental condition that the data are intended to represent. For this project, representative data will be obtained through careful selection of sampling locations and analytical parameters, through proper collection and handling of samples to avoid interference and minimize cross-contamination, and through consistent application of the appropriate established field and laboratory procedures.

To aid in evaluating the representativeness of the sample results, field and laboratory blank samples will be evaluated for the presence of contaminants. Laboratory procedures will be reviewed to verify that standard operating procedures were followed and method requirements were met during the analysis of project samples. Laboratory sample storage practices, holding times, sub-sampling procedures, method blanks, and will be assessed for potential impacts on the representativeness of the data. Data determined to be non-representative will be used only if accompanied by appropriate qualifiers and limits of uncertainty.

Representativeness as it relates to field procedures refers to the collection of samples that allow accurate conclusions to be made regarding the composition of the sample media at the entire site. Representativeness will be assessed qualitatively by evaluating whether the procedures described in this QAPP were followed.

Completeness

Completeness is a measure of the percentage of project-specific data that are valid. Valid data are obtained when samples are collected and analyzed in accordance with the procedures outlined in this QAPP and when none of the QC criteria used to determine the usability of the data is critically exceeded to the point of rejection.

When data validation is completed, the percent completeness value will be calculated by dividing the number of useable sample results by the total number of sample results planned for this investigation. The evaluation of completeness will help determine whether any critical deficiencies identified during the validation process resulted in non-attainment of project objectives.

Completeness will be evaluated by reviewing the tasks that contribute to the sampling event, such as sample handling and storage procedures, chain-of-custody procedures, analytical procedures, and data validation procedures. The procedures and determined impact on the sample results will be used to identify any problems along the data path that will render the decision-making process useless and the data set incomplete. The completeness goal for this project that still allows for attainment of the project objectives is

<p>90%.</p> $\frac{\text{Number of possible analyte results} - \text{Number of rejected and unreported results}}{\text{Possible number of analyte results}} \times 100$ <p>The project team may determine that an individual sampling point or area is more critical than others for decision making. Any sampling locations identified as such will have a completeness goal of 95% as determined by the validation process.</p> <p>Comparability</p> <p>Comparability expresses the confidence with which one dataset can be compared with another. Comparability of data will be achieved by following standard field and laboratory procedures outlined in standard operating procedures and published methods. In addition, standard units of measurement will be used in reporting analytical and field data. Analytical and field methods selected for this investigation are consistent with the methods used during previous investigations of this type. Oversight by experienced team members will ensure that the procedures are conducted in a manner appropriate to attaining the project objectives. Any deviations from field or laboratory methods will be documented on a change request form. The project team will review the change request to determine if the change will impact the comparability of the data.</p> <p>Sensitivity</p> <p>The LOD, and LOQ will be evaluated by the project team prior to sample analysis to determine if the laboratory is able to attain the sensitivity required for the project. If project decision limits are too sensitive, it will be determined prior to sample analysis whether a sensitivity variance will be issued to the laboratory based on the method chosen and the technology available.</p> <p>The LOD is the minimum quantity of an analyte that can be reliably detected for a specific analytical method at a 99% confidence level that the value is not a false negative. The LOQ represents the smallest quantity of an analyte that can be quantified accurately and reproducibly in a given sample matrix (e.g., three to five times the LOD). The LOD and/or the LOQ shall be sensitive enough to meet the project decision limits. The LOD and LOQ will be evaluated after sample analysis to determine if there were any matrix effects, operator errors, or analytical process errors that interfered with the ability to compare the results to the project decision limits. The LOD will be used to determine if detectable amounts of analytes are present. If no detectable amounts are reported, and all data are acceptable (as determined by the verification and validation process), then the data are usable. The LOD will be used to determine if any detectable amounts of contaminants of concern are present. If detectable amounts are reported and the verification and validation are acceptable, then the data are usable. Any detections falling between the LOD and LOQ will be qualified as estimated. If anomalies in sensitivity are present, the rationale for use or non-use of the affected samples will be discussed in the data validation reports. Worksheet</p>
--

	#15 presents the laboratory LODs and LOQs for the selected analytical method(s) used to support the project decision limits.
Step 2	<p>Review the data verification and data validation outputs</p> <p>The outputs from the verification and validation process will be used to determine data usability. Data validation reports and three phase inspection forms will be reviewed. Data will be summarized as necessary using graphs, maps, and/or tables. The entire project team is responsible for assessing whether the data meet the project objectives. Personnel at all levels will generate data and documentation that will be reviewed to identify trends, relationships, and/or anomalies in the dataset.</p>
Step 3	<p>Implement the statistical method</p> <p>For each analytical method, the laboratory will use the LCS data to track and analyze trends in the laboratory. From these trends, they can recognize deficiencies in the method and create in-house acceptance criteria. For this project, the limits are based on laboratory control limits. The precision and accuracy of the entire dataset will be used to determine if any systemic problems have occurred during the sampling event that will result in deficiencies in the dataset. The occurrence of systemic problems and the resulting consequences will be discussed in the data validation report. The data reviewer will make every effort to identify any critical elements or trends that would result in non-usability of data as early as possible.</p>
Step 4	<p>Document data usability and draw conclusions</p> <p>Again, the entire project team is responsible for assessing whether the data meet the project objectives. The site-sampling layout, including sampling locations, frequency of sampling, and timing of sampling activities, will be reviewed by the project team. In addition, the overall usability of the field and laboratory data will be reviewed. The conclusions will be discussed in the final annual report. If the data indicate anomalies, the impacted data will be qualified as described in EM-200-1-10. The impact will be documented along with the rationale for limited use of the data.</p>

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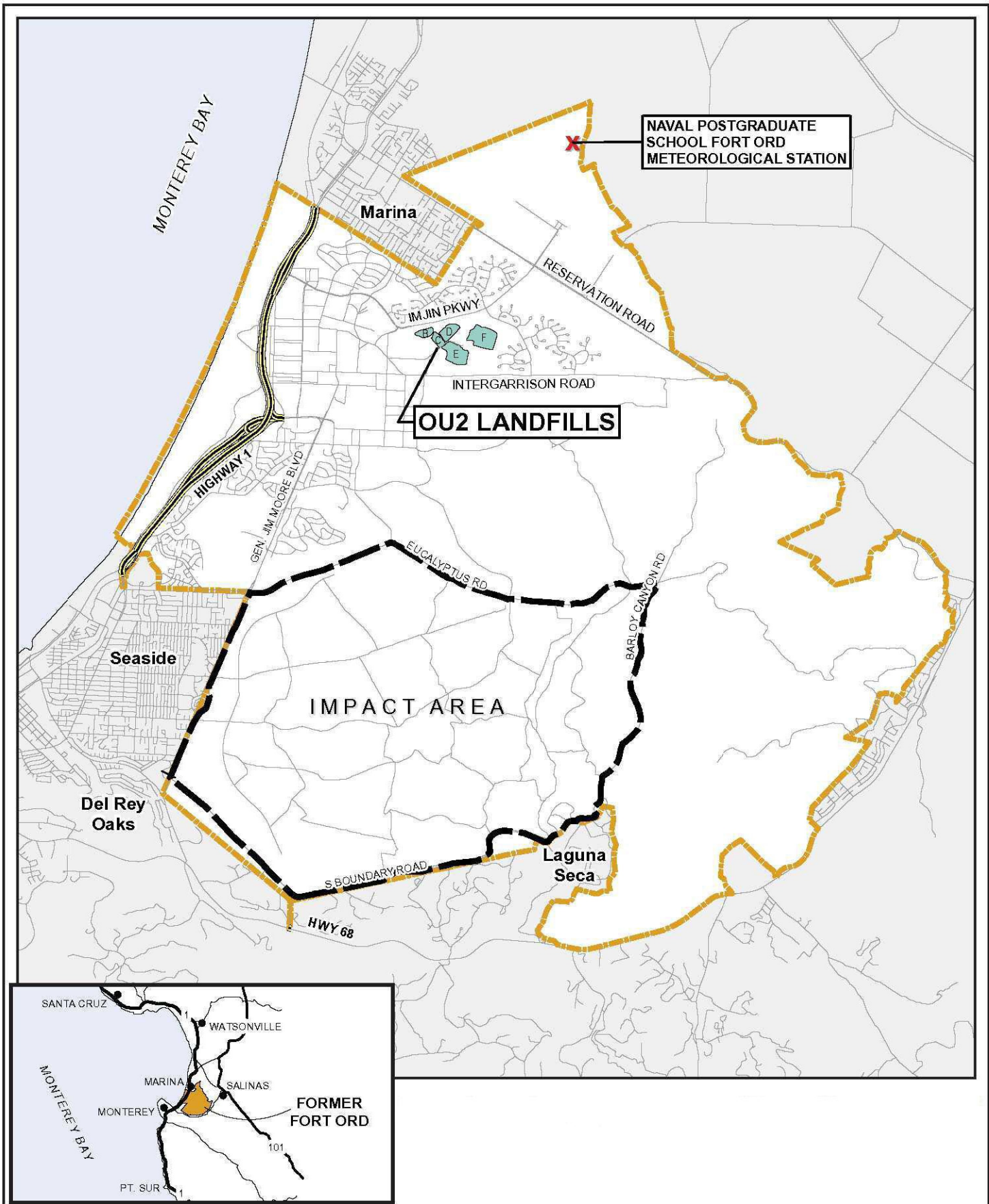
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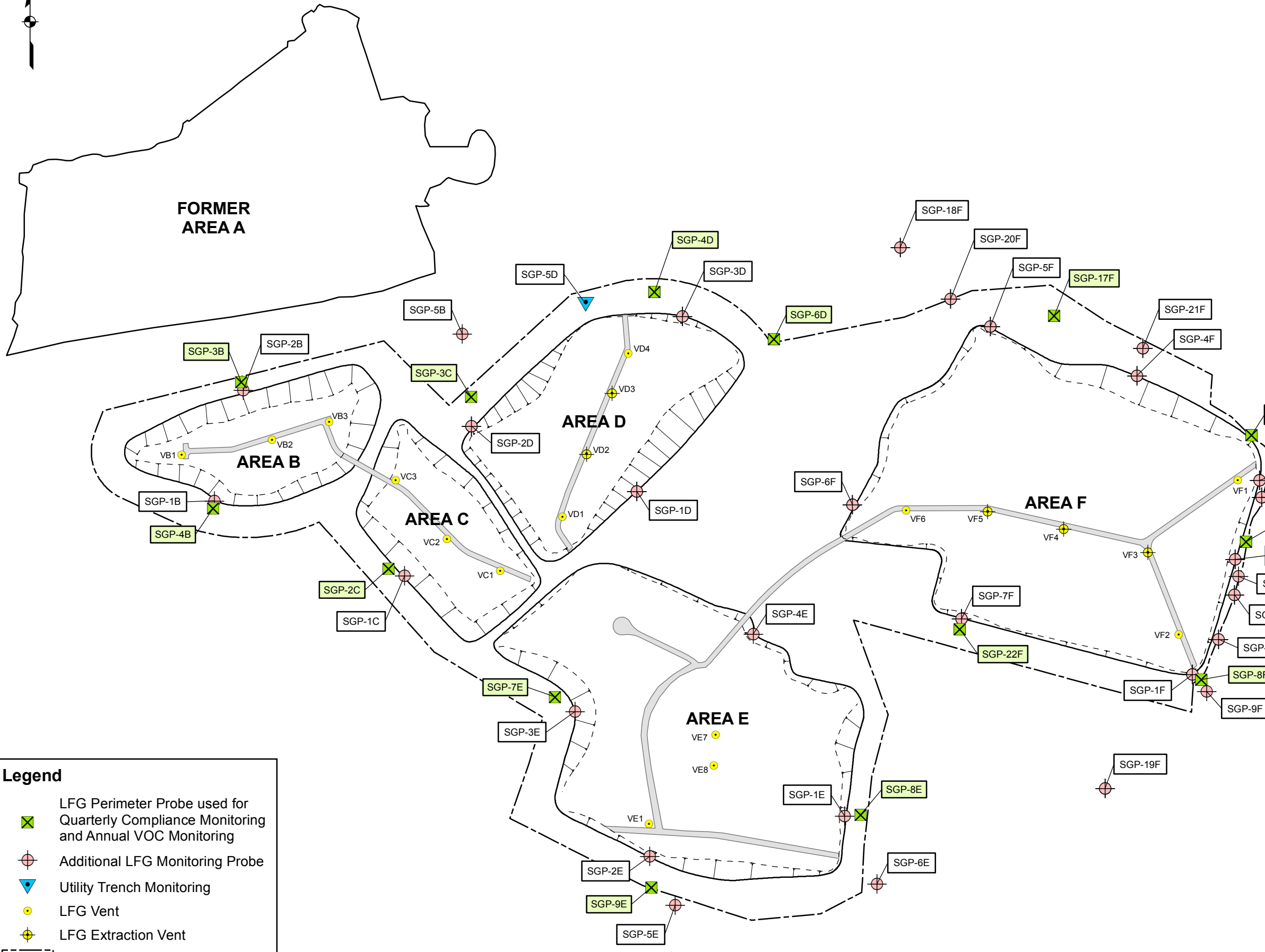
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FIGURES



U.S. Army Corps of Engineers, Sacramento District
 Operable Unit 2 Landfills
 Quality Assurance Project Plan
 Former Fort Ord, California

Figure 1
 Location Map



PROBE DEPTH TABLE

PROBE	DIMENSIONS (ft)		PROBE	DIMENSIONS (ft)	
	A	B		A	B
SGP-1B	12	-	SGP-1F	12	22
SGP-2B	12	-	SGP-2F	12	32
SGP-3B	12	-	SGP-3F	12	32
SGP-4B	12	-	SGP-4F	12	32
SGP-5B	12	-	SGP-5F	12	32
SGP-1C	12	-	SGP-6F	12	32
SGP-2C	12	-	SGP-7F	12	32
SGP-3C	12	-	SGP-8F	12	22
SGP-1D	12	22	SGP-9F	22	-
SGP-2D	12	22	SGP-10F	12	22
SGP-3D	12	22	SGP-11F	12	32
SGP-4D	12	22	SGP-12F	32	-
SGP-5D	4	-	SGP-13F	12	32
SGP-6D	12	22	SGP-14F	12	32
SGP-1E	12	-	SGP-15F	12	32
SGP-2E	12	-	SGP-16F	4	-
SGP-3E	12	-	SGP-17F	12	32
SGP-4E	12	-	SGP-18F	12	32
SGP-5E	12	-	SGP-19F	12	22
SGP-6E	12	-	SGP-20F	12	32
SGP-7E	12	-	SGP-21F	12	22
SGP-8E	12	-	SGP-22F	12	32
SGP-9E	12	-			

"-" in B dimension column means single probe

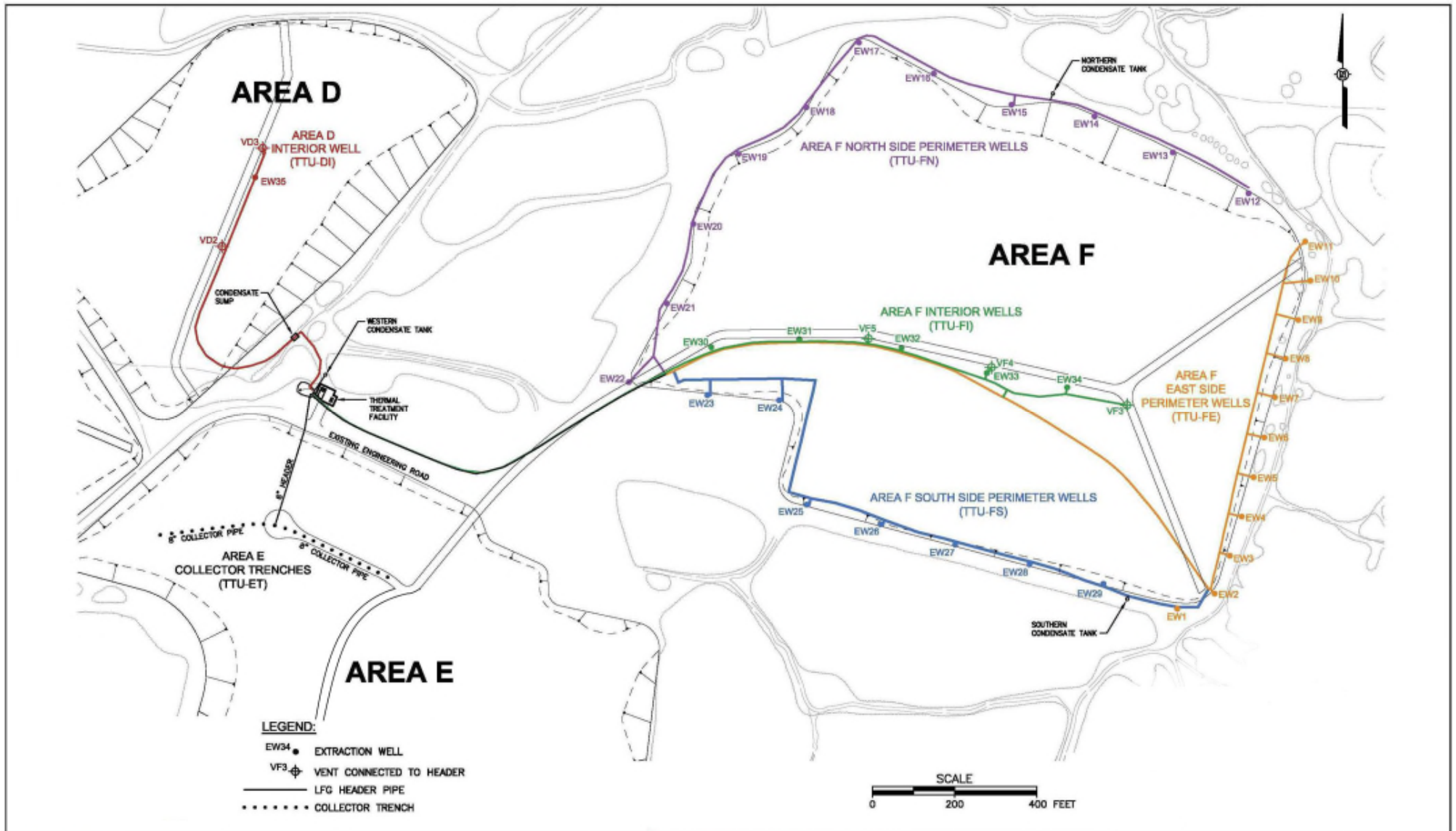
Legend

- LFG Perimeter Probe used for Quarterly Compliance Monitoring and Annual VOC Monitoring
- Additional LFG Monitoring Probe
- Utility Trench Monitoring
- LFG Vent
- LFG Extraction Vent
- Landfill Parcel Boundary

FORMER FORT ORD

Landfill Gas Monitoring Locations

		FIGURE NUMBER 2
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U.S. Army Corps of Engineers, Sacramento District
 Operable Unit 2 Landfills
 Quality Assurance Project Plan
 Former Fort Ord, California

Figure 3
 Landfill Gas Extraction and Treatment System



ATTACHMENT A
STANDARD OPERATING PROCEDURES



GEMTM2000

GAS ANALYZER & EXTRACTION MONITOR

OPERATION MANUAL

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CES-LANDTEC Release Date: July 26, 2005

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1 Introduction

CES-LANDTEC is the premier manufacturer of products, instruments and software for landfill gas extraction and for regulatory monitoring compliance. CES-LANDTEC has provided the landfill industry with a technologically innovative family of products for more than a decade. These products are the result of field-proven experience in design, operation and maintenance of landfills for environmental compliance.

The GEM™2000, designed by CES-LANDTEC, is specifically for use on landfills to monitor landfill gas (LFG) extraction systems, flares and migration control systems. The GEM™2000 samples and analyses the Methane, Carbon Dioxide and Oxygen content of LFG. The readings are displayed and can be stored in the instrument or downloaded to a personal computer for reporting, analysing and archiving.

The GEM™2000 instrument is frequently shipped in an optional protective hard case with a foam interior offers additional protection, transportation convenience and component hardware storage. When properly sealed, the hard case is watertight. The hard case is equipped with a pressure relief valve (located under the handle on the case) that is normally kept closed. If there is a change in elevation, the hard case may not open until turning the pressure relief valve equalizes internal pressure. When shipping a GEM™2000 back to CES-LANDTEC for calibration or service, always ship it in the original packaging to protect unit from damage.

Carefully unpack the contents of the GEM™2000, inspect and inventory them. The following items should be contained in your package:

- The GEM™2000 instrument
- GEM™2000 Operation Manual
- Registration/Warranty Card
- Soft carrying case with replaceable protective window and carrying strap
- Clear ¼" vinyl sampling hose assembly (5 ft.) with external water trap filter assembly
- Blue ¼" vinyl pressure sampling hose (5 ft.)
- Spare internal particulate filter element
- Polypropylene male connector (hose barb) connects to blue vinyl tubing
- Spare external water trap filter element
- 100-240 volt battery charger
- DataField CS software on CD-ROM
- RS-232 serial cable for computer/printer data downloading
- Temperature probe (optional)
- Hard carrying case (optional)

Complete the Registration/Warranty Card and return it to CES-LANDTEC. The model and serial numbers are located on the back of the GEM™2000 instrument.

Immediately notify shipping company if the GEM™2000 unit or accessories are damaged due to shipping. Contact CES-LANDTEC immediately if any items are missing.

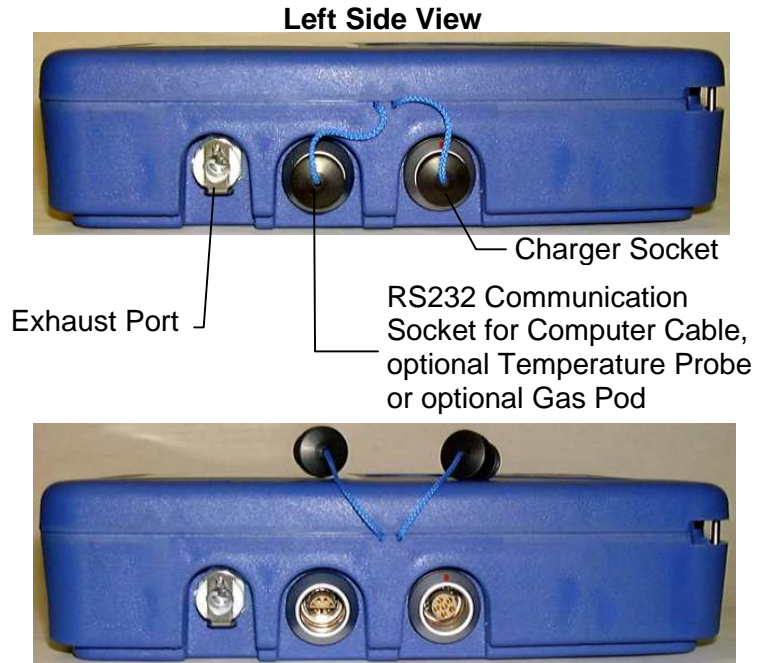
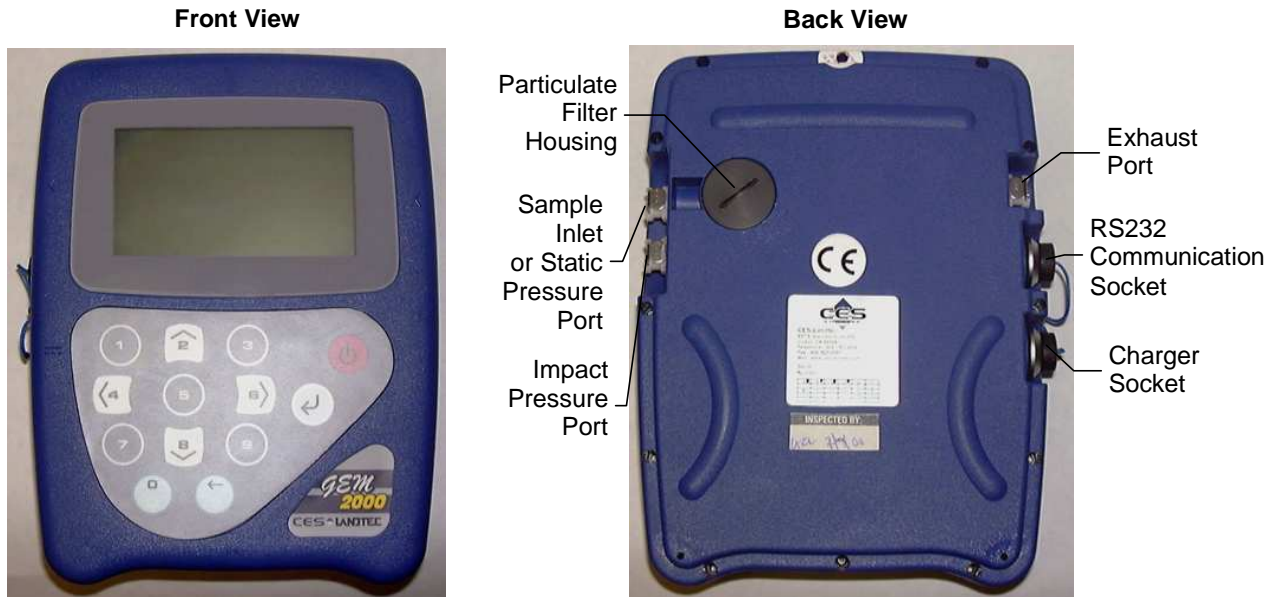
For questions regarding instrument operation and procedures, please contact CES-LANDTEC at:

Customer Service or Technical Support
Factory Service
Spare Parts and Calibration Gas
DataField Software Support

(800) 821-0496

2 General Operational Features

2.1 Physical Characteristics of the GEM™2000



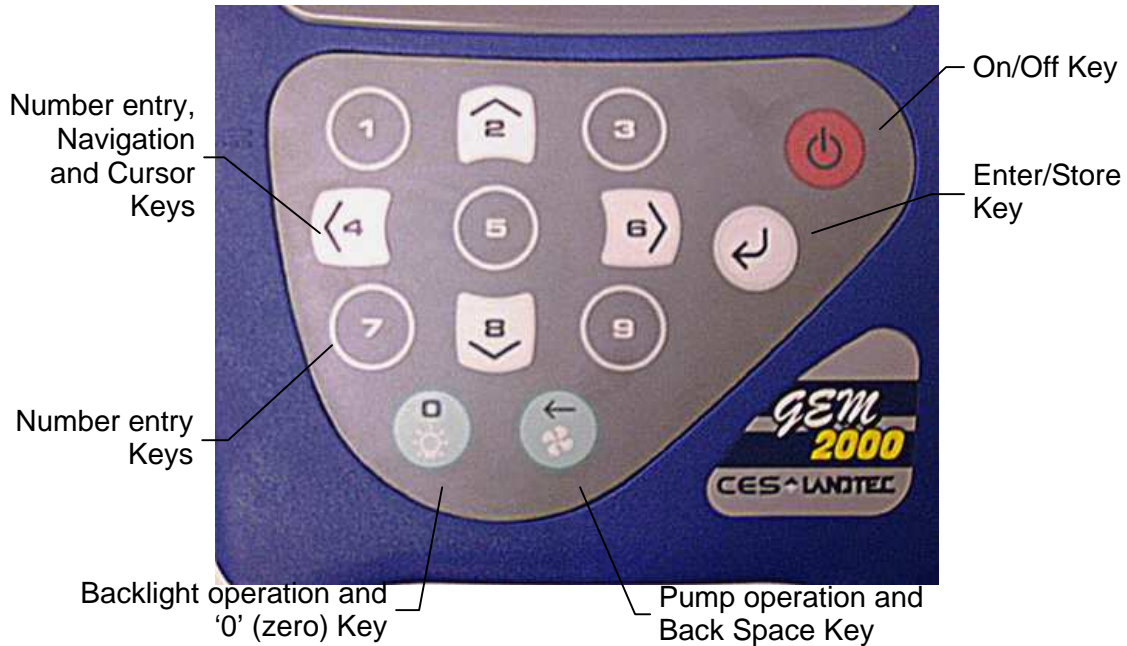
Right Side View



Impact Pressure Port

Sample Inlet or
Static Pressure Port

Keypad



Number entry,
Navigation
and Cursor
Keys

Number entry
Keys

Backlight operation and
'0' (zero) Key

On/Off Key

Enter/Store
Key

Pump operation and
Back Space Key

Whenever a key is pressed the unit will emit a short 'beep' as an acknowledgement. This function cannot be turned off.

2.2 Turning the Instrument On/Off

When switching the instrument on, a long beep will sound, followed by the CES-LANDTEC logo being displayed and the self-test will commence.

When switching the instrument off, the On/Off button must be held down for approximately 15 seconds, at which point a clean air purge will be carried out. If for any reason the instrument 'locks-up' and will not switch off, press and hold the On/Off button for 15 seconds. This will force the instrument to switch off.

2.3 Warm-up Self Test

When switched on, the instrument will perform a predetermined self-test sequence taking approximately 20 seconds, during this time many of the instrument's functions are tested, including:

- General operation
- Pump function
- Gas flow measurement
- Calibration
- Backlight function
- Solenoid function

During the self-test, the following information is also displayed:

- Calibration due date.
- Software version.
- Lifetime guarantee covered (or not).
- Date format.
- Serial Number.
- Operating language.

Upon self-test completion, the GEM™2000 should automatically enter the read gas levels screen.

2.4 Warning and Error Display

During the self-test, if any operational parameters are out of specification or the pre-programmed recommended calibration/service date has passed errors or warnings may be displayed. Only three errors/warnings can be displayed at any time. To ascertain if more errors occurred, use the '∧' and '∨' key to scroll up/down the list.

2.4.1 WARNING Displayed

All warnings displayed will be prefixed by the word '**WARNING**' followed by a relevant description. Two types of warnings may be displayed.

1. General warnings that may not have an effect on the instrument's function and those where the self-test has detected a function that is outside the usual programmed operating criteria (e.g. Battery charge low, memory nearly full, etc.).
2. Specific warnings of operational parameters that can affect the performance of the instrument (e.g. O₂ Cell out of calibration, CH₄ out of calibration, CO₂ out of calibration, etc.).

The most likely reason for the errors is either an incorrect user calibration, or sensor failure. If an incorrect user calibration has caused the warning, it should be correctable by way of returning the instrument to factory settings, zeroing or carrying out a user calibration as necessary for the relevant function.

2.4.2 ERROR Displayed

All errors displayed will be prefixed by the word '**ERROR**' followed by a number and description. The errors detected by the self-test are usually caused by a user calibration being out of specification or possibly memory corruption. This will have an effect on the functionality of the instrument and should be corrected before use (e.g. 01 - User cal data, CH₄ reading or channel out of specification, 02 - User cal data, CO₂ reading out of specification).

If any other Warnings or Errors are displayed, contact CES-LANDTEC for further information.

CES-LANDTEC is the ONLY authorized service center for the GEM™2000 instruments in the Americas

2.5 Storage

Do not keep the instrument in the trunk of a car or shed because it may be exposed to temperature extremes.

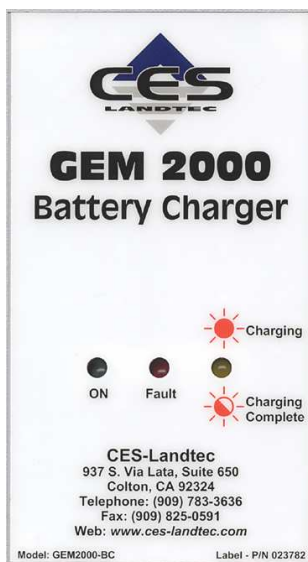
When not in use, instruments should be kept in a clean, dry and warm environment such as an office.

The instrument batteries should be discharged and fully charged at least once every four weeks regardless of indicated charge state. The discharge function may be carried out with the use of the Data Logging Function in GA mode of operation.

2.6 Battery/Charging

The Battery Charger IS NOT covered by the unit UL certification. Therefore, when connected to the Battery Charger, the instrument IS NOT intrinsically safe and should not be used in confined spaces.

The battery used in the GEM™2000 is a Nickel Metal Hydride manufactured as an encapsulated pack from six individual cells. This type of battery is not so susceptible to “memory effects” as Nickel Cadmium batteries, although it is not recommended that the unit be given short-term charges. When the flashing LED indicates “Charging Complete”, disconnect the charger.



The battery charger indicates when the unit is charging, charged or if there is a fault. A full charge should take approximately 2 hours. Charge the batteries until the ‘Charging Complete’ indicator is flashing.

2.7 Read Gas Levels Screen (GA mode of operation)

The read gas levels screen is also considered the normal operation screen and all operations are carried out from this starting point. The following information is displayed in various boxed sections at this time:

- Current programmed time and date.
- Current selected ID code.
- Pump status.
- Pump run time.
- Three main constituent gases – CH₄, CO₂, O₂ (in %).
- Balance gas.
- Last read time/date (if previous data is in memory), the benefits of this are, 1 – it is easily noted if a reading has been taken/stored, 2 – the current and previous readings can be easily compared.
- External Gas Pod “Not Fitted” (displays pod type when attached).
- Peak CH₄ reading (in %) (GA mode only).
- LEL CH₄ (GA mode only).
- Current barometric pressure reading.
- Current relative pressure reading (GA mode only).
- Gas Pod or Temperature Probe reading (if connected).
- Battery Charge graph (5 segment, flashes at 20% remaining).
- Memory Usage graph (5 segment, flashes at 5% remaining).

Other options:

- ① Menu Allows access to all instrument user functions.
- ③ Next ID Allows the next ID to be selected (if data available).
- ⌚ Previous Reading Allows the previous reading of the selected ID to be viewed (if data available).
- ↵ Store Reading Stores the current displayed reading. (GA mode only)

2.8 Optional Gas Pods

Optional gas pods are available for use with the GEM™2000. These pods are available in seven different gases with nine different PPM ranges. Connection to the instrument is made via the data port and exhaust port. The detected PPM level is displayed in the upper right area of the gas read screen and is saved in the same manner as the other gas readings.

Gas Type	Range (PPM)	Resolution (PPM)
H ₂ S	0-50	0.1
	0-200	1.0
CO	0-1000	1.0
SO ₂	0-20	0.1
	0-100	1.0
NO ₂	0-20	0.1
CL ₂	0-20	0.1
H ₂	0-1000	1.0
HCN	0-100	1.0

Gas pods are intended for use as an inexpensive detection means and not for regulatory reporting purposes. If the GEM™2000, fitted with a Gas Pod, indicates the presence of the selected gas, further testing should be performed with regulatory approved instrumentation. CES-LANDTEC recommends that field calibration be performed using the relevant gas and concentration, prior to sampling with a gas pod.

2.9 Cold Start

THIS FUNCTION SHOULD BE USED ONLY AS A LAST RESORT.

(For Gas Calibration Error Messages, confirm that Factory Setting and User Calibration is done).

A Cold Start should only be carried out to correct an instrument if no other course of action has proved successful. This function **WILL ERASE** the instrument memory entirely. After a cold start is performed the user will need to reset the instrument to factory settings, perform a field calibration and reset the internal time/date to the default settings. Please note, the time/date may only be updated through DataField software. It cannot be updated manually.

To carry out a cold start, turn the instrument on, during the self-test press and continue to hold the '↵' key until the self-test has been completed. Upon completion of the self-test, a pass code entry screen will be displayed. At this point the '↵' key may be released. Enter the code **12345** and press '↵' to confirm.

After the pass-code entry has been accepted, the instrument serial number will be displayed along with the hours of operation and two options:

- 1 - Cold Start
- 0 - Continue

ONLY select option '1' if a Cold Start is to be carried out. Press key '1' to confirm this operation. The cold start menu will be displayed again, press key '0' to continue with normal operation.

3 General Operations Menu

The following features and functions are selectable from the main menu via key 'Ⓞ **Menu**' from the read gas levels screen. Various options are available to the user including:

3.1 Zero Transducers

This function allows the user to zero the pressure transducer(s). Upon selection, the current pressure reading is displayed. The operation will be carried out when the '↵' is pressed.

3.2 Update Site Data

Allows the user to answer questions (pre-defined in DataField software) relating to the site (e.g. name of operator, weather conditions, etc.). Site Questions are different from Site Comments.

This is covered in detail in Section 6 of this manual.

3.3 Data Logging (GA mode only)

Enables the user to leave the Instrument unattended to take samples at a pre-determined time. The reading interval and pump run time may be edited prior to commencing the logging cycle. The ID code may ONLY be set in DataField communication software.

Once the logging function is activated, the instrument will carry out a 30 second 'Warm-up' countdown (displayed bottom right) and begin the first sample. After each sample, the unit will shut down (sleep) to conserve power if the time between the pump ending and the next sample is greater than 30 seconds.

The instrument is reactivated (awakened) during a logging cycle, the company logo will be displayed for a few seconds and the read gas levels screen will be displayed. This will initiate a 30 second countdown to the next sample being taken unless the operator stops the logging function.

If for any reason during a logging cycle the inlet port were to become blocked the Instrument will sense this as a flow fail during the 'pump on' time and will automatically retry until a reading can be obtained. Therefore, position the sample tubing carefully to ensure no blockage due to water/moisture can occur.

3.4 Print Data

Allows ALL the data currently stored to be printed. This may ONLY be carried out with an appropriate RS232 cable (included with new instruments & available from CES-LANDTEC) and a printer with a serial port connection.

3.5 Adjust Contrast

The GEM™2000 automatically adjusts the screen contrast according to the ambient temperature to maintain normal viewing.

The contrast can be manually adjusted by using the '<' and '>' cursor keys. The manual contrast setting is stored when the instrument is switched off.

3.6 Field Calibration

Whenever carrying out a user calibration function it is important to ensure the correct value is entered. Additionally, in the case of a zeroing function, ensure only ambient air is used and no connection is made to a probe or wellhead fitting. The calibration cylinders sold by CES-LANDTEC have a volume of 17 liters. The regulator, sold by same, is set to 0.5 liters per minute and 15 psig maximum. A normal field calibration usually requires the gas to be running for about two minutes.

Upon selecting this option, the Field Calibration screen is displayed. A brief description of the user span calibration procedure and the current reading (row 'R') and user span calibration gas values (row 'S') are displayed.

The span gas values may be changed via the 'Ⓢ Edit Target Concentrations' option. Once this option has been selected, **all** the gas values will require entry. Each entry is to be confirmed by pressing the '↵' key.

3.6.1 Zero Channels

Selected from the 'Field Calibration' - '↵-Calibration Menu' allows the relevant reading to be zeroed. When selected, a list of the available options will be displayed, this usually includes CH₄, and O₂, also the Gas Pod (if fitted).

Supply a zero gas mixture to the instrument for the gas to be zeroed. Insure the reading for the selected gas has settled to its lowest value before selecting the zero function. When the required option is selected, the user zero function will be carried out automatically. The operation will be carried out when the '↵' key is pressed.

3.6.2 Span Channels

Spanning Channels should be carried out prior to use or when the ambient operating temperature changes greater than +/- 20 degrees. Selected from the 'Field Calibration' - '↵-Calibration Menu', allows the relevant reading to be span calibrated (in accordance with the calibration value entered). When selected, a list of the available options will be displayed, which includes CH₄, CO₂, O₂, and Gas Pod (if fitted).

When the required option is selected from the list, the span calibration function will be carried out automatically. When carrying out this procedure, ensure the span calibration procedure (as outlined below) is followed:

1. Apply the relevant known certified gas concentration through the inlet port of the Instrument.
2. Wait until the current gas reading has stabilized.
3. Select the required calibration option via the '↵-Calibration Menu'.

3.6.3 Factory Settings

This will clear any user zero and span calibration data. It will also restore the pre-programmed factory settings for **ALL** channels – CH₄, CO₂, O₂ or Gas Pod (if fitted) and pressure transducers.

3.6.4 Last Field Cal

Displays the date the last field calibration was carried out (zero or span).

3.7 Mode of Operation

Allows changing instrument between GA mode and GEM mode of operation.

4 Taking Probe Readings (GA Mode)

CES-LANDTEC classifies non-extraction wells as Probes when **NOT** connected to an active vacuum extraction system. Probes, (commonly known as migration probes), may be placed on the perimeter of the landfill to test for gas migration or may be placed next to a building or road to test for the presence of Methane. The GEM™2000 instrument may be configured as a Gas Analyzer (GA mode) for sampling probes. To access this function from the gas read screen press 'Ⓢ' for menu and scroll down to **Mode of Operation**, press the '↵' key and highlight **Landfill Gas Analyzer**, pressing the '↵' key again will select GA mode of operation.

4.1 Preliminary Checks

Prior to going to the test site, it is good practice to ensure:

- All necessary ID codes and readings have been uploaded via DataField software.
- The time and date are correct.
- The water trap has a clean and dry filter fitted.
- The inlet-port particulate filter is clean and dry.
- A supply of spare filters is available in case of accidental water blockage or contamination.
- The battery has a good charge (minimum 25% charge, even if only a few readings are required).
- The memory has sufficient space available.
- The CH₄, CO₂, and O₂ readings have been auto-zeroed, without gas concentration present.
- Check the span calibration with a known concentration calibration gas.

Travel to site with the analyzer in the vehicle's interior - not in the trunk or truck bed, where it may be subjected to extremes of temperature and possible shock damage. Do not place the analyzer against anything hot (e.g. gas extraction pipe, car body or in an unattended car during the summer). This may cause erroneous readings.

When moving around a site, protect the instrument from strong direct sunlight, heavy rain or wind-chill. Strong direct sunlight can raise the temperature of the instrument beyond its operating range. If this occurs, the LCD display will appear almost black and the contrast setting cannot alter the contrast.

Always use the water trap! If the water trap becomes flooded, change the filter immediately and ensure all tubes are clear before re-use.

4.2 Update Site Data

Prior to taking the readings at a particular site, the Site Data should be updated (if programmed). This is accessed via the General Menu 'Ⓢ **Update Site Data**'. This function removes the need for the site conditions to be recorded manually.

A series of up to five questions can be pre-programmed with the use of DataField and answered at this time. The answers to these questions are stored and appended to each reading stored thereafter, until the site data is updated for another site.

4.3 Taking Readings – With ID

For this function to be used it is essential that the relevant ID and if required, previous readings are uploaded to the Instrument. An ID **cannot** be entered from the Instrument.

1. When the read gas levels screen is displayed, option 'Ⓢ **Next ID**' should be selected. A list of stored IDs is displayed for selection via the '↵' and 'Ⓢ' cursor keys, the 'next' ID on the list is automatically highlighted. To confirm selection, press the '↵' key. The display may be toggled to

display any relevant ID information such as a description of the probe location, work to be carried out, etc.

2. A reminder is displayed to disconnect sample tubes, as a clean air purge will automatically remove the previous sample from the instrument. Purge time may be set via DataField (default is 30 seconds). Once the '↵' key is pressed, purge will begin and the Read Gas Levels screen will be displayed upon completion. The purge may be aborted by pressing the 'EXIT' key.
3. The ID number selected and the pump runtime is displayed in the upper left corner of the read gas levels display.
4. At this point, connect the sample tube (with water trap) from the sample point to the inlet port of the instrument, ensuring the connector 'clicks' into place. Then connect the sample tube to the probe sample port. **Do not connect the sample tube to the probe port before connecting to the instrument as this will cause any pressure in the probe to dissipate and a proper pressure reading will not be taken.**
5. As soon as the connection is made, the relative/static pressure reading will be displayed. No sample is taken from the probe at this time. Once the reading stabilizes and the pump starts, the relative/static pressure reading is stored. The relative/static reading will remain displayed as the pressure last taken.
6. The pump will run for the pre-programmed time and a countdown timer will be displayed. The pump may be stopped or started at anytime by way of the 'P' (pump) key. The reading may be stored at anytime with the use of the '↵' key. When the pump automatically stops this should be used as a prompt to store the reading.
7. Upon storing the reading, any pre-programmed questions will be displayed for response. This may require a numeric, alphanumeric selectable comment, or exclusive comment answer. A maximum of eight selectable and exclusive comments may be entered.
8. Disconnect the sample tubing from the probe and proceed to Step 1 for the next probe.

For each reading, the following information will be stored:

- ID code.
- Current time/date.
- Site data (if entered).
- All gas readings and balance (CH₄, CO₂, O₂).
- LEL CH₄.
- Barometric Pressure.
- Relative Pressure.
- Questions/comments.
- Temperature (if temperature probe is connected).
- Gas Pod (if connected).

When the instrument is switched off, a clean air purge is automatically started for a pre-determined period. This may be aborted with the use of the '↵' key, although it is not recommended.

A tone will sound and a flashing bell will be displayed next to the appropriate gas reading value if a preset alarm condition has been exceeded.

4.4 Taking Readings – Without ID

1. From the ID list press 'Select No ID' or, if ID information has not been uploaded to the instrument, an ID list will not be available. In either case, the ID will be displayed and stored as ' - - - - - '.
9. A reminder is displayed to disconnect sample tubes, as a clean air purge will automatically remove the previous sample from the instrument. Purge time may be set via DataField (default is 30 seconds). Once '↵' is pressed, purge will begin and the Read Gas Levels screen will be displayed upon completion. The purge may be aborted by pressing the 'EXIT' key.

2. At this point, connect the sample tube (with water trap) from the sample point to the inlet port of the instrument, ensuring the connector 'clicks' in to place.
3. Now connect the sample tube to the probe sample port. **Do not connect the sample tube to the probe port before connecting to the instrument as this will cause any pressure in the probe to dissipate and a proper pressure reading will not be taken.**
4. The pump may be started or stopped at anytime by way of the '⊕' (pump) key and a 'time-on' timer will be displayed. The pump should always be stopped using the '↵' key, before storing a reading.
5. Upon storing the reading, a virtual keyboard will be displayed for any alphanumeric comments to be entered.
6. Disconnect the sample tubing from the probe and proceed from step 1 for the next probe.

Except for the ID code information, which will be stored as '- - - - -', and probe questions, for each reading the information stored will be the same as that for a reading with an ID.

A tone will sound and a flashing bell will be displayed next to the appropriate gas reading value if a preset alarm condition has been exceeded.

4.5 Temperature Probe Reading

The GEM™2000 has the facility to automatically display and record the probe temperature via an optional temperature probe (TP-100). When a temperature probe is fitted to the RS232 Communication Socket, the temperature will be displayed in the read gas levels screen and recorded with all other data. The temperature probe is part of the GEM™2000 UL certification and is therefore certified for use under the same conditions as the instrument.

4.6 Cross-Gas Effects

4.6.1 Methane, Carbon Dioxide and Oxygen

The Methane reading is filtered to an infrared absorption frequency of 3.41 μ m (nominal), the frequency specific to hydrocarbon bonds. Instruments are calibrated using certified Methane mixtures and will give correct readings provided there are no other hydrocarbon gasses present within the sample (e.g. ethane, propane, butane, etc.). If there are other hydrocarbons present, the Methane reading will be higher (never lower) than the actual Methane concentration being monitored.

The extent to which the Methane reading is affected depends upon the concentration of the Methane in the sample and the concentration of the other hydrocarbons. The effect is non-linear and difficult to predict.

The Carbon Dioxide reading is filtered to an infrared absorption frequency of 4.29 μ m (nominal), the frequency specific to Carbon Dioxide. Therefore, any other gases usually found on landfill sites will not affect the Carbon Dioxide reading.

The Oxygen sensor is a newly developed galvanic cell type and suffers virtually no influence from CO₂, CO, H₂S, NO₂, SO₂ or H₂, unlike many other types of Oxygen cell.

The infrared sensors will not be "poisoned" by other hydrocarbons. Normal operation will resume as soon as the gas sample has been purged.

Note - there has been one reported incident of a high reading due to the presence of Carbon Disulphide, which has a similar absorption frequency to Carbon Dioxide.

4.6.2 H₂S, CO and other Optional Gas Pods

The Gas Pods used to measure H₂S and CO do suffer from cross-gas effects. Such effects are not accurately specified. However, the following table may be useful as a guide. This table represents how many ppm would be read by a Gas Pod if 100ppm of the interfering gas was applied, (with no other cross-contaminates being present in the sample).

Cell	CO	H ₂ S	SO ₂	NO ₂	CL ₂	H ₂	CH ₄	CO ₂
CO	100	<3	0	<-20	0	<40	0	0
H ₂ S	<0.5	100	~20	~-20		~0.1	0	0

NOTE: All readings are given in parts per million (ppm). The life of an electrochemical cell is determined by exposure to gasses, typical life being one to two years. It is recommended that Gas Pods be field calibrated at regular intervals.

4.7 Memory

The instrument's memory is volatile. It is maintained by a battery back-up system, which will maintain the memory while the battery is being changed.

The memory is not to be used as a permanent storage medium and any data should be transferred to a more permanent storage medium as soon as possible. An Instrument should never be stored for prolonged periods with valuable data in its memory.

Although unlikely, sudden shocks, high levels of electromagnetic interference or static discharge may cause memory corruption or loss. If this occurs, the instrument should be Cold Started and the calibration reset to factory settings before further use. **Cold starting will erase all data in the instrument including resetting the time and date to the default value.**

5 Taking Extraction Well Readings (GEM Mode)

CES-LANDTEC classifies gas-producing penetrations on landfills as wells when used with vacuum extraction systems and flow determining devices such as the Accu-Flo wellheads, orifice plates or pitot tubes. The GEM™2000 may be configured as a Gas Extraction Monitor (GEM mode) for the purpose of sampling wells and obtaining flow measurements. To access this function from the gas read screen press 'ⓐ' and scroll down to **Mode of Operation**, press the '↓' key and highlight **Gas Extraction Monitor**, pressing the '↓' key again will select GEM mode of operation.

5.1 Preliminary Checks

Prior to going to site, it is good practice to ensure:

- All necessary ID codes and readings have been uploaded via DataField software.
- The time and date are correct.
- The water trap has a clean and dry filter fitted.
- The inlet-port particulate filter is clean and dry.
- A supply of spare filters is available in case of accidental water blockage or contamination.
- The battery has a good charge (minimum 25% charge, even if only a few readings are required).
- The memory has sufficient space available.
- The CH₄, CO₂ and O₂ readings have been auto-zeroed without gas concentration present.
- Check the span calibration with a known concentration calibration gas.

Travel to the site with the analyzer in the vehicle's interior - not in the trunk or truck bed, where it may be subjected to extremes of temperature and possible shock damage. Do not place the analyzer against anything hot (e.g. gas extraction pipe, car body or in an unattended car during the summer). This may cause erroneous readings.

When moving around a site, protect the instrument from strong direct sunlight, heavy rain or wind-chill. Strong direct sunlight can raise the temperature of the instrument beyond its operating range. If this occurs, the LCD display will appear almost black and the contrast setting cannot alter the contrast.

Always use the water trap! If the water trap becomes flooded, change the filter immediately and ensure all tubes are clear before re-use.

5.2 Update Site Data

Prior to taking the readings at a particular site, the Site Data should be updated (if programmed). This is accessed via the General Menu 'ⓐ'. This function removes the need for the site conditions to be recorded manually. A series of up to five questions can be pre-programmed with the use of DataField and answered at this time. The answers to these questions are stored and appended to each reading stored thereafter, until the site data is updated for another site.

5.3 Taking Gas and Flow Readings (GEM Mode)

The GEM mode of operation is designed to allow for gas flow (SCFM) and energy measurements (BTU) to be calculated at the wellhead. This function requires the use of an ID that has been uploaded from DataField software with the type of flow device defined. **Gas flow and BTU will not be calculated if this action has not been performed.**

1. When the gas read screen is displayed select 'ⓐ Next ID'. A list of stored IDs will be displayed for selection via the '↵' and '↓' cursor keys, the 'next' ID is automatically highlighted, to confirm the selection press the '↓' key. The screen may be toggled to display any relevant ID information such as a description of the well location, work to be carried out, etc.

2. A reminder is displayed to disconnect sample tubes, as a clean air purge will automatically remove the previous sample from the instrument. Purge time may be set via DataField (default is 30 seconds). Once the '↵' key is pressed, purge will begin and the Read Gas Levels screen will be displayed upon completion. The purge may be aborted by pressing the 'ⓀEXIT' key.
3. Connect the sample tubes (with water trap filter) to the wellhead ensuring the gas sample tube and impact pressure tubes are properly oriented. Insert the temperature probe if used.
4. Press the 'Ⓜ' key to start the sample pump; a countdown timer will be displayed in the upper left area of the display. The pump may be stopped and restarted any time by pressing the 'Ⓜ' key. The pump run time is set in DataField software. Allow the gas readings to stabilize and press 'ⓂMeasure Flow' key, this will store the gas level readings and display the '**PRESSURE READINGS**' screen. Note; a flashing bell will be displayed next to the appropriate gas and a beeping tone will be heard, if a preset alarm condition has been exceeded.
5. The '**PRESSURE READINGS**' screen will prompt the user to disconnect the sample tubes and allow the pressure to stabilize. Once the pressure has stabilized press '↵ Zero Transducers'. Press 'Ⓚ' to continue. **Note**; if Accu-Flo wellheads are used this zero function may be performed prior to connecting the sample tubes to the well head by selecting 'Ⓚ MENU' and highlighting '**ZERO TRANSDUCERS**'. This eliminates the need to disconnect and re-connect the sample tubes on the same wellhead.
6. If a temperature probe is not connected, the user is prompted to manually input the gas temperature, press the '↵' key when entry is finished.
7. The gas flow and energy screen is now displayed showing all the gas level readings taken in the gas read screen as well as the level of gas flow (SCFM) and power (BTU). In addition, Adjusted, Current and Previous (if downloaded) readings are displayed so modifications may be made to the well if required.
8. Pressing '↵ **STORE**' will save the readings to memory. Then, the comments screen (if comments were loaded) will display and allow you to answer questions or select comments about the condition of the well. A total of seven comments and one exclusive comment may be stored with each ID.
9. Press 'Ⓚ **NEXT ID**' and proceed to the next wellhead. An automatic purge will be performed at this time to ensure the sample has been exhausted from the instrument.

For each reading, the following information will be stored:

- ID code.
- Current time/date.
- Site data (if entered).
- All gas readings and balance gas (CH₄, CO₂, O₂).
- Barometric Pressure.
- Temperature.
- Gas Pod (if connected).
- Gas flow (SCFM) and Power (BTU).
- Comments and exclusive comment.

When the Instrument is switched off, a clean air purge is automatically started for a pre-determined global period. This may be aborted by pressing the '↵' key, although we do not recommend this action.

6 DataField CS Software

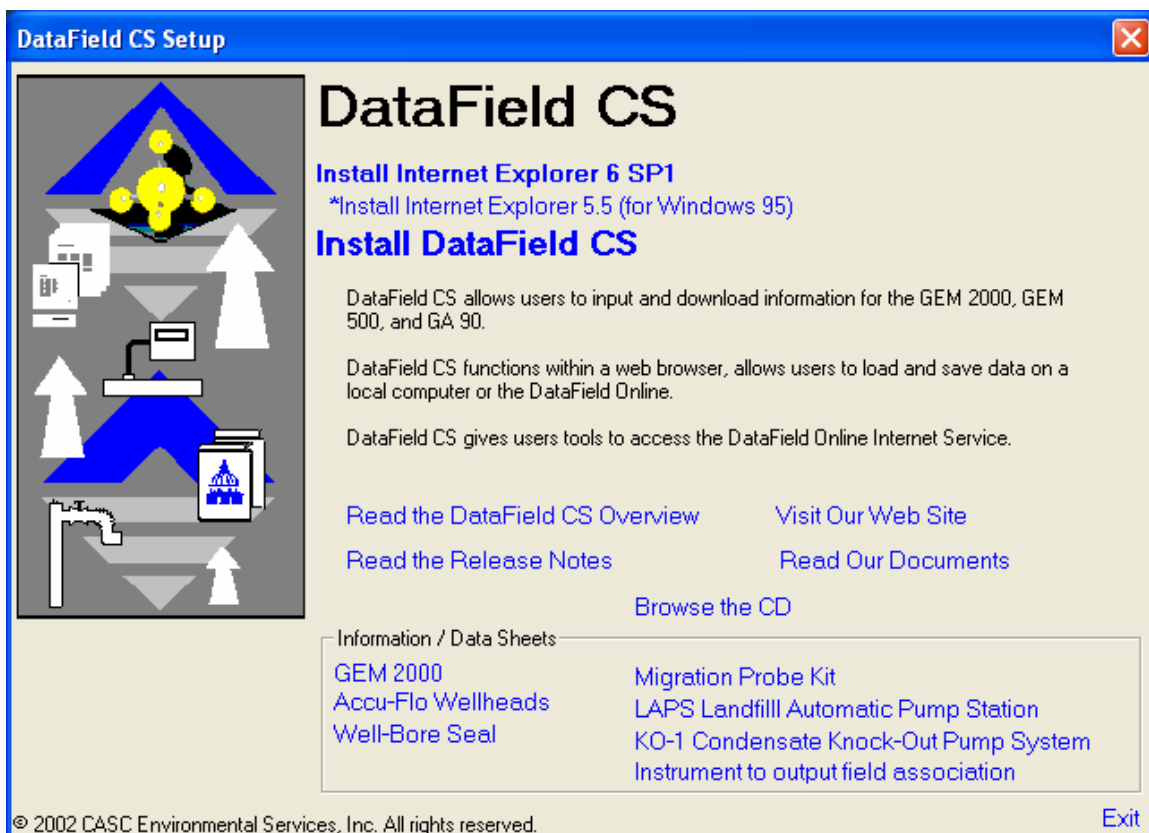
DataField CS is an integrated software program designed to communicate with the GEM™2000, GEM™500 and GA-90 instruments. The software will create files used for storing gas read data, ID data, comments and instrument configuration data. The files created are significantly different from the files created with GEM_COMM or GA_COMM software and are not compatible with these versions of software.

DataField CS is browser based (Java enabled) and will operate on Windows98 and higher Windows operating systems. Recommended hardware requirements are:

- Pentium III 500 MHz microprocessor or equal.
- 64 MB RAM.
- 120 MB of free hard disk space.
- CDROM drive.
- Mouse or pointer system.
- Standard keyboard.
- Installed printer.

6.1 Installing DataField CS

Be sure your computer is turned on and all software programs have been properly closed. Place the program disk in the CD ROM drive and close the tray. DataField CS will self start and display the DataField CS set-up screen.*



Install the Internet Explorer 6 SP1 by clicking on the corresponding link in the DataField CS set-up screen. If you are using Windows 95, install the Internet Explorer 5.5. Follow the onscreen instructions until the Internet Explorer is installed successfully.

Reboot the computer after the installation of the Internet Explorer is completed.

Re-insert CD Rom to start autorun again.

Install the DataField CS by clicking on the corresponding link in the DataField CS set-up screen. Follow the onscreen instructions.*

Other useful links on the DataField CS set-up screen:

Read the DataField CS Overview link will open a presentation with an overview of DataField CS.

Read the Release Notes link has information on the system requirements, application compatibility and other important issues.

Visit Our Web Site link will open the CES-LANDTEC web site.

Read Our Documents link will open a new window with manuals and user guides for GEM Instruments, as well as several viewers and 3rd party tools that can be downloaded.

Browse the CD link will open a file browser.

Information / Data Sheets set of links provides information on various Landfill instruments.

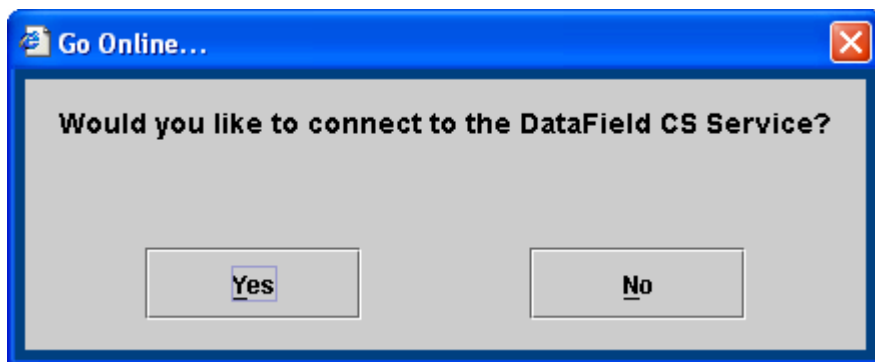
* If the DataField CS set-up screen hasn't appeared, open a file browser (ex. right-click on the Start button on your desktop and choose open) and navigate to your CD-ROM drive. Double-click on the **Autorun.exe**.

6.2 Establishing Communications

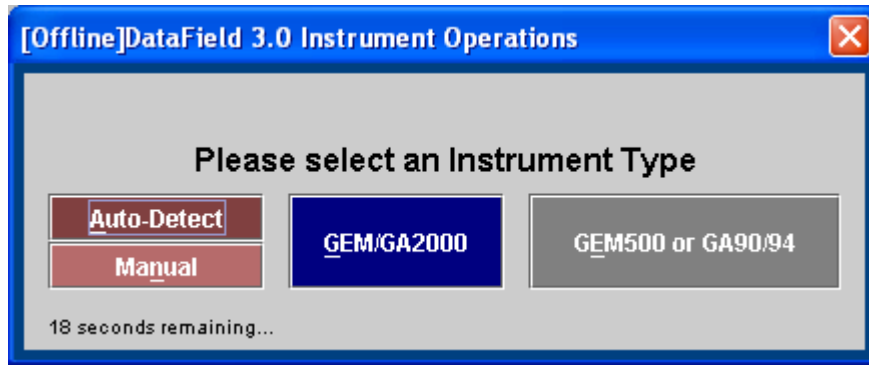
Connect the RS-232 download cable to an open COM port on your computer. Connect the other end of the RS-232 download cable to the GEM™2000 data port. DataField CS has the ability to automatically scan the different COM ports on your computer to find where the instrument is connected.

Turn the instrument on, wait for the self-test function to finish. The Gas Readings screen will display, if not, then turn off the GEM and re-start the instrument. The GEM™2000 must be in the Gas Reading screen in order to establish communications.

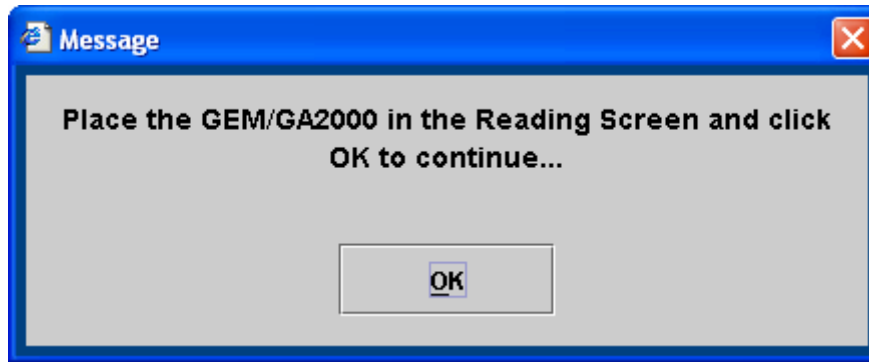
Once the instrument is in the proper communications mode, click on the Start menu then All Programs menu. Scroll to DataField and then DataField CS to initialize the software. The following screen will appear on the computer.



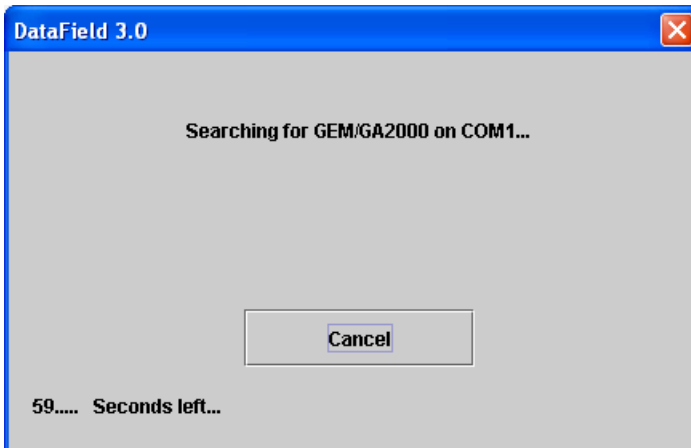
Click Yes to run DataField CS online or No to run it offline.



Click on the GEM/GA2000 button. You can also click on the Auto-Detect button for the DataField CS to automatically detect the instrument.

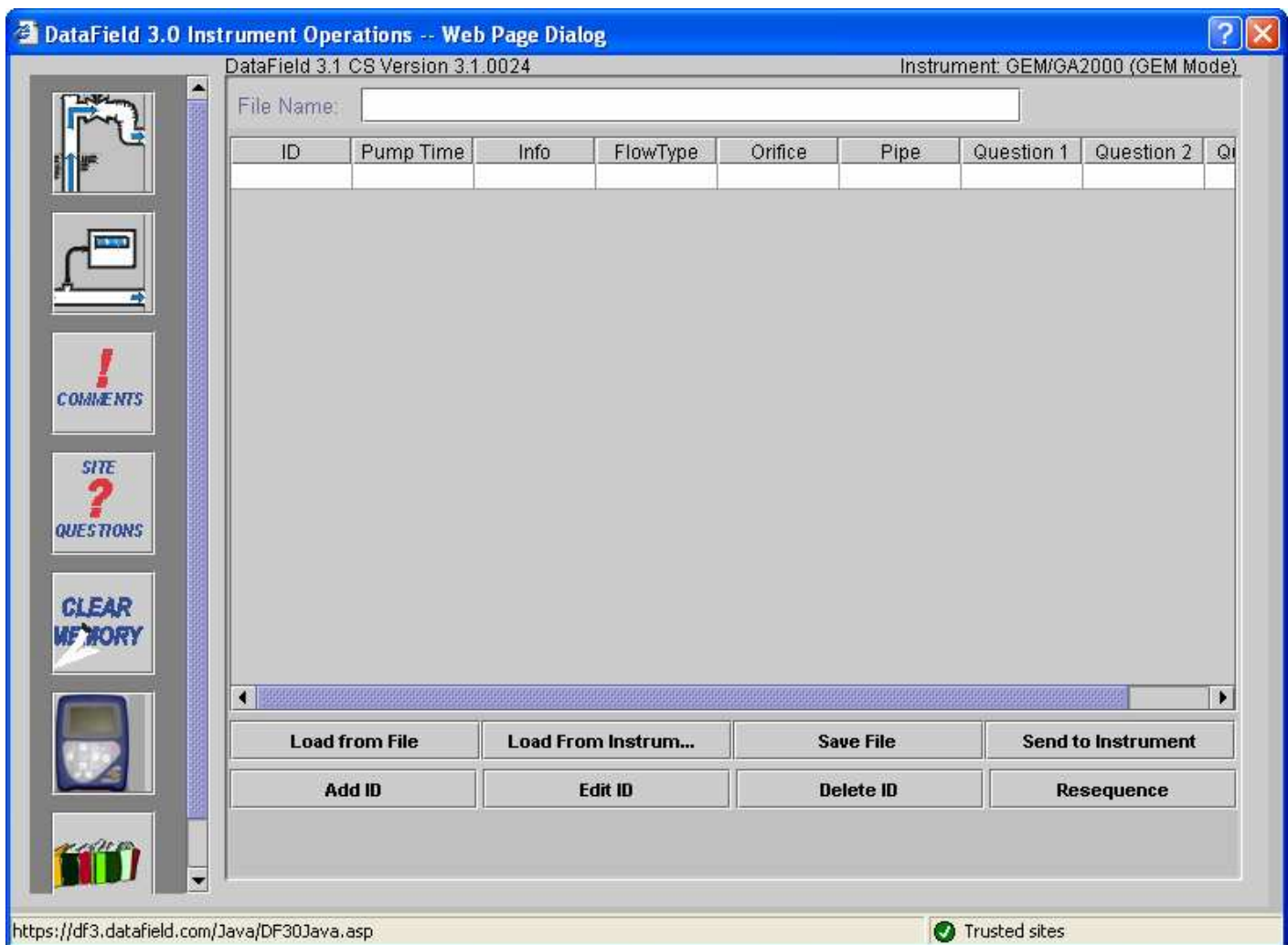


Click OK and DataField CS will automatically search for the instrument. This may take a few minutes. When the instrument is found and the communication is established, the software will display a box that indicates what type of instrument was found. If the software does not find the instrument, it will display a box that indicates that no instrument was found.



6.3 Main Screen

Once DataField CS establishes the communication with the instrument, the main software screen will appear.



Seven main categories (buttons) are listed down the left side of the screen: ID Functions, Readings, Comments, Site Questions, Clear Memory, Instrument Settings and Resource Links. Clicking on any one of the buttons will take the user to that functionality of the application.

6.4 Close the program

Clicking on the **Close** button in the top right corner of the screen will exit the program. This will close all files and exit the program.

6.5 Communications

It is not possible to change instruments and establish communications without re-starting the software.

6.6 Functions

Each button has a specific function as listed below:

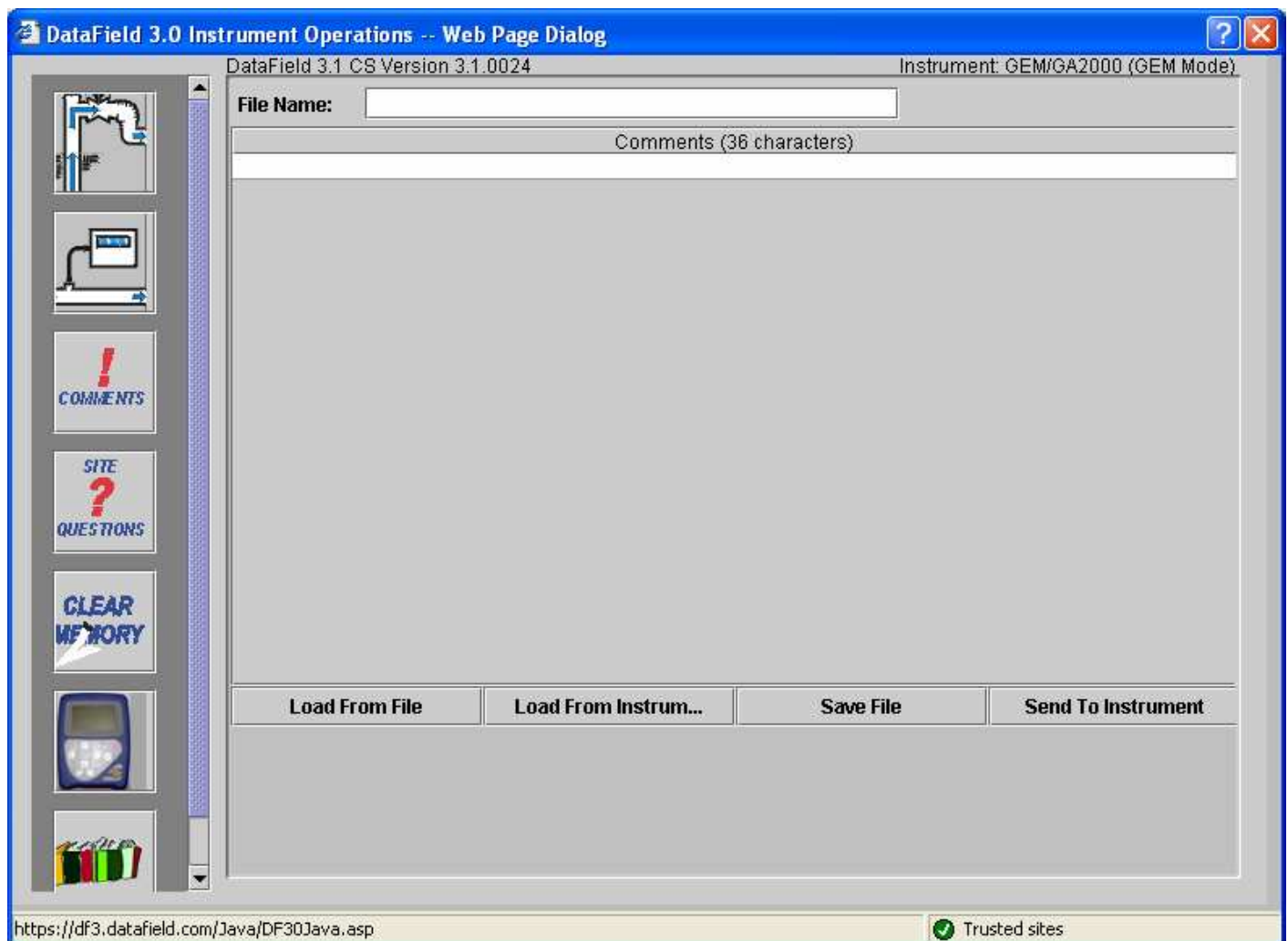
1. **Comments** – Allows entry of comments that may be selected for the IDs. A total of seven comments and one exclusive comment may be selected for each ID.
2. **IDs** – Used for adding new IDs, editing IDs or deleting IDs and entry of ID parameters such as pump run time, flow device, comments and questions for the ID.
3. **Readings** – Allows downloading and viewing data from instrument and uploading of previous data to the instrument.
4. **Site Questions** – DataField CS supports a total of five site questions that are answered by the technician and saved to the ID data.
5. **Clear Memory** – Allows the deletion of selective IDs, readings, comments, site questions or all memory loaded in instrument memory.
6. **Resource Links** – Allows the user to directly access information via the www.

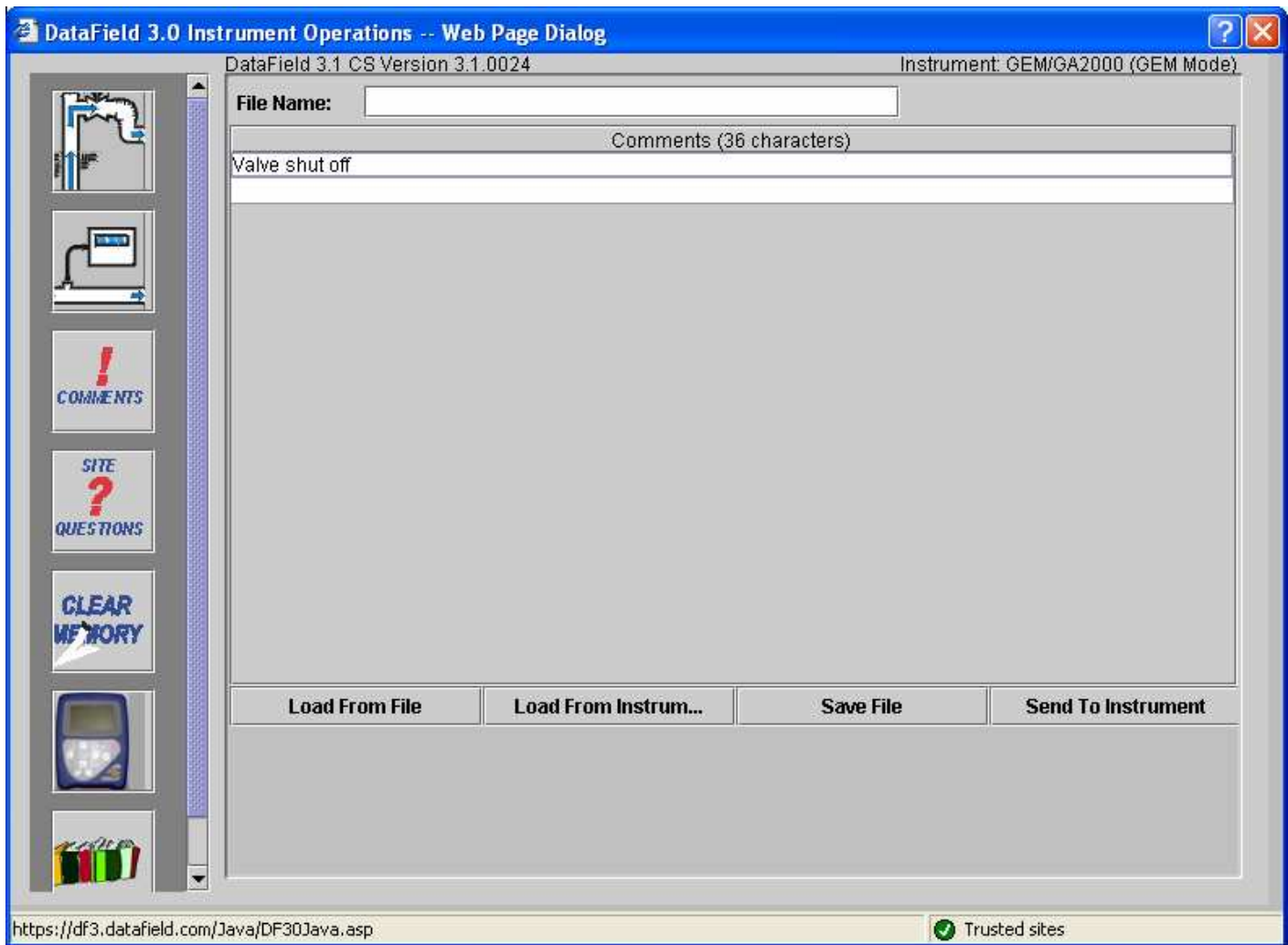
6.6.1 Comments



DataField CS allows up to 64 comments to be created for upload to the GEM™2000. Each comment may be up to 36 characters in length and may be alphanumeric or any character on the computer keyboard. **Select Comment** or **Exclusive Comment** must be turned on for comments to be selected for that ID. See section 6.6.2. Click on the **Comments** button to open the

following screen.





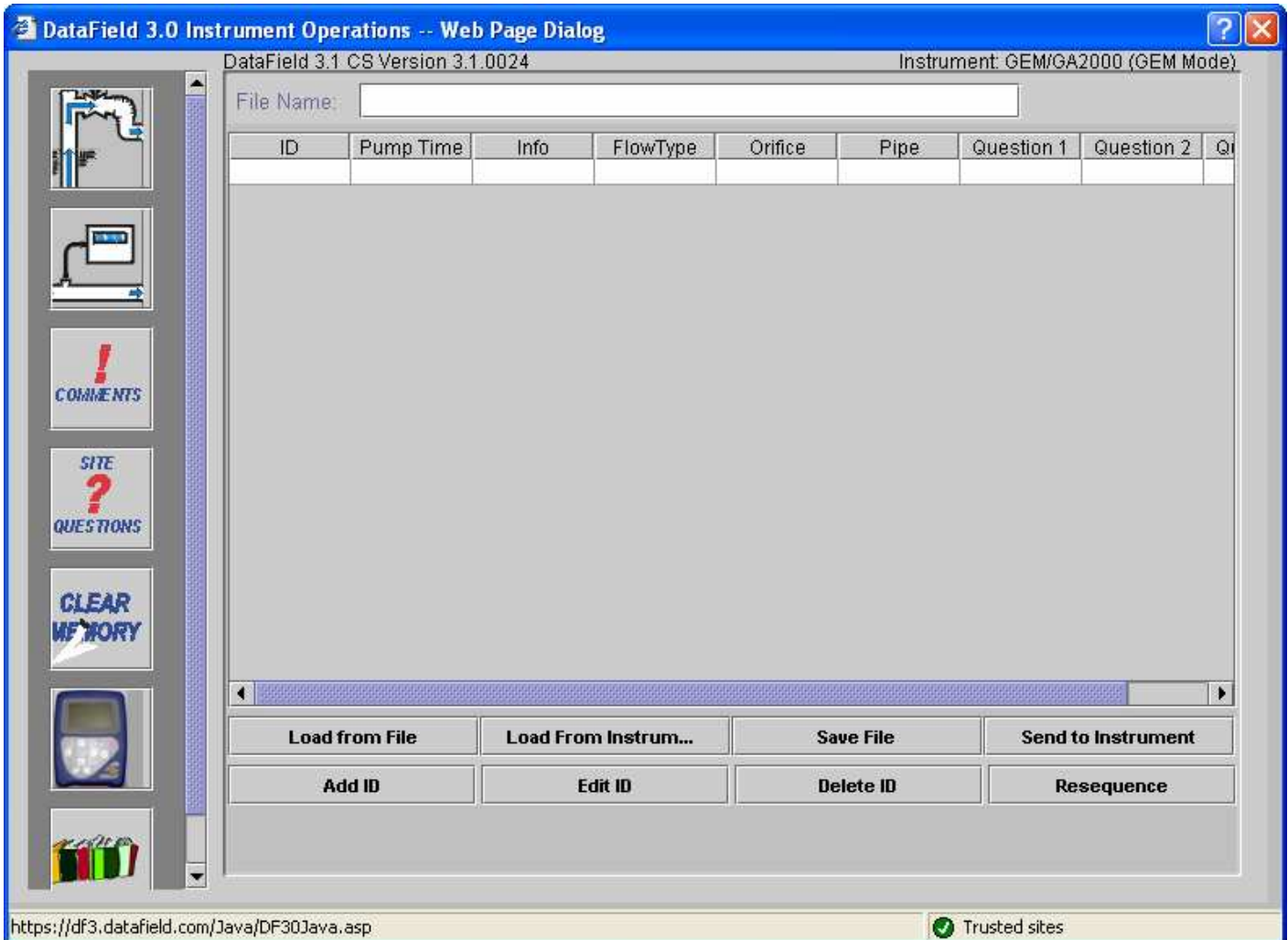
Enter the comment on the comment line and press **Enter** to continue entering comments until all the desired comments have been entered. Click on **Save File** to save the data to disk and then click on **Send to Instrument** to save the comments in the instrument. To delete a comment, click on the comment to highlight the comment and press the **Delete** key on the computer keyboard to remove the highlighted comment. It is always suggested to save the comment file because of the potential size and time required to recreate the comments. Once created, the comment file may be modified and saved under a different file name at any time.

Note: Comments must be created and sent to the instrument through the software. They can not be hand input into the instrument in the field.

6.6.2 Entering IDs



From the opening screen select the **ID** button. The following screen will open:



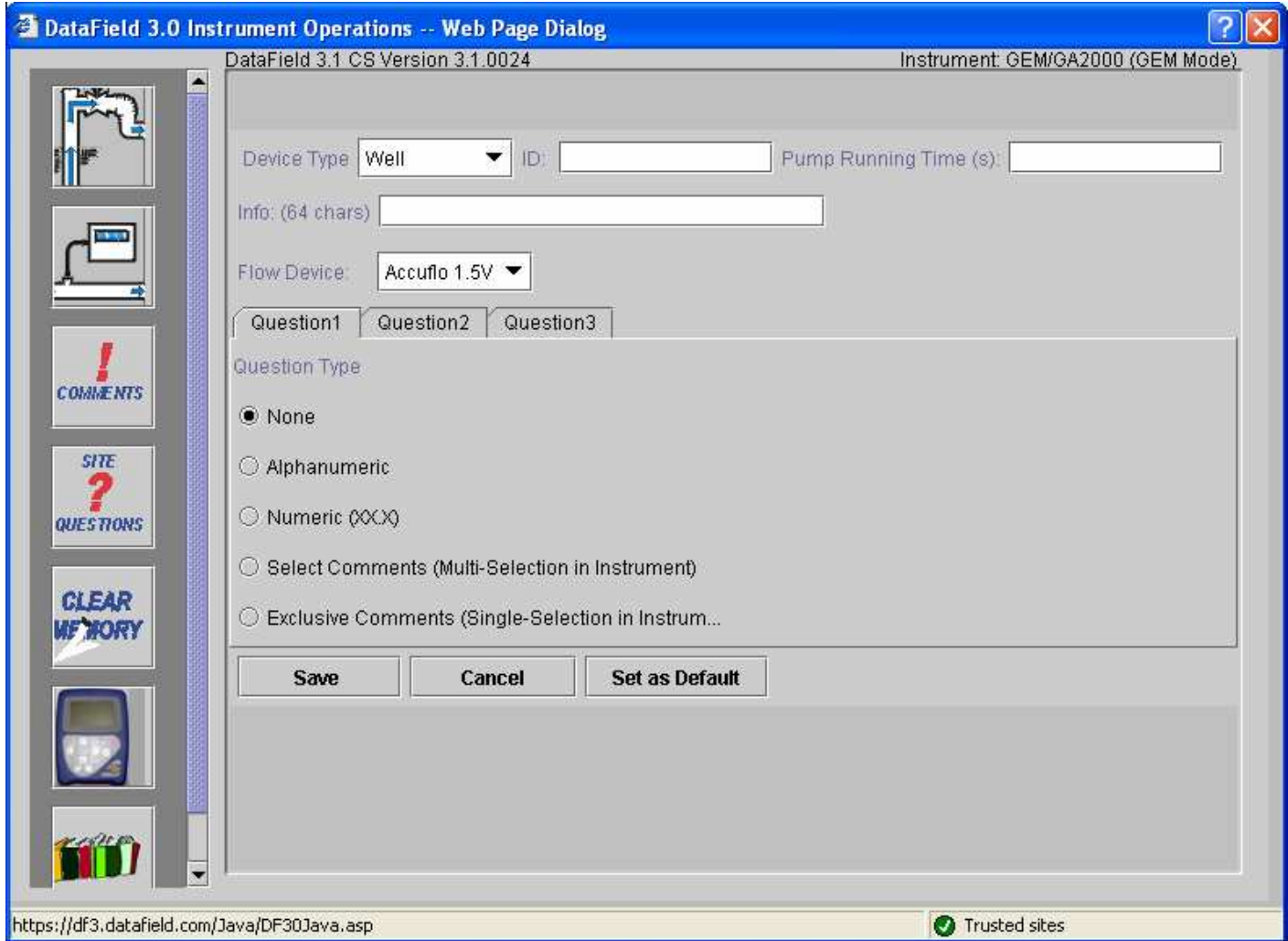
Selecting the **Save File** button will allow you to enter the name for the file you wish to save. The naming of files follows the extended naming convention for Windows.

Selecting the **Load from File** button will allow a previously created file to be loaded from the computer disk drive.

Selecting the **Load from Instrument** button will allow previously loaded IDs in the instrument to be downloaded for modification such as increasing the pump run time or adding additional comments to a specific ID. **CAUTION:** Loading IDs from an instrument can be a dangerous practice and is not recommended if using DF online service. The possibility exists of introducing into a project IDs from another project. When the IDs are downloaded from the instrument and stored online all IDs that are present in the instrument will be stored to the current project **IRRESPECTIVE** of if the IDs belong to the project.

Add ID button is used for the creation of a new ID or multiple IDs that may be sent to the instrument or saved to a new file for later use.

To enter a new ID or create a new ID set, click on the **Add ID** button and the following screen will open:



Enter the Well ID in any combination of alpha or numeric characters for a maximum of eight characters. **All eight characters must be used.** Enter the pump run time in seconds (maximum of 999 seconds), pump run time must be entered in order for the pump to be turned on for gas sampling. Enter information about the well, such as its location, previous problems, etc or leave blank. Enter the type of flow device used with the well (Accu-Flo wellhead, Pitot tube, or orifice plate); user input may also be selected. If Pitot tube or orifice plate is selected, the **inside** pipe diameter and **orifice diameter** must be entered. If the pump run time and the flow device are going to be the same for multiple wells, click on **Set as Default** to lock these two values. Three questions may be asked about the well for reply by the technician at the time a sample is taken. These can take the form of alphanumeric, numeric, selected comments or exclusive comments. If none is selected then no questions will be asked for this ID. Note: **If Select Comments or Exclusive Comments is selected, Comments must be created and sent to the instrument.** See section 6.6.1.

GEM™2000 Operation Manual

Click on **Save** to add this ID to the editor screen seen below. If additional IDs need to be entered, simply click on **Add ID** and enter the data as before.

DataField 3.0 Instrument Operations -- Web Page Dialog

DataField 3.1 CS Version 3.1.0024 Instrument: GEM/GA2000 (GEM Mode)

File Name:

ID	Pump Time	Info	FlowType	Orifice	Pipe	Question 1	Question 2	Question 3
12345678	30	Northeast c...	Accuflo 2H	0	0	Is the leach...	N/A	N/A

COMMENTS

SITE QUESTIONS

CLEAR MEMORY

Load from File Load From Instrum... Save File Send to Instrument

Add ID Edit ID Delete ID Resequence

https://df3.datafield.com/Java/DF30Java.asp Trusted sites

Once all the IDs have been entered, click **Save File** button to save the ID data to a file or **Send to Instrument** button if data is to be uploaded to an instrument for field sampling.

6.6.3 Editing IDs

IDs may be edited in a similar manner to entering a new ID. Click on the **ID** button. Click on the **Load from File** button if the IDs to be edited are in a saved file on disk or click on **Load from Instrument** if the IDs to be edited reside in the instrument. Once the IDs have been opened, the **ID Editor** screen will appear as shown below.

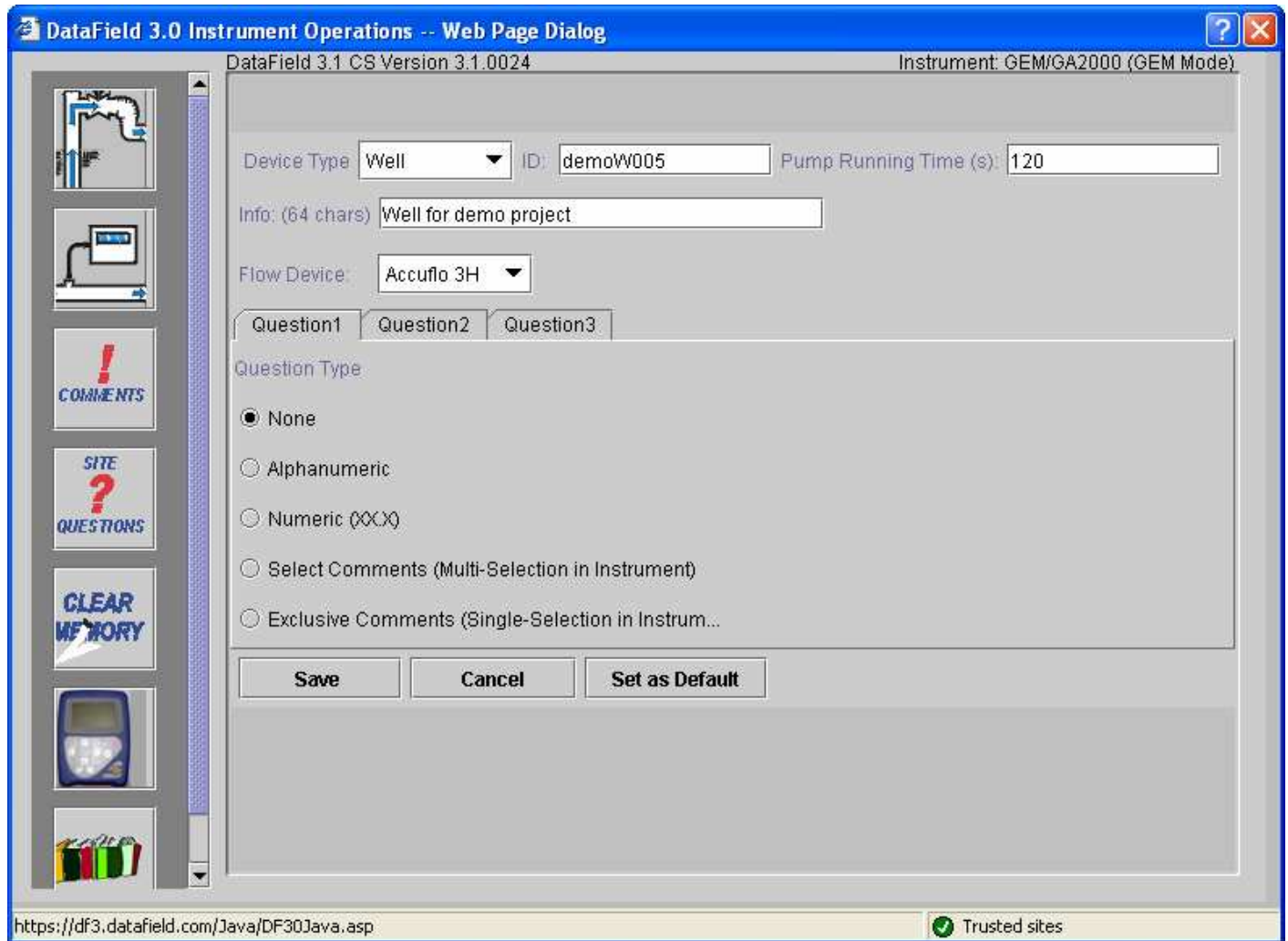
DataField 3.1 CS Version 3.1.0024 Retrieving Instrument Type and Mode...

File Name:

ID	Pump Time	Info	FlowType	Orifice	Pipe	Question 1	Question 2	Q
demoW001	120	Well for de...	Accuflo 1.5H	0.00	0.00	N/A	N/A	N/A
demoW002	120	Well for de...	Accuflo 1.5V	0.00	0.00	N/A	N/A	N/A
demoW003	120	Well for de...	Accuflo 2H	0.00	0.00	N/A	N/A	N/A
demoW004	120	Well for de...	Accuflo 2V	0.00	0.00	N/A	N/A	N/A
demoW005	120	Well for de...	Accuflo 3H	0.00	0.00	N/A	N/A	N/A
demoW006	120	Well for de...	Accuflo 3V	0.00	0.00	N/A	N/A	N/A
demoW007	120	Well for de...	Orifice Plate	0.75	3.00	N/A	N/A	N/A
demoW008	120	Well for de...	Pitot Tube	0.00	3.00	N/A	N/A	N/A
demoW009	120	Well for de...	User Input	0.00	3.00	N/A	N/A	N/A

https://df3.datafield.com/Java/DF30Java.asp Trusted sites

To select an ID for editing, click on the ID to highlight the ID, and then click on the **Edit ID** button. The Edit ID screen will open and allow information for the selected ID to be changed. When finished with the changes, click on **Save** to save the edited ID to the ID list.



When editing is completed, click on **Save** to return to the previous screen. Click on **Save File** to save the edited data to disk or click on **Send to Instrument** to append the IDs to the IDs in the instrument.

Note: IDs are only appended to the unit. It is strongly recommended to erase/clear IDs from unit prior to sending new IDs to the unit. One obvious exception is in the case of loading IDs for multiple sites in an instrument.

DataField 3.0 Instrument Operations -- Web Page Dialog

DataField 3.1 CS Version 3.1.0024 Retrieving Instrument Type and Mode...

File Name:

ID	Pump Time	Info	FlowType	Orifice	Pipe	Question 1	Question
demoW001	120	Well for demo pr...	Accufflo 1.5H	0.00	0.00	N/A	N/A
demoW002	120	Well for demo pr...	Accufflo 1.5V	0.00	0.00	N/A	N/A
demoW003	120	Well for demo pr...	Accufflo 2H	0.00	0.00	N/A	N/A
demoW004	120	Well for demo pr...	Accufflo 2V	0.00	0.00	N/A	N/A
demoW005	120	Shut this well off	Accufflo 3H	0.00	0.00	N/A	N/A
demoW006	120	Well for demo pr...	Accufflo 3V	0.00	0.00	N/A	N/A
demoW007	120	Well for demo pr...	Orifice Plate	0.75	3.00	N/A	N/A
demoW008	120	Well for demo pr...	Pitot Tube	0.00	3.00	N/A	N/A
demoW009	120	Well for demo pr...	User Input	0.00	3.00	N/A	N/A

COMMENTS

SITE QUESTIONS

CLEAR MEMORY

Load from File Load From Instrum... Save File Send to Instrument

Add ID Edit ID Delete ID Resequence

https://df3.datafield.com/Java/DF30Java.asp Trusted sites

6.6.4 Delete IDs

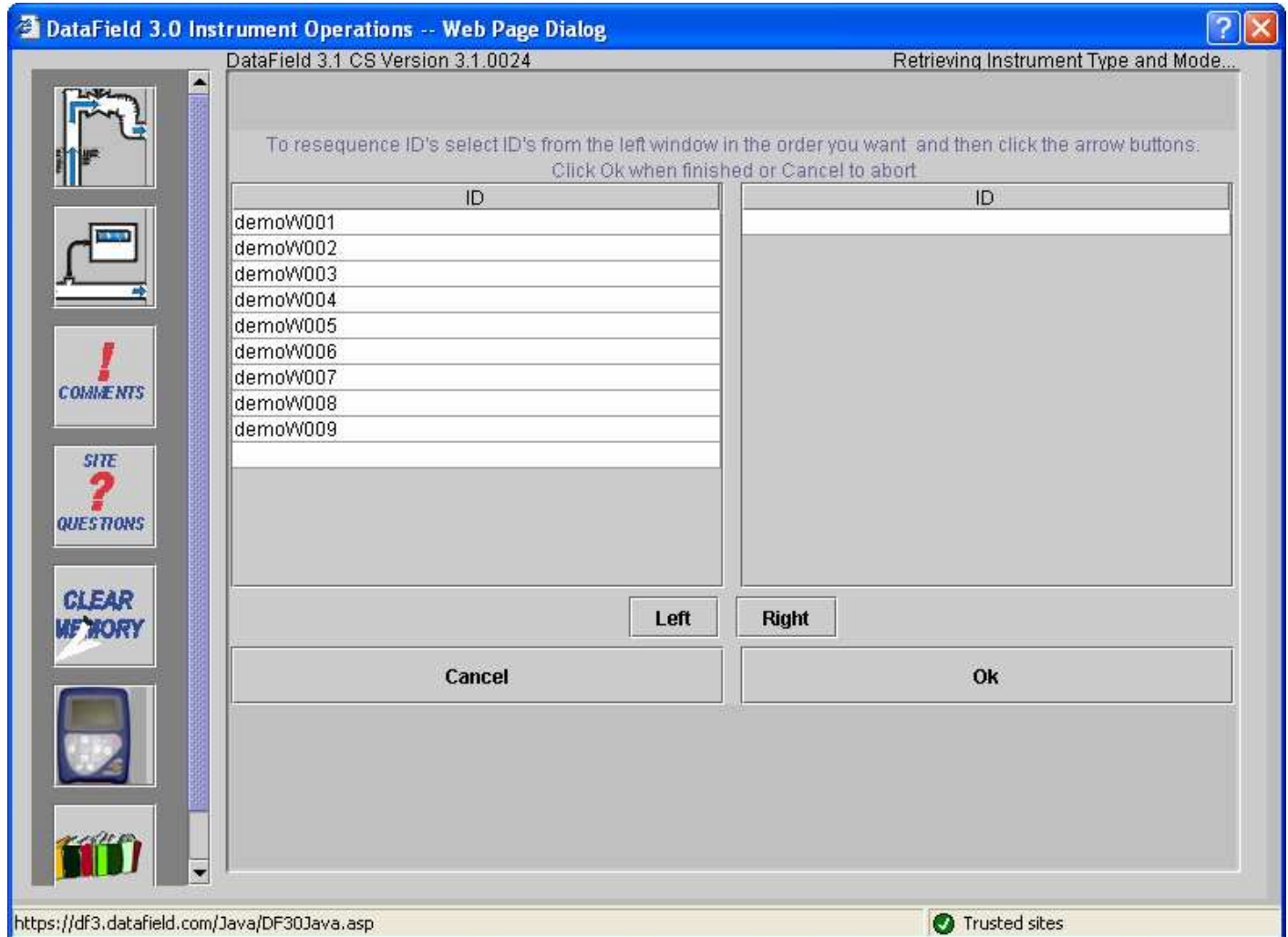
Select an ID to delete and click on it to highlight it. Click on the **Delete ID** button. A prompt will appear to verify the action. Clicking **Yes** will delete the ID. To select multiple IDs use **Ctrl** and **Shift** buttons on your keyboard. When deleting multiple IDs after clicking on the **Delete ID** button a prompt will appear: "Would you like to verify each deletion?" Clicking **No** will delete all the selected IDs. Clicking **Yes** will prompt on the deletion of each ID in the selection. In this case the deletion of some IDs in the selection can be cancelled.

Click on **Save File** to save the updated file to disk or click on **Send to Instrument** to update the instrument for field sampling.

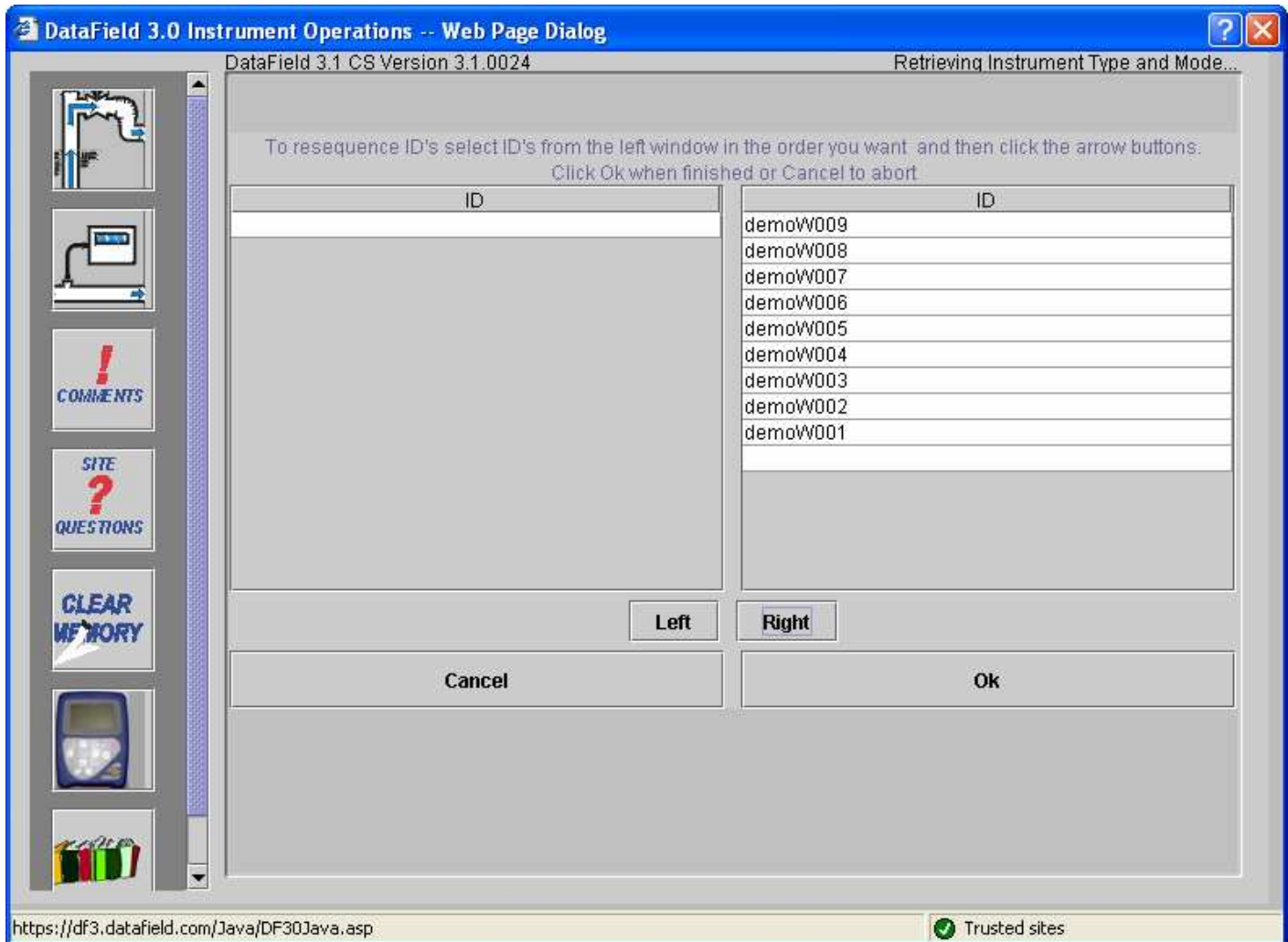
Note: We suggest clearing the ID information from the instrument prior to uploading the revised ID list. Otherwise the new ID list will be appended to the existing list. Clearing IDs in the instrument will clear IDs in the both GEM & GA modes of operation.

6.6.5 Re-sequencing

With DataField CS it is possible to change the order of the IDs in a file to put them in the same order as they are sampled in the field. This is called **Re-sequencing**. To re-sequence an ID data set, click on the **ID** button to open the ID editor. Load the ID data set from a file or download the data set from the instrument. Click on the **Re-sequence** button to open the screen shown below.



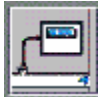
Select the ID from the left side window and click on the **Right** button to move ID to the right window to create the new sequence order. Repeat this process moving all IDs to the right side in the desired order.



Click OK when the desired new sequence is obtained, this will return you to the well ID screen. Click on the **Save File** button to save the new data set to a file on disk or click on **Send to Instrument** to upload the new data to the instrument.

Note: It is suggested to clear ID information from the instrument prior to uploading the re-sequenced ID list. Otherwise the new ID list will be appended to the existing list. Clearing IDs in the instrument will clear IDs in the both GEM & GA modes of operation.

6.6.6 Readings



The Readings screen provides the capability to download, upload, view, save data to a file and delete individual or multiple readings from a data set. Click on the **Readings** button to open the screen shown below.

Click on **Load from File** to open a file folder of saved data on the disk drive or click on **Load from Instrument** to download data from the instrument. Either action will open the following screen. All readings should be downloaded on a daily basis. While the instrument can hold readings for an extended period of time, it is recommended to download them to a non-volatile memory device (e.g. hard drive, CD, etc.).

DataField 3.1 CS Version 3.1.0024 Instrument: GEM/GA2000 (GEM Mode)

Currently Connected to: "DEMO1"

Device ID	Date/Time	CH4 [%]	CO2 [%]	O2 [%]	Peak CH4 [...]	Peak CO2 [...]	Peak O2 [%]	B
demoW001	01/23/2002...	50.5	36.0	0.0	0.0	0.0	0.0	0.0
demoW002	01/23/2002...	0.0	0.0	4.0	0.0	0.0	0.0	0.0
demoW003	01/23/2002...	56.5	41.6	0.0	0.0	0.0	0.0	0.0
demoW004	01/23/2002...	54.6	44.3	0.4	0.0	0.0	0.0	0.0
demoW005	01/23/2002...	54.6	44.4	0.3	0.0	0.0	0.0	0.0

Buttons: Load From File, Load From Instrument, Technician & Weather Stam..., Store Online, Send To Instrument, Delete Readings

URL: https://df3.datafield.com/Java/DF30Java.asp Trusted sites

Once the file has been opened or data downloaded from the instrument, the readings can be either **stored online** (only with the online version) or **saved to a file** (only with the offline version). When the instrument is in the GA Mode the readings can also be **sent to the instrument**. **Send to Instrument** button will be disabled when the instrument is in the GEM Mode. The screenshot above shows the online version with the instrument in the GEM mode.

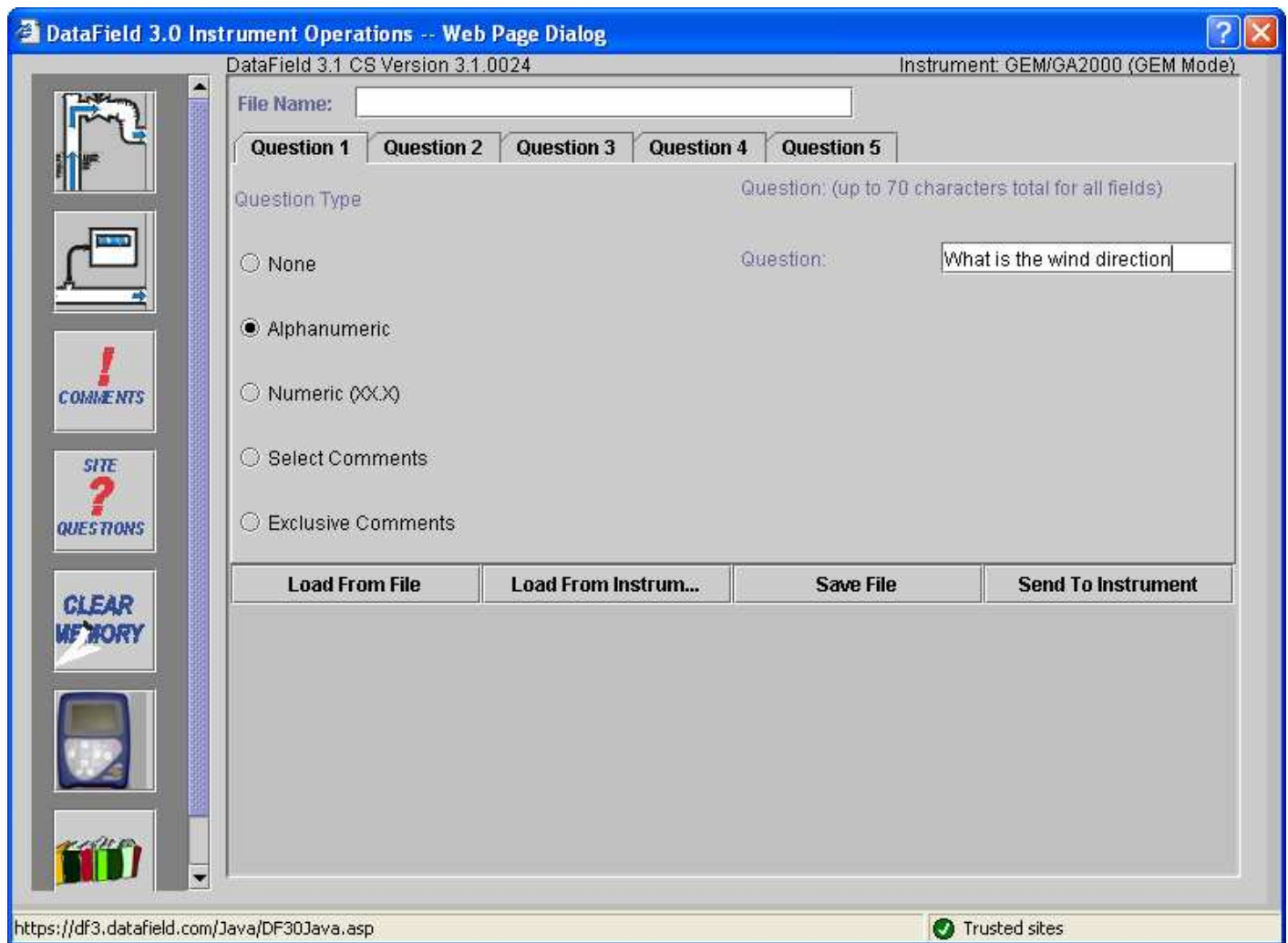
To delete an ID from the data set, click on this ID to highlight it and then click on the **Delete Readings** button. Only one ID can be deleted at a time.

6.6.7 Site Questions

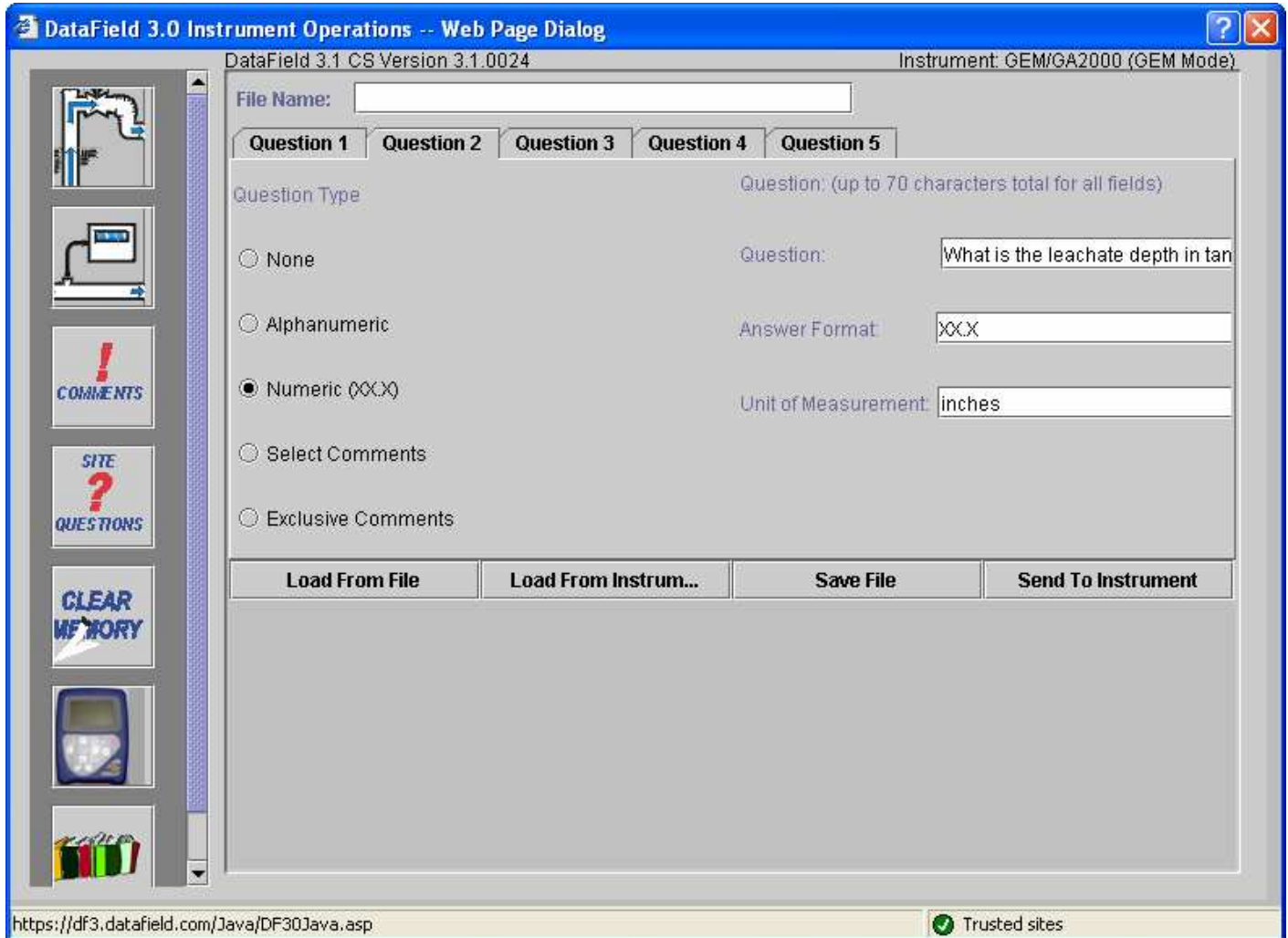


DataField CS supports up to five site questions. Site questions are answered only when **Update Site Data** is selected from the GEM menu screen and appended to all IDs taken thereafter until Update Site Data is selected again. This is a useful feature if conditions change in various locations on the landfill site or for selected wells/probes. Site questions can be either alphanumeric, numeric, select comment (the technician selects the comment from a list of ten answers) or exclusive comments (the technician may select only **ONE** exclusive question from a list of 10 answers). From the opening screen, click on the **Site Questions** button to open the following screen.

Note: Site questions must be created and sent to the instrument by the software prior to going into the field. They can not be hand inputted into the instrument in the field.

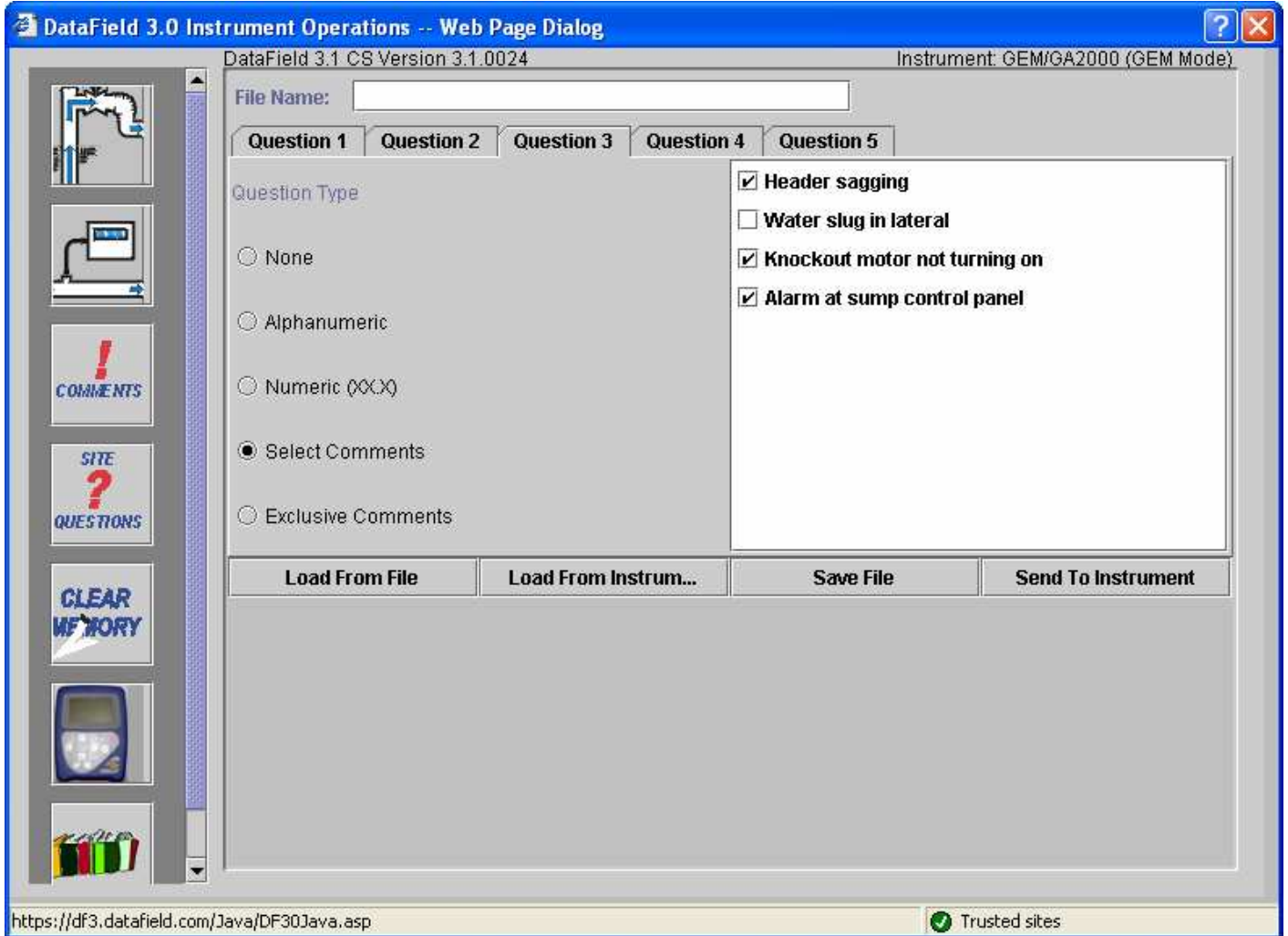


Click on the open spot, to the left of the alphanumeric category in **Question Type** to define Question 1 and type in the question.

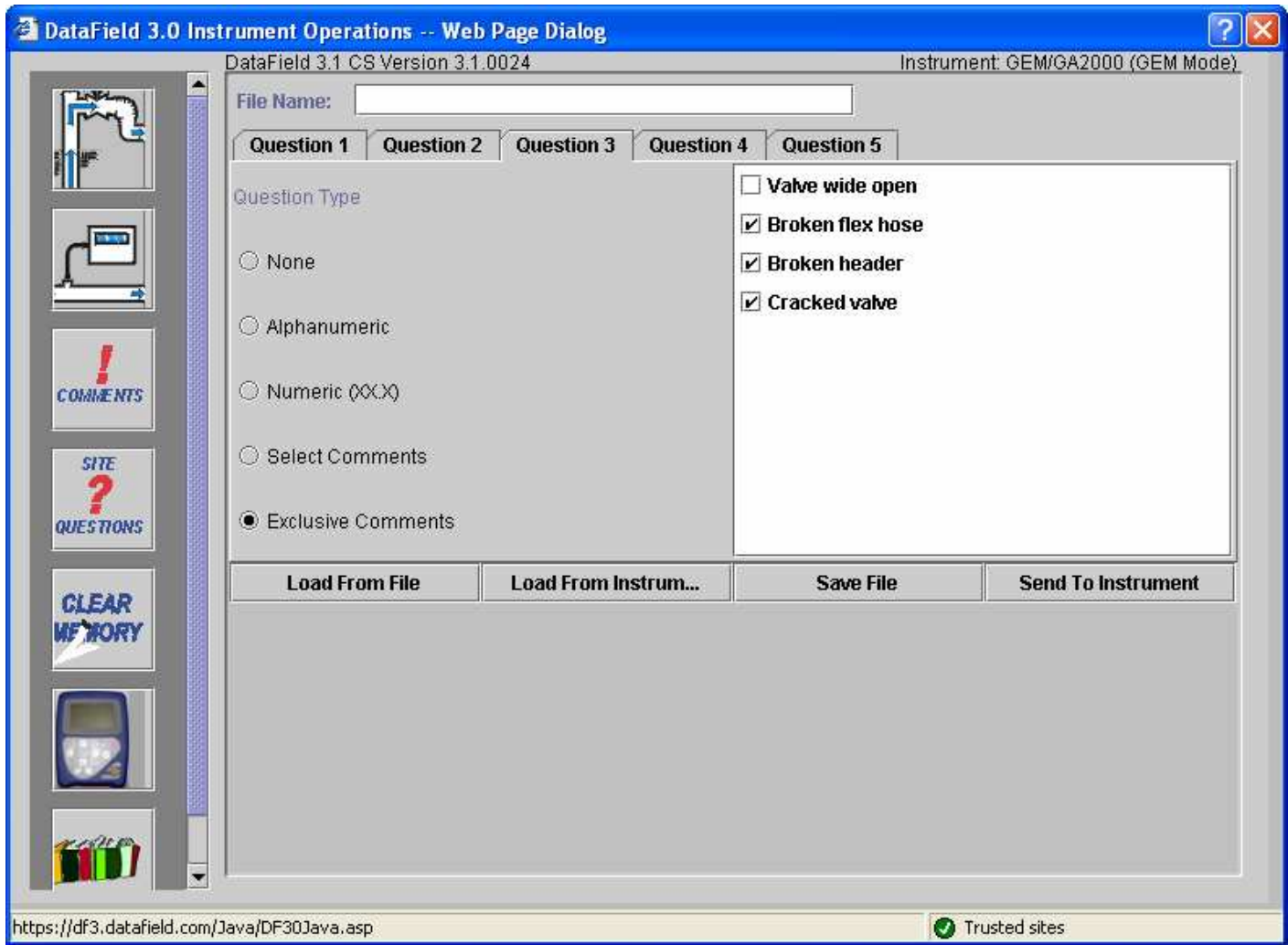


Click on Question 2 and then select Numeric as the Question Type. Note that Answer Format and Unit of Measurement fields appear for this type of question. Answer format refers to the number of digits and decimal places required for the answer. Unit of Measurement refers to inches, feet, yards, etc. for the answer. In this example, XX.X could be equal to 20.5 inches as per the question 'What is the leachate depth in tank?'

Comments may also be used as a site question, however comments must be downloaded from an instrument that has already had comments loaded in it. Connect the GEM™2000 and be sure it is in the read gas screen. Click on Select Comments and the list of comments from the instrument will open in the window for selection. Ten comments may be selected from the list to become **Site Questions**. Click on the box to the left of the comment to select it. The operator may choose any or all of the ten comments when **Update Site Data** is selected on the instrument.



Exclusive comments are treated in a similar manner as select comments in that they also must be downloaded from the instrument. Ten exclusive comments may be selected, however only **ONE** may be chosen by the operator to become an **Exclusive Comment**.



When all the desired questions have been entered, click on **Save File** to retain the information for later use and then click on **Send to Instrument** to update site data in the instrument.

6.7 Settings



Clicking on the **Settings** button on the main screen will display the **Instrument Settings**. The Instrument settings provides the capability to set or change optional controls in the instrument, such as time/date, data logging (GA mode only), purge times, etc.

6.7.1 Instrument Settings

Set the instrument for RS-232 communications and click on the **Settings** button and the following screen will open. The software will establish communications and download the current instrument settings.

Once the current settings have been obtained, the following screen will open.

Instrument	GEM/GA2000 (GEM MODE)
Software Version	Version 2.21 - 07/05/02
Serial Number	GM05330
Next Service Date	1 February 2003
Days Overdue	214
Last Factory Calibration	8 August 2002
Last Field Calibration	Unknown
Memory Remaining	
Battery Level	

There are six different “Menu Cards” under instrument settings. Each card provides different information or instrument settings that may be changed to update the operation of the GEM™2000. The instrument status card will always be shown first, providing calibration and maintenance information in addition to instrument serial number and software version number.

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Click on the card tab for **Alarm Levels** to open the alarm levels screen. Both a maximum alarm and a minimum alarm may be set. Note these are global settings and will be the same for all IDs entered in the instrument. Turn off the alarm by clicking off the check mark next to the gas. Click on **Update Alarm Levels** to send the new settings to the instrument.

The screenshot shows a web browser window titled "DataField 3.0 Instrument Operations -- Web Page Dialog". The page content includes:

- Header: DataField 3.1 CS Version 3.1.0024, Instrument: GEM/GA2000 (GEM Mode)
- Navigation tabs: Time, Units of Measurement, Instrument Status, Alarm Levels (selected), Data Logging, Instrument Options
- Alarm Levels configuration table:

	Max	Min
CH4(%) <input type="checkbox"/>	<input type="text" value="100"/>	<input type="text" value="0"/>
CO2(%) <input type="checkbox"/>	<input type="text" value="100"/>	<input type="text" value="0"/>
O2(%) <input type="checkbox"/>	<input type="text" value="100"/>	<input type="text" value="0"/>

Below the table is a button labeled "Update Alarm Levels".

On the left sidebar, there are icons for: a gas flow diagram, a computer monitor, a red exclamation mark labeled "COMMENTS", a red question mark labeled "SITE QUESTIONS", a blue "CLEAR MEMORY" button, a handheld device, and a stack of colored cards.

At the bottom of the browser window, the address bar shows "https://df3.datafield.com/Java/DF30Java.asp" and a "Trusted sites" icon.

GEM™2000 Operation Manual

Click on the **Data Logging** card tab to open the data-logging screen. In this screen enter the Logging ID; this may be any alphanumeric combination of eight characters. Enter the interval between readings in minutes and pump run time in seconds. Click on **Update Logging Data** to send to instrument. Only one logging ID may be loaded to the instrument.

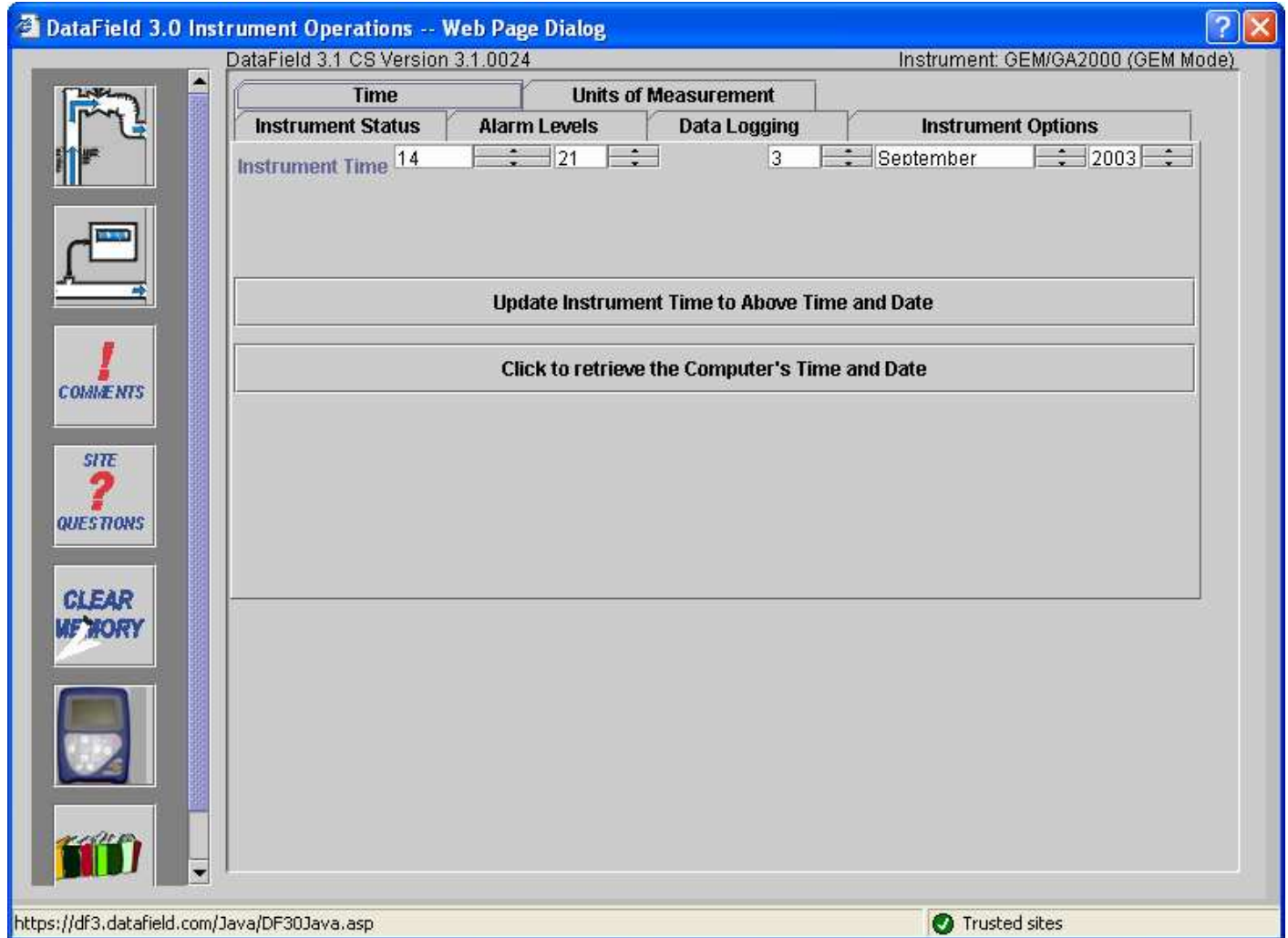
The screenshot shows a web browser window titled "DataField 3.0 Instrument Operations -- Web Page Dialog". The browser address bar displays "https://df3.datafield.com/Java/DF30Java.asp" and a "Trusted sites" icon. The application interface includes a sidebar with navigation icons: a pump diagram, a computer monitor, a red exclamation mark labeled "COMMENTS", a red question mark labeled "SITE QUESTIONS", a blue "CLEAR MEMORY" button, a handheld device, and a stack of papers. The main content area has a title bar "DataField 3.1 CS Version 3.1.0024" and "Instrument: GEM/GA2000 (GEM Mode)". Below this are tabs for "Time", "Units of Measurement", "Instrument Status", "Alarm Levels", "Data Logging" (selected), and "Instrument Options". The "Data Logging" tab contains three input fields: "Logging ID" with the value "AUTO-LOG", "Interval Between Readings (minutes)" with the value "1", and "Pump Running Time (seconds)" with the value "30". A large "Update Logging Data" button is positioned at the bottom of the form area.

Click on the **Instrument Options** card tab to open the instrument options screen. The settings in this screen affect different global functions of the instrument. Check the corresponding boxes in order to do the following: automatically purge the instrument during a shut down, automatically zero the instrument, display the percent lower explosive limit on readings screen. **Unchecking the last feature will disable % LEL display in both GA and GEM modes of operation.** The **Low Flow Warning** setting controls the point at which the pump is shut off due to low flow conditions. The default setting for this feature is 50 milliliters per minute but may be set to a lower number or even to zero, if sampling on high vacuum systems. The default value for the **Purge Time** is 30 seconds and may be reset to any length required. Turning off this feature is not recommended. Click on the **Update Instrument Options** button to send the new settings to the instrument.

The screenshot shows a web browser window titled "DataField 3.0 Instrument Operations -- Web Page Dialog". The browser address bar shows "https://df3.datafield.com/Java/DF30Java.asp" and a "Trusted sites" icon. The page content includes a navigation sidebar on the left with icons for "COMMENTS", "SITE QUESTIONS", "CLEAR MEMORY", and a device image. The main content area has a header "DataField 3.1 CS Version 3.1.0024" and "Instrument: GEM/GA2000 (GEM Mode)". Below the header are tabs for "Time", "Units of Measurement", "Instrument Status", "Alarm Levels", "Data Logging", and "Instrument Options". The "Instrument Options" tab is active, showing three checked checkboxes: "Automatically purge the instrument?", "Automatically zero the instrument?", and "Display % lower explosive limit on readings screen?". Below these are two input fields: "Low Flow Warning (ml/minute)" with the value "50" and "Purge Time (seconds)" with the value "30". At the bottom of the main content area is a button labeled "Update Instrument Options".

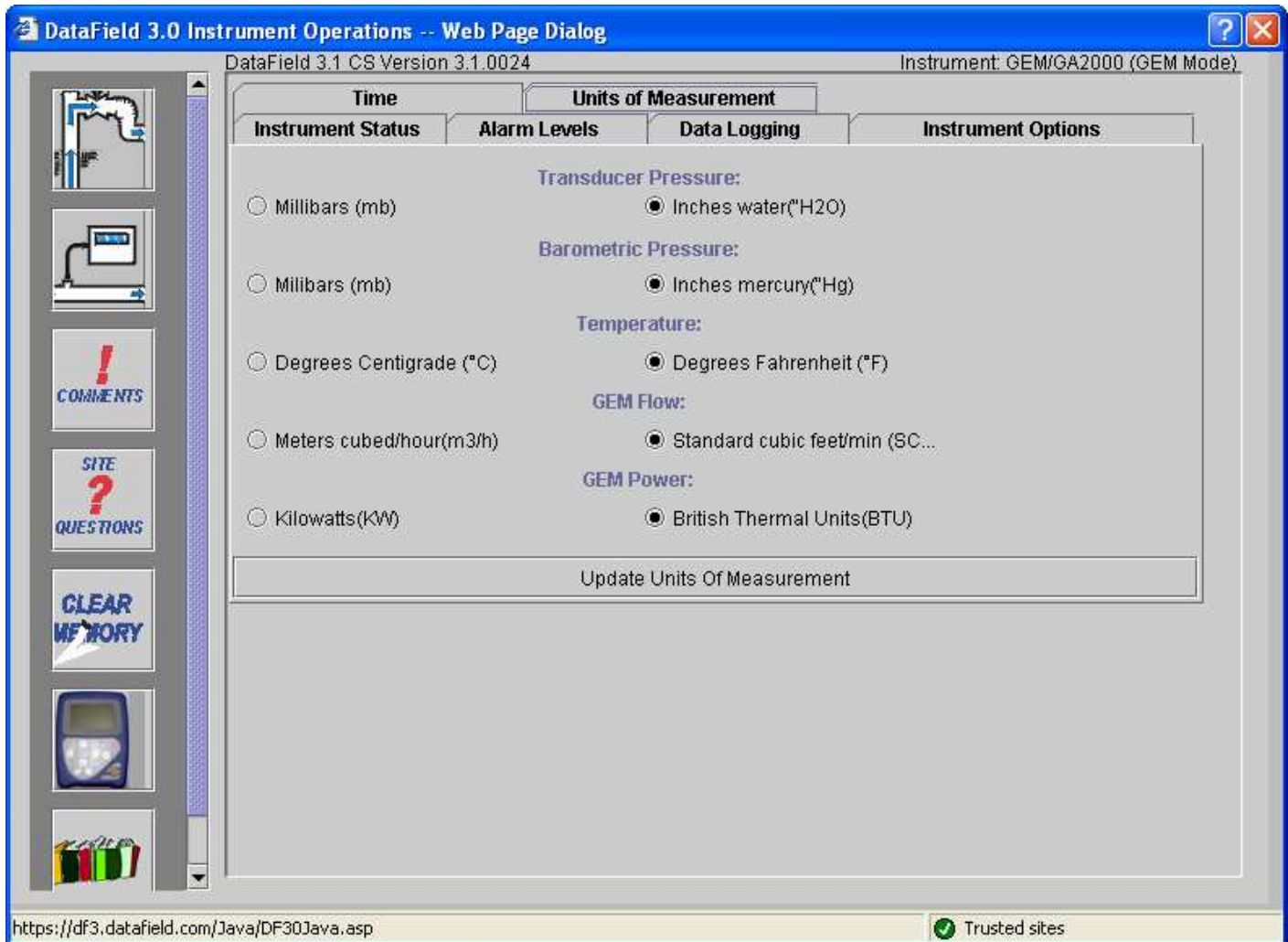
GEM™2000 Operation Manual

Click on the Time card tab to open the time and date setting screen. Time and date may be set to the computer time and date settings by clicking on the **Click to Retrieve the Computer's Time and Date** button. Manual setting of the time and date may be accomplished by clicking on the **Update Instrument Time to Above Time and Date**. Any time updates must be done through the software. The instrument time can not be manually updated in the field.



Units of Measurement screen allows the units to be changed.

This screen is protected by the password. If you need to change the units of measurement, please contact our technical support team.

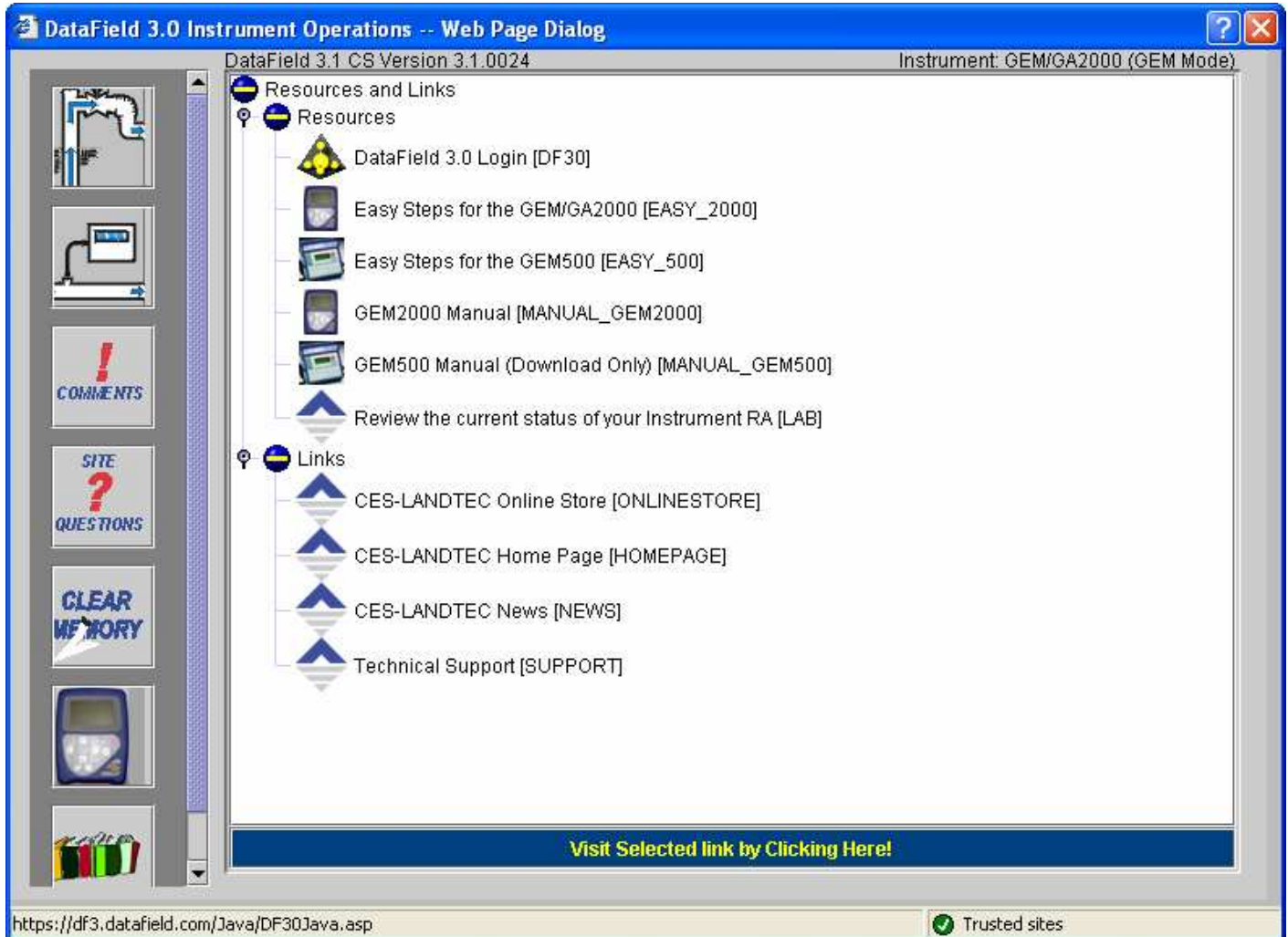


Note: EXTREME CAUTION should be taken if changing the Units of Measurement. All data from the instrument should be downloaded and stored in both, the GEM and the GA modes before updating the Units of Measurement. Updating Units of Measurement will erase readings from the instrument. The instrument should be turned off and restarted once the units of measurement have been updated.

6.7.2 Resource Links



Clicking on the **Resource Links** button on the main screen will display the **Resources and Links** screen.



By clicking on the supplied link the user is taken directly to the www and the information listed.

7 Field Operations

7.1 Landfill Gas Generation

A brief overview of the theory of landfill gas generation and Methane recovery follows. Initially, when decomposable refuse is placed into a solid waste landfill, the refuse is entrained with air from the surrounding atmosphere. Through a natural process of bacterial decomposition, the Oxygen from the air is consumed and an anaerobic (Oxygen free) environment is created within the landfill. This anaerobic environment is one of several conditions necessary for the formation of Methane-CH₄.

If Oxygen is reintroduced into the landfill, those areas are returned to an aerobic (Oxygen present) state and the Methane-producing bacteria population are destroyed. A period of time must pass before the productive capacity is returned to normal. Since there is some Methane of a given quality within the landfill void space, a decline in Methane quality is only gradually apparent depending upon the size of the landfill.

Carbon Dioxide is also produced under either an aerobic or anaerobic condition. Under static conditions, the landfill gas will be composed of roughly half Methane and half Carbon Dioxide with a little Nitrogen.

As air is introduced into the landfill, the Oxygen is initially converted to Carbon Dioxide and residual Nitrogen remains. Measurement of residual Nitrogen is usually a good indicator of the anaerobic state of the landfill; however, it cannot be directly measured. It can, however, be assumed and estimated using a subtraction basis as the balance gas. Hence, the measurement of Carbon Dioxide is an intermediary step. Because Carbon Dioxide levels may fluctuate depending on the changing concentrations of the other constituent gases, Carbon Dioxide levels are not evaluated directly but are considered in light of other data.

In evaluation of residual Nitrogen, allowances must be made if there has been any air leakage into the gas collection system or if there has been serious over pull. If enough air is drawn into the landfill, not all Oxygen is converted into Carbon Dioxide and the Oxygen is apparent in the sample. It is ideal to perform routine analysis of individual wells, as well as an overall well field composite sample, by a gas chromatography. This is not always practical at every landfill.

Under some conditions there may be a small amount of hydrogen in the LFG, (about 1 percent, usually much less). This may affect field monitoring response factors, but otherwise it can be ignored.

7.2 Subsurface Fires

If very large quantities of air are introduced into the landfill, either through natural occurrence or overly aggressive operation of the LFG system, a partly unsupported subsurface combustion of the buried refuse may be initiated. Subsurface fire situations are difficult to control or extinguish once started, present health and safety hazards, and can be quite costly. Therefore, prevention by good operation of the collection system and maintenance of the landfill cover is the best course of action. The presence of Carbon Monoxide, Carbon Dioxide, and Hydrogen Sulphide are indicators of poorly supported combustion within the landfill.

7.3 Techniques for Controlling Landfill Gas

There are many techniques for controlling landfill gas extraction. These techniques represent tools, which are used together to control landfill gas. The Accu-Flo wellhead is designed to work with all of these techniques. Below is a discussion of the individual techniques, how to use them, and their limitations. Reliance on only a few of the techniques discussed can lead to misinterpretation of field data and improper operation of the well field. Later the best use of these techniques to optimize landfill gas control will be discussed.

7.3.1 Controlling by Wellhead Valve Position

Unless the valve handle is calibrated for a given flow rate, this method is unreliable. The position of the valve handle alone does not provide sufficient information about the well to control it. It is useful to note the relative position of the valve, and essential to know which valves are fully open or fully closed.

7.3.2 Controlling by Wellhead Vacuum

This technique relies on the relationship of well pressure/vacuum to flow for a given well. Reliance upon this method, however, can be misleading. This is because the square root relationship between flow and pressure is difficult to affect while performing day-to-day well field adjustments. As decomposition, moisture, and other conditions change, this method shows itself to be inadequate and imprecise.

7.3.3 Controlling by Gas Composition

This method determines Methane, Nitrogen (balance gas) and other gas composition parameters at wellheads and at recovery facilities using portable field instruments and, sometimes, analytical laboratory equipment. Complete knowledge of gas composition (i.e., major fixed gases: Methane, Carbon Dioxide, Oxygen and Nitrogen) is desirable. It is also necessary to check other gas parameters, such as Carbon Monoxide, to fully evaluate the condition of the well field. Reliance on this information can lead to improper operation of the well field. Indications of excessive extraction often do not show up right away. This method often leads to a cycle of damage to the Methane producing bacteria population and then to over-correction. This cycling of the well and producing area of the landfill is not a good practice. It leads to further misinterpretation of the condition of the well field and has a disruptive effect on the operation of the well field. The use of analytical laboratory instrumentation such as a gas chromatograph is a valuable supplementary tool to verify gas composition. This normally requires collection of samples at the wellhead and analysis at some fixed location where the equipment is located. The drawbacks of this method as a primary means of obtaining information for well field adjustment are the time expended, cost, and probably most important, responsiveness to the needs of the well field for timely adjustment. The laboratory equipment required is also very costly. Some analysis is recommended for verification of field readings from time to time. It is recommended a monthly sample of the composite gas be taken at the inlet to the flare or gas recovery facility.

7.3.4 Controlling by Flow Rate

This is a more exacting technique for determining and adjusting gas flow at individual wells. It requires using a fixed or portable flow measurement device at each wellhead to obtain the data needed to calculate volumetric (or mass) flow rates. It is normally convenient to use cubic feet per minute or per day, as a standard unit of measure for volumetric flow. It is important to distinguish between the volumetric quantity

of landfill gas and the volumetric quantity of Methane extracted from each well and the landfill in total. The two variables are somewhat independent of each other and it is the total quantity of Methane extracted we are interested in. It is possible for the total quantity of landfill gas extracted to increase while the total quantity of Methane extracted decreases. To monitor this, the quantity of Methane extracted (LFG flow x percent Methane) or the quantity of BTUs recovered per hour (LFG flow x percent Methane x BTUs per cubic foot of Methane x 60 minutes per hour) can be calculated. It is conventional to measure BTUs per hour as a unit of time. There are approximately 1012 BTUs of heat per cubic foot of pure Methane (like natural gas), although this figure varies a little among reference texts.

Measuring flow is an essential part of monitoring and adjusting a well field. The well should be adjusted until the amount of Methane recovered is maximized for the long term. A greater amount of Methane or energy can usually be recovered over the short term; however, this ultimately leads to diminishing returns. This is seen in stages as increased CO₂ and gas temperature and later as increased Oxygen from well over-pull. In time, the Methane will also decline. This is the result of a portion of the landfill, usually at the surface, being driven aerobic. In this portion of the landfill, the Methane-producing bacteria will have been destroyed (due to the presence of Oxygen). With the Methane-producing capacity of the landfill reduced, the pore space in the area no longer producing may become filled with landfill gas equilibrating (moving in) from an unaffected producing area. This leaves the impression that more gas can be recovered from this area, and may lead to the operator opening the well or increasing flow.

7.4 Well field Monitoring

The frequency of LFG well field monitoring varies depending upon field requirements and conditions. Normal monitoring frequency for a complete field monitoring session with full field readings (suggested normal and abbreviated field readings list follows) will vary from typically once a month to once a week. Well field monitoring should not normally be extended beyond one month. The importance of regular, timely monitoring cannot be overemphasized.

7.5 Typical Field Readings

- Name of person taking readings
- Date/time of each reading
- Methane (CH₄)
- Oxygen (O₂)
- Carbon Dioxide (CO₂)
- Balance Gas (primarily Nitrogen N₂)
- Wellhead gas temperature (flowing)
- Ambient air temperature
- Static pressure (PS) (from GEM™2000 or magnehelic) or other device (anemometer/velometer)
- Velocity head (P or PT) (from GEM™2000 or pitot tube and magnehelic)
- Wellhead gas flow (from GEM™2000, or pitot tube & magnehelic, or anemometer/velometer)
- Wellhead adjustment valve position (initial and adjusted)
- New wellhead vacuum and flow information after adjustment
- Calculation of each well's LFG and Methane flow and sum total
- Observations/comments

Additionally, Carbon Monoxide (CO) or Hydrogen Sulphide (H₂S) readings may be taken if problems are suspected. Supplementary monitoring once to several times a week may be performed using an abbreviated form of field readings.

7.6 Abbreviated Field Readings

- Name of person taking readings
- Date/time of each reading
- Methane (CH₄)
- Oxygen (O₂)
- Wellhead gas temperature (flowing)
- Ambient air temperature
- Static pressure (PS) (from GEM™2000 or magnehelic)
- Velocity head (P or Pt) (from GEM™2000 or pitot tube and magnehelic)
- Wellhead gas flow (from GEM™2000, or pitot tube and magnehelic, or anemometer/velometer)
- Wellhead adjustment valve position (initial and adjusted)
- New wellhead vacuum and flow information after adjustment
- Observations/comments

Line vacuums and gas quality may be taken at key points along the main gas collection header and at subordinate branches. This helps to identify locations of poor performance, excessive pressure drop, or leakage. Perform systematic monitoring of the well field, taking and logging measurements at each wellhead and major branch junction in the collection system.

During monitoring, examine landfill and gas collection system for maintenance issues. Record needed maintenance or unusual conditions. Examples of unusual occurrences or conditions are unusual settlement, signs of subsurface fires, cracks and fissures, liquid ponding, condensate/leachate weeping from side slopes, surface emissions and hot spots, and liquid surging and blockage in the gas collection system. Field readings should be kept in a chronological log and submitted to management on a timely basis.

7.7 Well field Adjustment Criteria

There are several criteria used in well field adjustment. The primary criterion is Methane quality. Methane quality is an indicator of the healthy anaerobic state of the landfill and thus proper operation of the LFG collection system. However, a decline in the healthy productive state of the landfill is usually not immediately apparent from Methane quality. Due to this, several criteria must be considered at once.

Conditions within the landfill favor Methane production. Following are well field adjustment criteria and typical conditions for consideration:

- Methane quality (ranging from 26 percent upwards)
- pH
- Temperature
- General overall quality
- Moisture conditions
- Waste stream characteristics
- Placement chronology
- Insulation characteristics
- Oxygen quality (ranging below 1 percent, preferably less than ½ percent)
- Landfill cover porosity and depth in the proximity of the well
- Landfill construction factors including:
 - Type of fill
 - Size and shape of refuse mass

- Depth of fill
- Compaction
- Leachate control methods
- Seasonal, climatic, geographical, and recent weather, or other considerations, including seasonally arid or wet conditions, precipitation, drainage, groundwater
- Surrounding topography and geologic conditions
- Proximity of the well to side slopes (within 150 to 200 feet and less may require conservative operation of the well)
- Nitrogen (typically 8 to 12 percent and less)
- Temperature (between ambient and about 130 °F)
- LFG and Methane flow from the wellhead
- Design of the gas collection system
- Landfill perimeter gas migration and surface emission control, or energy recovery objectives
- Diurnal fluctuation (day to night) of atmospheric pressure

7.8 Establishing Target Flows

The goal is to establish a target flow which will likely produce the best possible Methane quality and minimum Oxygen levels while maximizing the recovery of landfill gas. Typically, small adjustments are made in flow to achieve and maintain quality objectives. The well must not be allowed to over pull. High well temperatures, (130° to 140°F and greater), are an indication of aerobic activity and, thus, well over-pull. These effects may not be immediately apparent.

Well adjustment should be made in as small an increment as possible, preferably an increment of ten percent of the existing flow or less. There may be obvious conditions when this is not appropriate, such as when first opening up a well or when serious over-pull is recognized. Every effort should be made to make adjustments and operations as smooth as possible. Dramatic adjustments, or operating while switching between a high flow mode and a well shutoff mode, should be avoided.

7.9 Well field Optimization

Every effort should be made to continuously locate and correct or eliminate conditions (e.g., gas condensate, surging and blockage, settlement, etc.), which inhibit efficient operation of the gas collection system. This allows well monitoring and adjustment to be significantly more effective.

7.10 Migration Control—Dealing with Poor Methane Quality

If Methane and Oxygen quality objectives cannot be maintained at a given well, such as a perimeter migration control well, then an attempt should be made to stabilize the well as closely as is practical, avoiding significant or rapid down trending of Methane or up trending of Oxygen.

It is not uncommon for perimeter migration control wells to be operated at less than 40 percent Methane or greater than one-percent Oxygen. It should be recognized that these wells are likely in a zone where some aerobic action is being induced, and that there is some risk of introducing or enhancing the spread of a subsurface fire. Sometimes a judicious compromise is necessary to achieve critical migration control objectives or because existing conditions do not allow otherwise. Such situations should be monitored closely.

7.11 Well field Adjustment—Purpose and Objectives

The objective of well field adjustment is to achieve a steady state of operation of the gas collection system by stabilizing the rate and quality of extracted LFG in order to achieve one or several goals. Typical reasons for recovery of LFG and close control of the well field are:

- Achieve and maintain effective subsurface gas migration control.
- Achieve and maintain effective surface gas emissions control.
- Assist with proper operation of control and recovery equipment.
- Avoid well “over-pull” and maintain of a healthy anaerobic state within the landfill.
- Optimize LFG recovery for energy recovery purposes.
- Control nuisance landfill gas odors.
- Prevent or control subsurface LFG fires.
- Protect structures on and near the landfill.
- Meet environmental and regulatory compliance requirements.

Well field adjustment is partly subjective and can be confusing because it involves judgment calls based on simultaneous evaluation of several variables, as well a general knowledge of site specific field conditions and historical trends. Well field evaluation and adjustment consist of a collection of techniques, which may be used, in combination, to achieve a steady state of well field operation.

8 Troubleshooting

Problem

Unit does not turn on or operation is erratic

“Flow Fail” is displayed and an audible alarm is heard

Readings taken are not what was expected

Unit displays***** or >>>>>

Oxygen reading is high on all wells

Unit will not download readings or an error occurs while downloading.

Methane and Carbon Dioxide readings drift

Oxygen readings drift

Black screen displayed when unit turned On

Nothing happens when the Gas Pod is installed

Temperature does not update when temperature probe is installed

Corrective Action/Reason

Battery charge is too low-recharge batteries.

Unit is too hot - cool down unit and try again.

Contact Factory Service.

The inlet is blocked.

Remove blockage and retry.

The particulate filter or water trap filter needs replacing.

Unit may be out of calibration. Calibrate unit with known gas concentration.

Water trap or particulate filters are clogged. Replace filter(s).

These symbols are substituted when the measured reading is out of range of the instruments capabilities in some fields or when a value needs to be entered manually such as temperature.

Check that the water trap housing is screwed on tight.

Check or replace O-rings on the water trap and instrument inlet.

Check the wellhead inset for cracks, replace O-ring on insert.

Field calibrate Oxygen channel.

Verify that the communications software is the right version for the instrument being used.

Check that the proper serial port is selected in the software.

Contact Factory Service.

Perform a field calibration and check well again. Verify cal gas is flowing when regulator is turned on.

Verify all connections are tight and filters are not clogged.

Contact Factory Service.

Perform a field calibration - zero and span.

Contact Factory Service.

Charge unit over night and try again.

Unit too hot - cool down and try again.

Try adjusting contrast level.

Contact Factory Service.

Remove and re-seat the Gas Pod.

Contact Factory Service.

Check the probe fitting is fully seated.

Check the probe plug is screwed together tightly.

Contact Factory Service.

9 Technical Specifications

9.1 Physical

Weight	4.4 lbs.
Size	L 2.48" x W 7.48" x D 9.92".
Case material	Anti-static ABS.
Keys	Membrane panel.
Display	Liquid Crystal Display 40 x 16 characters. Fibre optic woven backlight for low light conditions.
Filters	User replaceable integral fibre filter at inlet port and an external PTFE water trap filter.

9.2 General

Certifications	UL Certified to Class 1, Zone 1, AEx Ib d Ila T4
Temperature measurement	With optional probe 14°F to 167 °F.
Temperature accuracy	±0.4°F (± probe accuracy).
Visual and audible alarm	User selectable CO ₂ , CH ₄ and O ₂ Min/Max levels via DataField CS software.
Communications	RS232 protocol via download lead with variable baud rate.
Relative pressure	±250 mbar from calibration pressure

9.3 Power supply

Battery type	Rechargeable Nickel Metal Hydride battery pack containing six 4AH cells. Not user replaceable. Lithium Manganese battery for data retention.
Battery life	Typical use 10 hours from fully charged condition.
Battery charger	Separate intelligent 2A battery charger powered from AC voltage supply (110-230V).
Charge time	Approximately 2 hours from complete discharge.
Alternative power	Can be powered externally for fixed-in-place applications only. Contact CES-LANDTEC for further information.
Battery lifetime	Up to 1,000 charge/discharge cycles.

9.4 Gas Ranges

Detection principle	CO ₂ and CH ₄ by dual wavelength infrared cell with reference channel. O ₂ by internal electrochemical cell.			
Oxygen cell lifetime	Approximately 18 months in air.			
Typical Accuracy 0 - Full Scale	Gas	0-5% volume	5-15% volume	15%-FS
	CH ₄	±0.3%	±1%	±3% (100%)
	CO ₂	±0.3%	±1%	±3% (60%)
	O ₂	±1%	±1%	±1% (21%)
Response time, T90	CH ₄	≤20 seconds		
	CO ₂	≤20 seconds		
	O ₂	≤20 seconds		
Range	CH ₄	0-70% to specification, 0-100% reading.		
	CO ₂	0-40% to specification, 0-100% reading.		
	O ₂	0-25%		

9.5 Pump

Typical flow	300 cc/min.
Flow fail point	50 cc/min approximately.
Flow with 200 mbar vacuum	250 cc/min approximately.
Vacuum	70 inches H ₂ O.

9.6 Operating Conditions

Operating temp range	32°F to 104 °F.
Relative humidity	0-95% non-condensing.
Atmospheric pressure range	700-1200 mbar. Displayed in Inches of Mercury (5.9 – 35.4“Hg). Not corrected for sea level.
Atmospheric pressure accuracy	±5 mbar approximately.
Case seal	IP65.

9.7 Optional Gas Pods

Typical Accuracy (Subject to User calibration).	Gas	0-Full Scale
	CO	±10% FS
	H ₂ S	±10% FS
	SO ₂	±10% FS
	NO ₂	±10% FS
	CL ₂	±10% FS
	H ₂	±10% FS
	HCN	±10% FS
Response time, T90	CO	≤60 seconds
	H ₂ S	≤60 seconds
	SO ₂	≤60 seconds
	NO ₂	≤60 seconds
	CL ₂	≤60 seconds
	H ₂	≤60 seconds
	HCN	≤60 seconds
	Range	CO
H ₂ S		0-50 or 0-200ppm
SO ₂		0-20 or 0-100ppm
NO ₂		0-20ppm
CL ₂		0-20ppm
H ₂		0-1000ppm
HCN		0-100ppm



Soil Gas

Vapor Intrusion

Property Redevelopment

Ambient Air Monitoring

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Air Toxics

Guide to Air Sampling

Canisters and Bags



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Guide to Whole Air Sampling – Canisters and Bags

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Section 1.0 Introduction

Eurofins Air Toxics Inc. 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. Eurofins Air Toxics provides the “Guide to Sorbent-Based Sampling - Volatiles and Semi-Volatiles” for other types of sampling.

1.1 Whole Air Sampling of VOCs

There are three general ways to collect compounds in a gas phase sample. A sampler may collect the gas sample in a container, actively pump the vapor through a sorbent tube, solution or filter, or rely on passive sample collection onto a sorbent bed. This guide focuses on collecting a sample in the most common air sampling containers, Summa canisters and bags. The sample may be collected in the container either passively, relying on an evacuated canister to drive the sample collection, or actively using a pump to fill the container. The container is subsequently sealed and transported to the laboratory for analysis. The sample is referred to as a “whole air sample” and the compounds remain in the gas matrix inside the container.

As a general rule, whole air sampling is appropriate when target compounds are chemically stable and have vapor pressures greater than 0.1 torr at 25°C and 760mm Hg (EPA standard ambient conditions). Performance of a given compound in a whole air sample is dependent upon its chemical properties, the matrix of the sample, and the degree of inertness of the sample container.

1.2 Choosing Between Canisters and Bags

Table 1.2 compares the features and performance of Summa canisters and bags. Summa canisters or similarly treated canisters are rugged containers designed to provide superior inertness and extended sample storage times. Evacuated canisters also do not require a sampling pump for sample collection. By contrast, bags require a sample pump, but can be purchased inexpensively in bulk, require little preparation or cleaning, and take up little space prior to use. Unlike canisters, bags are typically not appropriate for ppbv-level VOC measurements due to their background artifacts and short hold-times. Over time, low molecular weight gases can diffuse through the bag material while chemicals with lower vapor pressures can condense on the bag surface thereby compromising analyte recoveries. Call your Project Manager at 800-985-5955 if you have questions regarding the appropriate sampling media.

Table 1.2 Comparison of Canisters to Bags

	Canisters	Bags
Type of Sampling	Passive (vacuum)	Active (pump required)
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	Batch or 100% certified to ppbv/pptv levels	Some VOCs present in the ppbv range
Sampling Application	Ambient air, soil/landfill gas	Soil/landfill gas, stationary sources, SVE systems
Rule of Thumb	“ppbv device”	“ppmv device”
Advantages	Inertness, hold time, ruggedness, no pump	Purchase/shipping cost, availability, convenience

Section 2.0 Canisters and Associated Media

This section provides a description of air sampling canisters, practical considerations for sampling, and step-by-step instructions for collecting grab and integrated samples.

Photographs illustrate the correct way to assemble the various sampling components.

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

An air sampling canister is a container for collecting a whole air sample. A canister may be spherical or cylindrical and is constructed of specially treated stainless steel. 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. Flow controllers can be utilized to restrict the flow and allow for collection at a desired flow rate or over a desired range. When the sample has been collected, the valve is closed and the canister is returned to the laboratory. Canisters range in volume from less than 1 liter (L) to 6 L. In general, 6 L canisters are used to collect ambient air samples and samples requiring time integration greater than 2 hours. One liter canisters are typically used for taking high concentration (i.e., greater than 5 ppbv) samples not requiring time integration such as soil vapor.



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. Eurofins Air Toxics maintains a large inventory of Summa canisters in 1 and 6 L volumes.

2.1.2 Canister Certification

Eurofins Air Toxics provides two types of canister cleaning certification, batch and 100%, depending upon the requirements of the project. The batch certification process is most appropriate for routine ambient air applications and high concentration applications such as soil vapor and landfill gas monitoring. The batch certification process begins by cleaning a set of canisters using a combination of dilution, heat and high vacuum. The cleaning batch is certified by analyzing a percentage of canisters for approximately 60 VOCs using GC/MS. The batch meets cleaning requirements if the target compound concentrations are below 0.2 ppbv. Alternatively, the 100% certification (i.e., individual certification) process is typically required for ambient and indoor air applications driven by risk assessment or litigation requiring pptv (parts per trillion by volume) sensitivity. If 100% certification is required, 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 batch or 100% canister certification.

2.1.3 Canister Hold Time

Media Hold Time: Unlike water and soil environmental samples, which are collected in single-use, disposable vials and jars, air samples are collected in reusable summa canisters. Eurofins Air Toxics requires that canisters be returned within 15 days of receipt to effectively manage our inventory and to insure canisters meet performance requirements in the field. Evacuated canisters have a finite timeframe before the canisters naturally lose

vacuum during storage. Using canisters beyond 15 days increases the risk of having unacceptable initial vacuum at the start of sampling.

Sample Hold Time: EPA Method TO-15 cites a sample hold time of up to 30 days for most VOCs. Several non-routine compounds, such as bis(chloromethyl)ether, degrade quickly and demonstrate low recovery even after 7 days. Reactive sulfur compounds such as hydrogen disulfide and methyl, ethyl, and butyl mercaptan are not amenable to storage in stainless steel summa canister, and either fused silica lined (FSL) canisters or Tedlar bags are required for sample collection.

2.2 Associated Canister Hardware

Associated hardware used with the canister includes the valve, brass cap, particulate filter and vacuum gauge. (Flow controllers are covered in detail in section 3.2.)

2.2.1 Valve

An industry standard 1/4" stainless steel bellows valve is mounted at the top of the canister. The valve maintains the vacuum in the canister prior to sampling and seals 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.

To protect the valve and provide secure connections in the field, a replaceable fitting is attached to all canisters. As threads wear and require replacement, new fittings can be installed at the laboratory prior to shipping to the field. You will need a 1/2" wrench to secure the fitting while connecting or removing the required equipment to the canister.

2.2.2 Brass Cap

Each canister comes with a brass cap (i.e., Swagelok 1/4" 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 damaging 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. The 2 micron filter is a fritted stainless steel disk that has been pressed into a conventional Swagelok adapter. This device has a relatively high pressure drop across the fritted disk and restricts the flow into the canister even when sampling without a flow controller. Table 2.2.3 lists the typical fill time for a grab sample using a 2 micron particulate filter.



Table 2.2.3 Grab Sample Fill Times for Canisters

CANISTER VOLUME	2 micron filter
6 L	<5 minutes
1 L	<1 minute

2.2.4 Fittings

All fittings on the sampling hardware are 1/4" Swagelok, and a 9/16" wrench is used to assemble the hardware. A 1/2" wrench is also required to tighten fittings onto a union connector. 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 will dilute the sample and cause the canister to fill at a faster rate than desired. Eurofins 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. Eurofins Air Toxics 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 considered to be rough gauges, intended to obtain a relative measure of vacuum change. Accuracy of these field gauges are generally on the order of +/- 5 in Hg. Individuals with work plans that outline specific gauge reading requirements are strongly encouraged to purchase and maintain their own gauges in the field. In special cases, a laboratory-grade, NIST-traceable vacuum gauge can be provided upon request.



The vacuum gauges that are routinely provided are intended as a rough gauge measurement device (+/-5 in Hg accuracy).

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) to provide a point-in-time sample concentration, while an integrated sample is taken over a specified duration or utilizing a specified flow rate. In both modes the canister vacuum is used to draw the sample into the canister. This is commonly referred to as passive canister sampling. Sections 3.1 and 3.2 detail procedures for grab and integrated sampling, and section 3.3 provides procedures specific to soil vapor collection.

Regardless of the type of canister samples collected, the following rules apply:

- 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.
- DO NOT make modifications to the equipment connections and/or use Teflon tape unless approved by the laboratory.
- AND, if you have any questions or need any support, our experienced project management team is just a phone call away at 800-985-5955.



Use a 9/16" and 1/2" wrench to tighten Swagelok connections on the canister sampling train.

3.1 Grab Sampling Using Canisters

The most common hardware configuration used to take a grab sample is to simply attach a particulate filter to the canister inlet. A particulate filter is shown in section 2.2.3 and is used to prevent particulate matter from fouling the valve and entering the canister.



3.1.1 Step-By-Step Procedures for Canister Grab Sampling

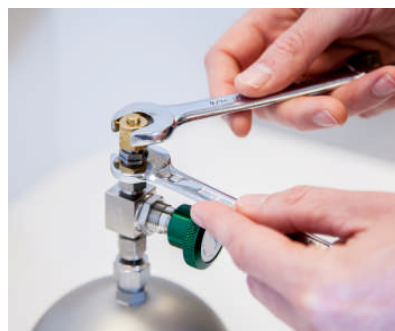
These procedures are for a typical ambient air sampling application; actual field conditions and procedures may vary.

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. Make sure you include a 9/16" and 1/2" wrench in your field tool kit.
 3. Verify the gauge is working properly.
 4. Verify the initial vacuum of canister as described in the following section:
- **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. Eurofins 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, ambient air may have leaked into the canister during storage or transport and the sample may be compromised. Contact your Project Manager if you have any questions on whether to proceed with sample collection. 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 that 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 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 that canister valve is closed and remove gauge.
9. Replace the brass cap.



When ready to sample:

1. Confirm that 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 less than 5 minutes 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). For grab samples, the ending vacuum is typically close to ambient pressure (0 in Hg).
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.
10. Return sample media in packaging provided.

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 (if applicable) across flap.
14. Ship accordingly to meet method holding times.



Return all equipment used or unused to the laboratory. Unreturned canisters and associated hardware will result in additional charges as outlined in the media agreement.

3.2 Integrated Sampling with Canisters and Flow Controllers

As an alternative to an “instantaneous” grab sample, an air sample collected at a controlled rate is referred to as an integrated sample. Flow controllers or flow restrictors are devices which provide sample collection at a desired flow rate and/or sampling interval. By using a flow controller at a specified flow rate, air samples can provide information on average compound concentrations over a defined period. For example, 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 collected to determine residential exposure to indoor or outdoor air sources. In addition to using a flow controller for time-integrated sample collection, a flow controller may be required for soil gas collection to restrict the vacuum applied to the soil and pore water and to collect a representative sample with minimal intrusion of ambient air.

Eurofins Air Toxics 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 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 over the desired time period. As the differential pressure decreases, the flow rate decreases and the diaphragm responds by opening up to allow more air to pass through to maintain a stable flow rate. Mass flow controllers are calibrated in the laboratory to provide flow rates suitable for durations up to 24 hours. Durations greater than 24 hours are possible, however, performance of the flow controller is less reliable due to the low flow rates required.



3.2.2 Critical Orifice Devices

Eurofins Air Toxics has two types of critical orifice controllers – “capillary column” and “frit pressed”. Both types restrict the flow rate and the canister fill rate decreases as the canister fills to ambient pressure.



These controllers are suitable for applications not requiring constant flow rate over the sampling period such as soil vapor collection or at sites in which temporal variability of VOCs is not expected. Critical orifice devices can cover intervals from 0.5 to 12 hours and flow rate from 10 to 250

ml/min. The “capillary column” device (also known as the Blue Body Flow Controller) restricts air flow by forcing the sample to enter a capillary column of minute radius. The flow rate is a function of the length of inert capillary column. The frit pressed device has a critical orifice machined to meet a set flow rate.



3.2.3 Sampling Interval and Flow Controller Setting

When you request canisters and flow controllers from Eurofins Air Toxics, you will be asked for the flow rate (soil vapor) or sampling interval (ambient air), and the flow controllers will be pre-set prior to shipment. The flow rate is set at standard atmospheric conditions (approximately sea level and 25°C). If samples will be collected at elevation or at ambient temperatures significantly different than 25°C, the canister will fill faster or slower depending on sample conditions. If you specify unusual sample conditions at the time of project set-up, we can set the flow controller accordingly. (See Section 5.2 for a discussion of collecting a sample at elevation.) Mass flow controllers should not be utilized for source or process samples in which the collection point is under vacuum or pressure. Please discuss these specific non-standard field conditions with your Project Manager at the time of project set-up.

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	167	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.

3.2.4 Final Canister Vacuum and Flow Controller Performance

For time-integrated sample collection using a mass flow controller, the final vacuum of a canister should ideally be approximately 5 in Hg or greater. The flow rate will remain constant as the canister fills and will start to decrease as the canister vacuum approaches

5 in Hg. At this point, the differential pressure between the canister and ambient air is not sufficient to maintain the set flow rate. Because of normal fluctuations in the flow rate due to changes in field temperature and pressure, the final vacuum typically ranges between 3 and 10 in Hg.

- **If the residual canister vacuum is greater than 10 in Hg** (i.e., more vacuum), the actual flow rate is lower than the set point and less sample volume is collected. When the canister is pressurized prior to analysis, the pressurization dilution will be greater than normal. This will result in elevated reporting limits.
- **If the residual canister vacuum is near ambient pressure** for a time-integrated sample, the canister filled faster than calibrated. Once the vacuum decreases below 5 in Hg, the flow rate begins to decrease from its set point. This scenario indicates that the sample is weighted toward the first portion of the sampling interval. 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

$$\text{Final Reporting Limit} = \text{Method Reporting Limit} \times \text{Dilution Factor (Canister Pressurization)} \times \text{Dilution Factor (Sample Analysis)}$$

$$\text{Dilution Factor (Canister Pressurization)} = \frac{\text{Final Pressure}}{\text{Receipt Pressure}} = \frac{14.7 \text{ psig} + \text{Final Pressure (psig)}}{14.7 \text{ psig}} \left[\frac{1 - \text{Receipt Vacuum (in Hg)}}{29.9 \text{ in Hg}} \right]$$

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:** 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. (Follow the leak check step #4 in 3.2.6).
- **Verify Initial Vacuum of Canister:** See Section 3.1.1 for instructions on verifying initial canister vacuum. A separate gauge is not necessary as both the mass flow controllers and critical orifice flow controllers have built-in rough gauges.
- **Monitor Integrated Sampling Progress:** When feasible, it is a good practice 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, when using a 24-hour mass flow controller, at a quarter of the way (6 hours) into a 24-hour sampling interval, the canister should be a quarter filled (1.25 L) and the gauge should read approximately 6 in Hg lower than



the starting vacuum (~22 in Hg). More vacuum indicates that the canister is filling too slowly; less vacuum means 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; the time interval need not be continuous.

- **Avoid Contamination:** Flow controllers should be cleaned between uses. This is done by returning them to the laboratory.
- **Caution When Sampling in Extreme Temperatures:** Field temperatures can affect the performance of the mass flow controllers. Laboratory studies have shown that flow rates can increase slightly with decreasing temperatures. A flow rate increase of approximately 10% is expected when sampling at field temperatures of 5 to 10°C.

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, and flow controller)
2. Make sure you include a 9/16" and 1/2" wrench in your field tool kit.
3. Verify the gauge is working properly
4. Verify the initial vacuum of canister (section 3.1.1)

When ready to sample:

1. Confirm that valve is closed (knob should already be tightened clockwise).
2. Remove brass cap from canister.

3. Attach flow controller to canister. The flow controller is securely attached if the flow controller body does not rotate.
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 a ½ turn.
6. Monitor integrated sampling progress periodically.
7. Verify and record final vacuum of canister (simply read built-in gauge).
8. When sampling is complete, close valve by hand tightening knob clockwise.
9. Detach flow controller and replace brass cap on canister.
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 and associated media in boxes provided. **Failure to return all of the provided equipment will result in a replacement charge as outlined in the media agreement.**
12. Fill out chain-of-custody and relinquish samples properly (it is important to note the canister serial numbers on the chain-of-custody).
13. Place chain-of-custody in box and retain pink copy.
14. Tape box shut and affix custody seal at each opening (if applicable).
15. Ship accordingly to meet method holding times.

3.3 Soil Gas Sample Collection

Canisters can be used for the collection of soil vapor by attaching the sampling train to the soil gas probe. Typically, a critical orifice flow controller is used to minimize the applied vacuum in order to minimize partitioning of VOCs from the soil or pore water to the soil vapor. Additionally, lower flow rates help to minimize the intrusion of ambient air into the soil vapor probe. In general, time-integration is not required for soil gas samples; however, there may be exceptions to this rule of thumb. For example, some regulatory guidance documents recommend concurrent indoor air and sub-slab soil vapor collection over a

24-hour period. This means that a mass flow controller calibrated for a 24-hour sample would be required for the sub-slab as well as the indoor air sample.

3.3.1 Canister to probe connection – Tubing

Collection of a soil gas sample requires the use of tubing to connect the soil gas probe to the sample train. Teflon FEP tubing is recommended based on its low background and its inertness. Alternative tubing can be used if shown to meet data quality objectives. Please note that Low Density Polyethylene or flexible Tygon tubing is not recommended due to VOC adsorption during sample collection. Teflon tubing is provided by the laboratory upon request at the time of order. A charge based on the length will be assessed. It is important to store the tubing away from VOC sources during storage and transport to the site to minimize contamination.

3.3.2 Canister to probe connection –Fittings

To connect the tubing to the canister sampling train, a Swagelok fitting and a pink ferrule are used. The position of the ferrule is key to ensure the fitting is securely connected to the canister. See the figure below for the correct positioning and connection. The pink ferrule is flexible and cannot be over-tightened.



3.3.3 Leak Check Compounds Considerations

To determine whether ambient air is introduced into soil gas sample, a leak check may be used. Leak check compounds may be liquid or gaseous tracers. Liquid compounds are challenging to use effectively in the field and can be introduced into the sample due to improper handling in the field, erroneously indicating a leak in the sampling train. Liquid tracers such as isopropanol should never be directly applied to connections in the sampling train. Rather, the liquid is carefully applied to a cloth and placed near the connection or on the ground next to the probe. Great care must be used in the field to insure the liquid tracer is not handled during sampling train assembly or disassembly. Even a trace amount of a liquid tracer on a glove used to replace a canister brass cap can contaminate the sample. Liquid leak check compounds can interfere with the analytical runs, and even small leaks may result in analytical dilution and raised reporting limits when measuring ppbv target compound levels.

Gaseous tracers such as helium are typically used with shroud placed over the sampling equipment and/or borehole. To quantify the leak, the concentration of the tracer gas in the shroud should be measured.



Specify the leak check compound planned for your soil gas sampling event and record on the COC.

3.3.4 Step-by-Step Procedures for Soil Vapor Sampling

These procedures are for a typical soil vapor sampling application; actual field conditions and procedures may vary. Please consult your specific regulatory guidance for details.

Before you get to the field:

1. Verify contents of the shipped package (e.g., chain-of-custody, canister, tubing, fittings, and flow controller).
2. Make sure you include a 9/16" and 1/2" wrench in your field tool kit.
3. Verify the gauge is working properly.
4. Verify the initial vacuum of canister.

Prior to vapor collection:

- **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. A standard rule of thumb is to utilize 3 purge volumes prior to sample collection. However, under certain circumstances, purge volumes of 1 to 10 may be appropriate. Please review your regulatory guidance and your site specific conditions in determining the appropriate purge volumes.
- **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.

When ready to sample:

1. Confirm that valve is closed (knob should already be tightened clockwise).
2. Remove brass cap from canister.
3. Attach flow controller to canister if needed. The flow controller is securely attached if the flow controller body does not rotate. (Note: The frit-press flow controller and 1 L canister may be pre-assembled by the laboratory.)
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.

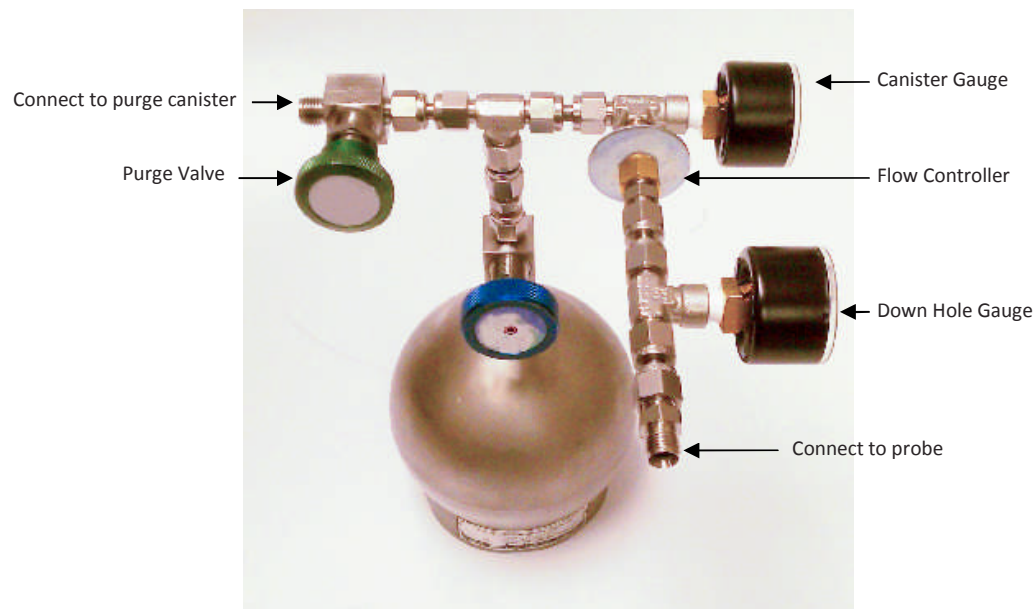
5. Once the sample train is airtight remove the brass cap from the flow controller and attach the probe tubing to the flow controller using the pink ferrule and Swagelok nut. (See 3.3.2 for proper positioning of the ferrule.)
6. Once the probe line has been purged and appropriate leak check measures have been implemented, open the canister valve a ½ turn.
7. Verify and record final vacuum of canister (simply read built-in gauge).
8. When canister fills to the desired end vacuum, close valve by hand tightening knob clockwise.

Please note: Some projects require residual vacuum of approximately 5 in Hg at the end of sample collection even if time-integrated samples are not required. The residual vacuum serves to provide a check of the integrity of the canister during transport to the laboratory to insure no leaks occurred during shipment. A field vacuum reading similar to the lab receipt vacuum reading demonstrated that no leak occurred.

9. Detach tubing and flow controller and replace brass cap on the canister.
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 and associated media in boxes provided. **Failure to return all of the provided equipment will result in a replacement charge as outlined in the media agreement.**
12. Fill out chain-of-custody and relinquish samples properly (it is important to note the canister serial numbers on the chain-of-custody).
13. Place chain-of-custody in box and retain pink copy
14. Tape box shut and affix custody seal at each opening (if applicable)
15. Ship accordingly to meet method holding times

3.4.4 Collecting Soil Gas Samples with Sampling Manifolds

If required, Eurofins Air Toxics can provide a sampling manifold to assist with leak checking the sampling train, purging the sampling line, and monitoring the vacuum applied to the soil gas bore hole during sample collection. The manifold is shown below:



The ‘Down Hole Gauge’, located prior to the flow restrictor, is a vacuum gauge that monitors the vacuum applied to the soil gas probe. 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. Low flow, high vacuum conditions can be encountered when sampling in low permeability soil. The ‘Canister 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.

There are several options to use as a purge vacuum source to attach to the purge valve connection – a Summa canister, sampling pump or sampling syringe. The below instructions assume a Summa canister will be used as a purge volume source since other sources are generally provided by the client.

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 center fitting to sample canister.
4. Attach purge canister to the Purge Valve end of the manifold by attaching provided Teflon tubing and compression fittings.
5. 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

6. 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.
7. 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 167 ml/min.

8. Once the desired purge volume is met close both the manifold valve and the purge canister valve by hand tightening the knobs clockwise.
9. 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

10. The line is now ready to be sampled. Open the sample canister valve and monitor sampling progress periodically.
11. 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).
12. 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).
13. Return canisters in boxes provided and all parts of the soil gas manifold. **Unreturned media will result in a replacement charged assessed as described in the media agreement.**
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.

Section 4.0 Sampling with Bags

This section provides a description of the types of air sampling bags, selecting the right bag for your application, practical considerations for sampling, and step-by-step instructions for collecting a grab sample. Photographs illustrate the correct way to assemble the various sampling components.

4.1 Introduction to Bags

Air sampling bags are containers used to collect whole air samples for landfill gas, soil gas and stationary source applications. Bags can be constructed from various materials which can differ in terms of stability characteristics and cleanliness. In general, air sampling bags are best suited for projects involving analysis of compounds in the ppmv range. They can be used to collect sulfur compounds, but only if the fittings are non-metallic (e.g., polypropylene, Teflon[®], or Nylon).

Air sampling bags are equipped with 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 vapor sample is pulled in. When the target volume of the sample is collected, the valve is closed and the bag is returned to the laboratory. Bag materials should be selected based on the specific application. Common air sampling bags include Tedlar film and FlexFoil. Eurofins Air Toxics maintains a limited inventory of air sampling bags in 1 L, 3 L 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.

Tedlar[®] bags may be used to collect samples containing common solvents, hydrocarbons, chlorinated solvents, sulfur compounds, atmospheric and biogenic gases and many other classes of compounds. Compounds with low vapor pressures such as Naphthalene are not appropriate for Tedlar bags as recovery is very low even under short sample storage times. Low molecular compounds such as Helium and Hydrogen can diffuse through the Tedlar bag material resulting in poor storage stability.



4.1.2 Tedlar[®] Bag Suppliers and Re-use

Compounds commonly detected from analyzing new Tedlar[®] bags include methylene chloride, toluene, acetone, ethanol, 2-propanol, phenol, and dimethylacetamide. While levels of these common artifacts are typically in the ppbv range, the cleanliness of bags can vary significantly between vendors, and purchasing bags directly from an unknown vendor should be avoided. Once the Tedlar[®] bag is used for sample collection, 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. Consider your data quality objectives to determine whether re-using Tedlar[®] bags is appropriate.

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.

The sample hold time to analysis varies by method and compound. See Table 4.1.3 for recommended sample storage times for commonly requested parameters.

Table 4.1.3 Recommended Maximum Sample Storage Times for Tedlar® Bags

Analytical Method	Chemical Class	Storage Time
ASTM D5504	Suite of sulfur compounds including Reactive Sulfur compounds (Hydrogen sulfide, Methyl mercaptan)	24 hours
ASTM D1946 ASTM D1945	Atmospheric and natural gases: CO, CO ₂ , CH ₄ , C ₂ -C ₅ hydrocarbons (He and H ₂ not recommended)	Up to 3 days
Modified TO-14A, TO-15, TO-3, TO-12	Volatile Organic Compounds (VOCs)	Up to 3 days

4.1.4 FlexFoil Bags

FlexFoil bags are made from an opaque and flexible material with 4-ply construction resulting in high physical strength to minimize rupture and leakage and low permeability to provide good stability for low molecular weight compounds. FlexFoil bags are ideal for target compounds such as Hydrogen and Helium and can be used for the suite of atmospheric and natural gas components. While the reactive sulfur compounds, Hydrogen Sulfide and Methyl Mercaptan, show good stability over 24 hours in FlexFoil bags, other sulfur compounds demonstrate low recovery. Table 4.1.4 summarizes the compounds and the hold times amenable to FlexFoil bags.

Table 4.1.4 Recommended Maximum Sample Storage Times for FlexFoil Bags

Analytical Method	Chemical Class	Storage Time
ASTM D5504	Hydrogen sulfide, Methyl mercaptan only Not recommended for full sulfur list.	24 hours
ASTM D1946 ASTM D1945	Atmospheric and natural gases Full List	Up to 3 days

4.2 Air Bag Sampling

Using a 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 bag: a pump or a lung sampler.

- Sampling with a Pump:** The most common method for filling a bag is to use a small pump with low flow rates (50-200 mL/min) and tubing to fill the bag. Eurofins Air Toxics, Inc. does not provide pumps but pumps may be rented from equipment providers or purchased from manufacturers such as SKC or Gilian.
- Sampling with a Lung Sampler:** A “lung sampler” may be used to fill a bag. Although a little more complicated than simply using a pump, the main advantage to using a lung sampler to fill a bag is that it avoids potential pump contamination.



A bag with attached tubing is placed in a small airtight chamber (even a 5-gallon bucket can work) 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. Eurofins Air Toxics does not provide lung samplers, but they can be rented from equipment suppliers or purchased by manufacturers such as SKC Inc.

4.2.1 Considerations for Bag Sampling

Some considerations for collecting a bag sample:

- **Fill the 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 bag:** Store and ship the bag samples in a protective box at room temperature. An ice chest may be used, but DO NOT CHILL
- **Fill out the bag label:** It is much easier to write the sample information on the label before the bag is inflated. Make sure to use a ball-point pen, never a Sharpee or other marker which can emit VOCs.
- **Provide a “back-up” 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 Bag:** Do not ship any explosive substances, radiological or biological agents, corrosives or extremely hazardous materials to Eurofins Air Toxics. Bag rupture during transit to the laboratory is possible and the sampler assumes full liability.

4.2.2 Step-by-Step Procedures for 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.

Before you get to the field:

1. Verify contents of the shipped package (e.g., chain-of-custody, bag, and tubing/fittings – if requested).
2. Verify pump cleanliness and operation (Eurofins Air Toxics 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 bag sample tag.
7. Attach additional new Teflon® tubing from the pump outlet to the bag valve.
8. Open bag valve.
9. Collect sample (FILL NO MORE THAN 2/3 FULL).
10. Close bag valve by hand tightening valve clockwise.
11. Return filled bags in a rigid shipping container (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 (if applicable) across flap.
15. Ship first overnight or priority overnight to meet method holding times.



Expedite delivery of air sampling bags to the laboratory for analysis.

Section 5.0 Special Sampling Considerations

This section provides recommendations for the collection of field QC samples such as field duplicates. Considerations for sampling at altitude, sampling SVE ports and using sample cylinders are presented.

5.1 Field QC

To measure accuracy and precision of the field activities, project plans often include field duplicates, field blanks, ambient blanks, trip blanks and/or equipment blanks.

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.

Alternatively, if the project objective is to assess spatial or temporal variability, then field duplicates may be deployed in close proximity (ambient air sampling) or samples may be collected in succession (soil vapor).

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. The trip blank VOC concentrations essentially provide information regarding the cleanliness and performance of the trip blank canister. Results cannot necessarily be applied to the associated field sample canisters accompanying the trip blank. **Eurofins Air Toxics does not recommend collecting 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 to the right 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.

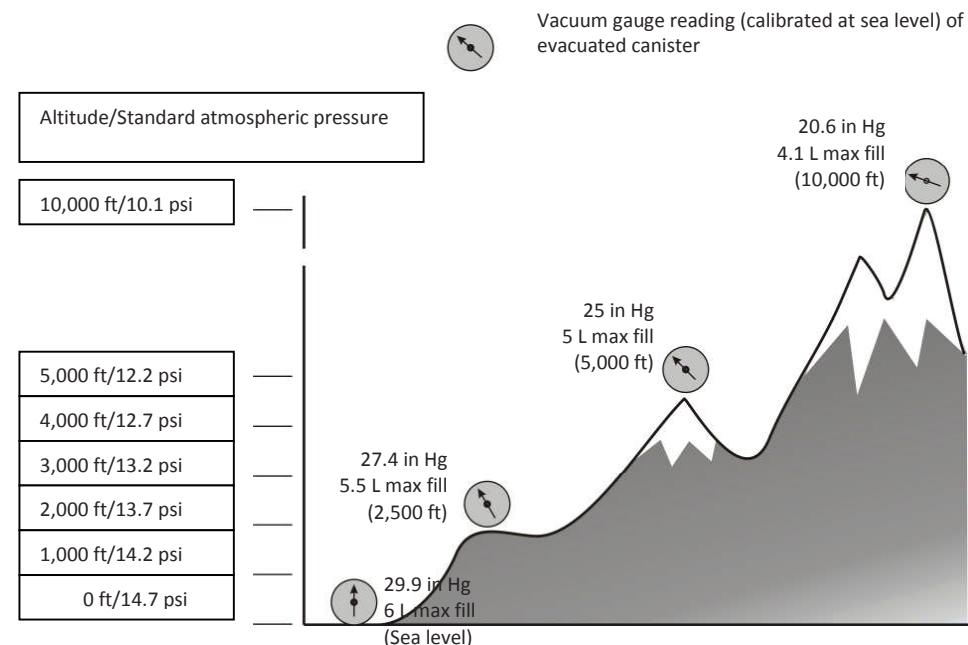
There is less atmospheric pressure in Denver and 5 L is the maximum fill volume of standard air assuming the canister is allowed to reach ambient conditions (i.e., final gauge reading of 0 in Hg). Theoretically, if you sample high enough (e.g., in space), no sample would enter the canister because there 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 Eurofins Air Toxics, Inc. (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 your Project Manager at 800-985-5955.



5.3 Considerations for SVE/LFG Collection System Sampling

There are some additional sampling considerations for collecting grab samples (canister or bag) from a Soil Vapor Extraction (SVE) system or landfill gas (LFG) collection system. The general challenge with these samples arises from the need to employ a length of tubing to direct the landfill gas or process air to the canister or bag. Tubing introduces the potential for contamination and diluting the sample.

- **Use inert tubing.** Teflon® tubing is recommended. Tubing with an outer diameter of ¼” works best with the fittings on the particulate filter. (See Section 3.3.1).
- **Do not reuse tubing.**
- **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.
- **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 (see Section 5.4). Under no circumstances should a Summa canister be pressurized more than 15 psig. Bleed off excess pressure by opening the valve temporarily while monitoring the canister with a pressure gauge.

5.4 Considerations for Sample Cylinder Sampling

Sample cylinders, also known as “sample bombs”, are DOT-approved, high pressure, thick-walled, stainless steel cylinders with a valve at each end. They were intended for collecting a pressurized sample for petroleum gas applications. Sample cylinders differ from sample canisters in that they do not have a Summa-passivated interior surface and are not evacuated prior to shipment. Sample cylinders are not suitable for analysis of hydrocarbons at ppbv levels. Sample cylinders can be used for analysis of natural gas by ASTM D-1945 and calculation of BTU by ASTM D-3588. Eurofins Air Toxics assumes that clients requesting a sample cylinder have a pressurized process and sample port with a built-in gauge and 1/4” Swagelok fitting to attach to the sample cylinder. Eurofins Air Toxics has a limited inventory of 500 mL sample cylinders that are particularly suited for landfill gas collection systems (i.e., LFG to energy applications). This section provides step-by-step procedures for sampling with a sample cylinder.



Inform the lab during project set up if hazardous samples (e.g. high Hydrogen Sulfide concentrations) will be collected to verify the lab can safely handle the samples.

Step-by-Step Procedures for Sample Cylinder Sampling

These procedures are for a typical stationary source sampling application and actual field conditions; procedures may vary. Follow all precautions in the site Health and Safety Plan when dealing with a pressurized sample port and sample cylinder. Follow required DOT guidelines for packaging and shipping.

1. Verify contents of the shipped package (e.g., chain-of-custody, sample cylinder, particulate filter).
2. Verify that gauge on sample port is working properly.
3. Purge sample port.

4. Remove brass caps on either end of cylinder.
5. Attach particulate filter to upstream valve.
6. Attach filter/cylinder assembly directly to the sample port.
7. Open both valves 1/2 turn.
8. Allow sample air to flow through sample cylinder (approximately 10 L for a 500 mL cylinder).
9. Close downstream valve of sample cylinder by hand tightening knob clockwise.
10. Allow sample cylinder to pressurize to process pressure (max 100 psig).
11. Close upstream valve of sample cylinder and sample port.
12. Detach filter/cylinder assembly from sample port and remove particulate filter.
13. Replace brass caps.
14. Fill out sample cylinder sample tag.
15. Fill out chain-of-custody and relinquish samples properly.
16. Include the chain-of-custody with the samples and retain pink copy.
17. Pack, label, and ship according to DOT regulations.



Follow DOT regulations for packaging and shipping hazardous samples.



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Appendix F

Sample Documentation and Shipment Instructions

F.1 Documentation

F.1.1 Scope and application. This section describes procedures for maintaining sample control through proper sample documentation. When samples are collected for chemical or physical characteristics analysis, documentation such as sample labels, daily contractor quality control reports (QCR), chain-of-custody and sample analysis request forms, custody seals, and field logbooks need to be completed. The information presented in this section enables maintenance of sample integrity from time of sample collection through transportation and storage. It is this documentation that will verify that samples were handled properly.

F.1.2 Documentation. The following discussion outlines standard practices and procedures to be used when documenting a sampling episode. All project-specific documentation requirements must be presented in the sampling and analysis plan (SAP). This includes identification of procedures required for field documentation, sample labeling, and the maintenance of chain-of-custody. Applicable requirements are identified in the following sections. Proper completion of all documentation with indelible ink is necessary to support the use of these records in any potential enforcement actions that may result. Protocols for corrections to documentation should not obliterate data entries, but place a single line through incorrect entry, noting corrected information, recorder's initials, and date correction was performed. Maintaining sample integrity through proper documentation is essential. Following site activities, all project documentation becomes a part of the final evidence file. These records should be maintained for a certain period of retention time. The documentation retention time requirements of a project must be presented within the SAP and may be based on the use of the data, funding source, or regulatory authority.

F.1.2.1 Daily contractor quality control reports (QCR). During the field investigation or remedial action activities, daily contractor QCRs should be prepared daily, dated, signed by the project contractor quality control representative, and sent to USACE at a rate specified in the scope of work or specifications. With respect to geotechnical and chemical procedures, these reports should include weather information at the time of sampling, field instrument measurements, calibrations, identification of all field and control samples taken, departures from the approved SAP necessary, deviations from approved geotechnical procedures (such as well installation or drilling), any problems encountered, and instructions from Government personnel. Any deviations that may affect data quality objectives must be conveyed to U.S. Army Corps of Engineers (USACE) personnel (technical manager, project geologist, project chemist, etc.) immediately. The following should be attached to the daily contractor QCRs: quality assurance (QA) sample tables that match up primary, replicate (quality control (QC)/QA), and other field control samples (e.g., blanks), copies of chain-of-custody forms, field-generated analytical results, and any other project forms that are generated. Additional documentation requirements of the daily contractor QCRs are outlined in Engineer Regulation (ER) 415-1-302 and Corps of Engineers Guide Specification (CEGS) 01451.

F.1.2.2 Field logbooks. Sampling situations vary widely. No general rules can specify the exact information that must be entered in a field logbook for a particular site. However, the logbook should contain sufficient information to enable the sampling activity to be reconstructed without relying on the collector's memory. Project field logbooks should be bound and have numbered, water-resistant pages. Record the site name and project name and number on inside front cover of logbook. All pertinent information regarding the site and sampling procedures must be documented as near to real-time as possible. At the conclusion of each day, the person maintaining the logbook should sign and date the day's

documentation entries. Notations should be made in logbook fashion, noting the time and date of all entries. Information recorded in other project documents (e.g., boring logs, well installation/development logs, or drum logs) should not be repeated in the field logbook, except in summary form to avoid transcription errors. Logbooks should be kept in the field team member's possession or in a secure place during field work. Following site activities or if the logbook is completely filled, the logbook becomes a part of the project final evidence file as noted previously. The technical planning team may also elect to establish documentation requirements that follow a more uniform organization than a field logbook. These documentation requirements would include the use of project forms. This approach helps enhance consistency in the information recorded and streamlines the documenting process. Any forms proposed for use should be task specific and should incorporate appropriate topics from those identified as follows. All forms must be presented in the project SAP. The following are some suggested topics to include in the field logbook:

- Name and exact location of site of investigation or interest.
- Name and title of person maintaining logbook (author).
- Date and time of arrival and departure at site location.
- Purpose of site visit or sampling activity.
- Name and address of field contact. This may also include information on access agreements.
- Names and responsibilities of all persons on site.
- Names, affiliations, and purpose of all site visitors.
- Level of personal protective equipment worn at the site.
- Weather conditions on the day of sampling, and any additional environmental conditions or observations pertinent to field activities.
- Field instrumentation or equipment used, and purpose of use (i.e., health and safety screening, sample selection for laboratory analysis). Note source, quality, or lot numbers for any supplies or reagents (e.g., sample containers, preservatives, reagents, water for field blanks/field control samples, and decontamination procedures). Retain any certificates or information supplied with the equipment used.
- Type of waste, suspected waste concentrations if known, and sample matrices to be handled.
- Document the sample collection method and any sample handling procedures such as filtration, compositing, and executed preservation techniques used.
- Document the sample location. If a compositing scheme is used, clearly identify appropriate locations for all sample aliquots included within each composite sample. Prepare a dimensional sketch of the general surroundings of the sampling area (site), and/or support with other forms of documentation (i.e., photographic log). Sample identification numbers should correspond directly with sample locations.

- Identify sample numbers, volumes, and containers (number, size, type) used for each sample collected. Note the date and time of each sample, identify any associated QC samples, or any factors that may affect the quality.
- Record any field measurements, field screening/analytical results generated, calibration methods used, field results, and QC information.
- Identify decontamination procedures employed for sampling equipment.
- Document appropriate references to maps and photographic logs of the sampling site.
- Record information on scheduling modifications, change orders, sampling or drilling decisions/changes.
- Describe the number of shipping coolers packed, note chain-of-custody (COC) numbers or attach a copy of COC, and record the mode of transportation and applicable tracking numbers.
- Record name and address of all receiving laboratories.
- Maintain appropriate documentation for investigation-derived wastes. Note contents and volumes of waste generated, storage, and disposal methods used.

F.1.2.3 Documenting sampling points and locations. The exact locations of sampling points should be documented for purposes of generating an accurate representation of the site conditions using the data generated to date, defining data gaps, and identifying potential future data needs. A monument should be chosen at each site to act as a stationary reference point from which all sampling points can be measured using a compass and measuring tape. If a building or other stationary structure exists, its corner may act as this reference point. If no monument exists, it will be necessary to create one. A piece of wood, approximately 5 cm by 5 cm (2 in. by 2 in.), should be hammered into the ground to almost ground level, making it difficult to remove and thus assuring its permanence. The stake should then be marked with flagging tape or fluorescent paint. When applicable, sampling points associated with coordinates that are referenced to a position on the earth must comply with ER 1110-1-8156. ER 1110-1-8156 requires geospatial data to be documented using the Federal Geographic Data Committee's content standards for digital geospatial metadata. Geospatial data are nontactical data, referenced either directly or indirectly to a location and boundaries on the earth. Additional guidance on geospatial data systems may be found in EM 1110-1-2909. To establish a sampling point, the following procedure is recommended:

- Standing at the monument, facing the sampling point, use the compass hairlines to determine the degree of direction.
- Ensure that the line of sight runs from the monument, through both hairline needles on the compass, to the sampling point.
- When first establishing the sampling point, record the degree and direction reading from the compass in the field logbook, along with the distance measurement from the monument to the sampling point.

F.1.2.4 Photographic documentation. All sampling points should be documented on film. A film record of a sampling event allows positive identification of the sampling point. In some cases, a photograph

of the actual sample collected may also be required. Photographs are the most accurate and convenient record of field personnel observations. Photographs taken to document sampling points should include two or more reference points to facilitate relocating the point at a later date. Keeping a record of photographs taken is crucial to their validity as a representation of an existing situation. Photographic documentation is invaluable if the sampling and subsequent analytical data end in litigation, enforcement, or cost recovery actions. In addition to photographs, video coverage of a sampling episode can be equally as valuable as or even more valuable than photographs because it can be used to prove that samples were taken properly as well as verify the location at which they were taken. Video coverage can be used as a record of site conditions and can give those who have not been onsite an idea of the circumstances. For each photograph taken, the following items should be noted in the field logbook:

- Date.
- Time.
- Photographer (signature).
- Name of site.
- General direction faced and description of the subject.
- Sequential number of the photograph and the roll number.
- Site photo map (see Figure F-1).

F.1.2.5 Sample documentation

F.1.2.5.1 Sample labels. Sample labels are required for properly identifying samples and evidence. All samples must be properly labeled with the label affixed to the container prior to transportation to the laboratory. It is also recommended that samples be photographed so that labels are clearly readable for later identification. Information on sample labels should include, but not be limited to, the following:

- Project Code. An assigned contractor, project number, site name.
- Station Number. A unique identifier assigned to a sampling point by the sampling team.
- Sample Identification Number. Each sample, including field control samples, collected for a project should be assigned a unique number. This assigned number incorporates information on the sample type and date as noted in Section F.1.2.5.2.
- Samplers. Each sampler's name and signature or initials.

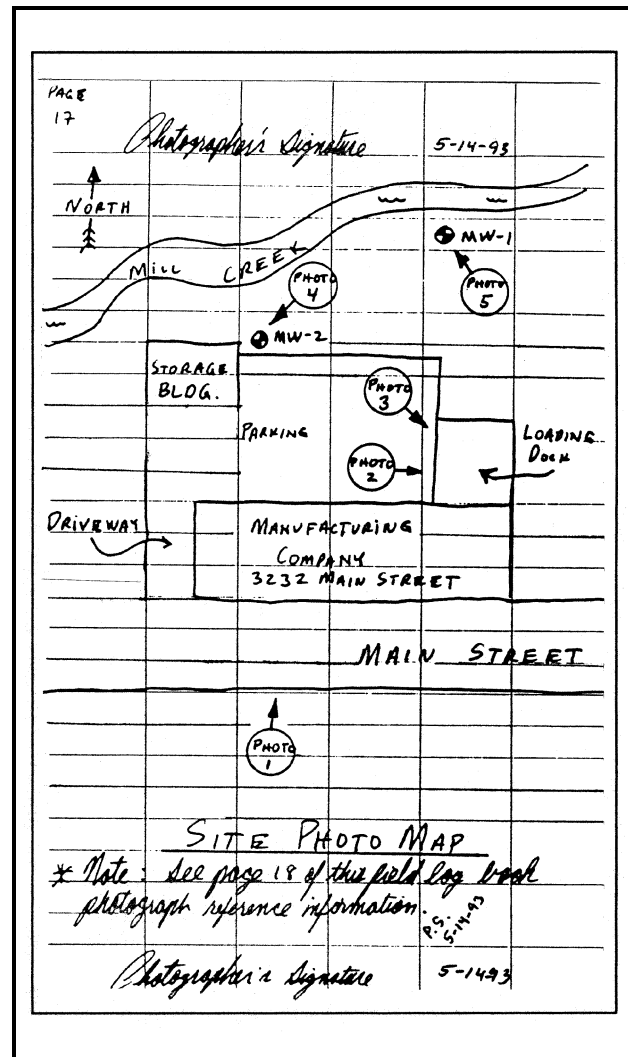


Figure F-1. Site photo map

- Preservative. Whether a preservative is used and the type of preservative.
- Analysis. The type of analysis requested.
- Date/Time. Identify the date and time the sample was taken.
- Type of Sample. The type of sample should be identified as discrete or composite.

F.1.2.5.2 Sample numbering. A sample numbering system should be used to identify each sample collected and submitted for analysis. The purpose of the numbering system is to assist in the tracking of samples and to facilitate retrieval of analytical results. The sample identification numbers for each sampling effort should be used on sample labels, sample tracking matrix forms, COC forms, field logbooks, and all other applicable documentation. A listing of all sample identification numbers should be recorded in the field logbook. The sampling numbering system may vary depending upon the number and type of samples that will be collected at the site. An example of a sample numbering system follows. Location and sample identification numbers should consist of the following designations to identify the location (AABBB-CC), sample sequence number, date (MMDDYY), and sample depth interval for soils (00-00):

- For soil: AABBB-CC/MMDDYY/00-00
- For water: AABBB-CC/MMDDYY
- For QC samples: AABBB-CC/MMDDYY

Example: SB001-01/081492/08-10 = Soil Boring SB001 Sample Number 1, sampled on August 14, 1992, from a sample depth interval of 8 to 10 ft (2.4 to 3 m). Duplicate samples should be numbered in sequential order. For example, a duplicate sample collected from this soil boring example would have a designation as follows: SB001-02/081492/08-10. Each sample collected must be assigned a unique sample number. Sample numbers should change when the media or location changes. Sample numbers should not change because different analyses are requested. For example, water samples collected at the same location, date, and time for volatile organics, semivolatile organics, and metals analyses would all have the same sample number, although the various sample aliquots would be collected in different containers.

F.1.2.5.3 Chain-of-custody (COC). COC procedures provide documentation of the handling of each sample from the time it is collected until it is destroyed. COC procedures are implemented so that a record of sample collection, transfer of samples between personnel, sample shipping, and receipt by the laboratory that will analyze the sample is maintained. Records concerning the cleaning of empty sample containers, container shipment from the laboratory to the site, and security of empty containers at the site should also be maintained. The COC record (Figure F-2) serves as a legal record of possession of the sample. The COC record is initiated with the acquisition of the sample. The COC record remains with the sample at all times and bears the name of the person (field investigator) assuming responsibility for the samples. The field investigator is tasked with ensuring secure and appropriate handling of the bottles and samples. To simplify the COC record and eliminate potential litigation problems, as few people as possible should handle the sample or physical evidence during the investigation. A sample is considered to be under custody if one or more of the following criteria are met:

CHAIN-OF-CUSTODY RECORD											
PROJ. NO.		PROJECT NAME				NO. OF CON- TAINERS					REMARKS
SAMPLERS: (Signature)											
STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION						
Relinquished by: (Signature)			Date/Time	Received by: (Signature)			Relinquished by: (Signature)		Date/Time	Received by: (Signature)	
Relinquished by: (Signature)			Date/Time	Received by: (Signature)			Relinquished by: (Signature)		Date/Time	Received by: (Signature)	
Relinquished by: (Signature)			Date/Time	Received for Laboratory by: (Signature)			Date/Time		Remarks		

Figure F-2. Chain-of-custody form

- - The sample is in the sampler's possession.
 - The sample is in the sampler's view after being in possession.
 - The sample was in the sampler's possession and then was locked up to prevent tampering.
 - The sample is in a designated secure area.

In addition to the COC record, there is also a COC (custody) seal. The COC seal (Figure F-3) is an adhesive seal placed in areas such that if a sealed container is opened, the seal would be broken. The COC seal ensures that no sample tampering occurred between the field and the laboratory analysis.

F.1.2.5.4 **Transfer of custody and shipment.** All sample sets should be accompanied by a COC record. When transferring possession of samples, the individual receiving the samples should sign, date, and note the time that he/she received the samples on the COC record. This COC record documents transfer of custody of samples from the field investigator to another person, other laboratories, or other organizational units. Samples must be properly packaged for shipment and delivered or shipped to the designated laboratory.

for analyses. Shipping containers must be secured by using nylon strapping tape and custody seals (Instruction F-2). The custody seals must be placed on the container so that it cannot be opened without breaking the seals. The seal must be signed and dated by the field investigator. When samples are split with a facility, state regulatory agency, or other government agency, the agency representative must sign the COC record, if present. All samples should be accompanied by the COC record. The USACE tracking number (e.g., laboratory information management system (LIMS) number) that is used in conjunction with the

<p>CUSTODY SEAL</p> <hr/> <p>Date</p> <hr/> <p>Signature</p>	<p>CUSTODY SEAL</p> <hr/> <p>Date</p> <hr/> <p>Signature</p>
--	--

Figure F-3. Chain-of-custody seal

Government QA sample shipment must be written on the COC record of the QA sample. The original and one copy of the record will be placed in a plastic bag taped to the inside lid of the secured shipping container. One copy of the record will be retained by the field investigator or project leader. The original record will be transmitted to the field investigator or project leader after samples are accepted by the laboratory. This copy will become a part of the project file. If sent by mail, the package should be registered with return receipt requested. If sent by common carrier, an air bill should be used. Receipts from post offices and air bills should be retained as part of the documentation of the COC. The air bill number or registered mail serial number should be recorded in the remarks section of the COC record.

F.1.2.5.5 Sample analysis request. To ensure that proper analysis is performed on the samples, additional paperwork may need to be filled out, as required by the laboratory performing the analysis. This form identifies samples by number, location, and time collected and allows the collector to indicate the desired analysis. This form should act as a supplement/confirmation to the COC record and laboratory contacts made prior to the sample event initiation.

F.1.3 QA/QC requirements.

F.1.3.1 Corrections to documentation. All original data recorded in field logbooks and on sample labels, COC records, and receipt-for-samples forms are written in waterproof ink. If an error is made on an accountable document, corrections should be made simply by crossing out the error and entering the correct information. The erroneous information should not be obliterated. Any error discovered on a document should be corrected by the person who made the entry. All corrections must be initialed and dated.

F.1.3.2 Photographs. The photographer should review the photographs or slides when they return from developing and compare them with the photographic log to confirm that the log and photographs match.

F.1.4 Potential problems. Although most sample labels are made with water-resistant paper and are filled out using waterproof ink, inclement weather and general field conditions can affect the legibility of sample labels. It is recommended that after sample labels are filled out and affixed to the sample container, the label should be covered with wide clear tape. This will preserve the label and keep it from becoming illegible. In addition to label protection, COC and analysis request forms should be protected when samples are shipped in iced coolers. Typically, these forms should be placed inside a ziplock bag or similar waterproof protection and taped to the inside lid of the secured shipping container with the samples.

F. 2 Packaging and Shipping Procedures

F.2.1 Scope and application. This section describes procedures for properly packaging and shipping environmental and hazardous waste samples, as well as the shipment of preservatives used in the environmental sampling. Guidelines for proper container and preservative selection can be found in Appendix B. Personnel that are involved in packaging, shipping, and receipt of samples must be aware of Department of Transportation (DOT) regulations, know when to apply them, and know what procedures are needed to support this application. Personnel who ship samples considered a DOT hazardous material (HM) must be trained in accordance with the requirements set in 49 CFR 172.704. The following procedures identify packaging and shipping requirements for environmental and hazardous waste samples that are both DOT-regulated and nonregulated. Further information is presented for shipping carriers (i.e., FedEx, UPS) that use the International Air Transportation Association (IATA) regulations to govern domestic and international shipments. Shipping procedures for common preservatives and decontamination fluids are also addressed. Finally, it should be noted that DOT regulations also apply to the shipment of asbestos samples.

F.2.2 Procedures for shipping environmental samples. Environmental samples are defined as those samples collected from environmental matrices such as soil, groundwater, or sediments. The following sections identify packaging and shipping requirements for environmental samples that are unpreserved or preserved by acid/base/chemical addition. The following general procedures apply to the packaging of all environmental samples:

- Verify that the sample label is complete and adequately identifies the items described in Instruction F-1.
- Verify that each sample cap/lid is secured on the bottle, and place each sample in a plastic bag. For multiple volatile organic analysis (VOA) vials, all vials from each sample location should be placed in a small plastic bag at a minimum. Evidence tape or custody seals may be placed over the sample lid and container, or over the seal of the bag for additional security, if desired.
- Squeeze as much air as possible from the bag, and seal the bag. Trip blanks are packaged in the same manner as that for aqueous VOA samples.
- Prepare the shipping container for use. For a commercial cooler, this includes taping the drain plug shut inside and out, and lining the cooler with a large plastic garbage bag. Place approximately 7.5 cm (3 in.) of inert packing material in the bottom of the liner. Place vermiculite or perlite on the bottom if the materials are liquid. Alternative shipping containers may be used if approved by project technical personnel.
- Place the samples upright in the lined cooler or storage container in such a way that the samples will not touch each other during shipment. Add inert packing material as necessary to ensure separation of samples.
- With the exception of aqueous metals analyses, all environmental samples should be shipped to the laboratory on ice and chilled to $4\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$. If any of the shipped samples require cooling, place double bags of ice around the containers. Also include a 40-mL VOA vial filled with water for use as a temperature blank for the laboratory.

- Fill the cooler with packing material and tape the inner liner shut. NOTE: Do not use “environmentally friendly” peanuts made of starch to pack containers of liquids. These packing materials will dissolve when they get wet or moist.
- Place the paperwork (Instruction F-1) being sent to the laboratory inside a plastic bag and tape it to the inside of the cooler lid. Include a copy of the COC form in the paperwork sent to the laboratory. The sampler keeps one copy of the COC form. Include any additional paperwork to notify the laboratory of project information (laboratory notification checklist), or if a sample is suspected of containing any substance for which laboratory personnel should take safety precautions.
- Close the cooler and seal it with strapping tape.
- Place at least two custody seals on the outside of the cooler (one on the front and one on the back). More custody seals may be used at the discretion of the sampler.
- Prepare standard air bill paperwork for shipment of the samples to the laboratory. Personnel should be aware of carrier weight or other policy restrictions.

F.2.2.1 Unpreserved environmental samples. Environmental samples that are shipped unpreserved are not considered a hazardous material by DOT if they do not exhibit a DOT hazard class. This exempts them from DOT regulation during transportation to the laboratory. In general, this applies to soil/sediment and aqueous samples preserved by cooling. Follow the general procedures identified in Section F.2.2 for packaging and shipment of unpreserved environmental samples.

F.2.2.2 Preserved environmental samples. All samples that are preserved by the addition of chemicals are subjected to greater scrutiny when defining whether DOT regulations apply and the appropriate packaging and shipping requirements necessary. Care should be exercised when adding any chemicals to environmental samples for preservation purposes. Samples must be observed, noting any chemical reactions that take place, and following with any contingency measures needed to obtain a representative sample. Most importantly, add only the amount of preservative needed to achieve the required preservation criteria. Excessive preservation may make an otherwise unregulated sample subject to DOT hazardous materials regulations. On average, testing of water samples arriving at commercial laboratories has shown that between 30 and 50 percent of the samples are excessively preserved and may have been improperly packaged and shipped. Samples in this category may also be considered a Resource Conservation and Recovery Act (RCRA) characteristic or listed waste. However, an exclusion from manifesting and hazardous waste marking requirements exists under RCRA for shipping environmental samples to the laboratory. The RCRA exclusion can be found in 40 CFR 261.4(d). Materials that are Toxic Substances Control Act (TSCA) regulated (polychlorinated biphenyls (PCBs)) may be shipped under exclusions found in 40 CFR 761.65(I). However, these exemptions do not pertain to DOT regulations, and compliance with DOT regulation is still required. Field personnel should also realize that even though the DOT may allow for these items to be shipped by air, other international regulations governing air carriers (such as IATA/International Civil Aviation Organization (ICAO)) may further limit or forbid materials allowed by DOT. The shipper must also comply with all packaging regulations. These regulations will be found in 49 CFR 171.101 and 49 CFR 173. Packaging and shipping requirements for preserved environmental samples are determined based on whether the preserved samples exhibit the same physical or chemical characteristics that initially defined the preservative as a DOT hazardous material. Follow the guidance presented in Section F.2.2.2.1 and in Sections F.2.2 or F.2.3 to determine the appropriate shipping and packaging requirements to apply.

F.2.2.2.1 Excepted preserved environmental samples. The DOT definition of a corrosive material is based on the destruction of intact animal skin. The DOT packing group (PG) associated with these samples determines the packaging and shipping procedures necessary, which are based on the time frame of observed tissue damage. Alternative testing to the animal testing has been developed and is accepted by DOT to support an application for exception from DOT classification and regulation. In the spring of 1997, USACE performed alternative testing to support the exception from the determination of acid/base preserved samples as a DOT corrosive classification. The testing showed that samples preserved in the manner described in Table F-1 and packaged as outlined in paragraph F.2.2 did not meet the definition of corrosive materials as prescribed by DOT under 49 CFR 173.136 (a)(1), 173.137 (a,b,c(1)). Based on this information, environmental samples meeting these criteria may be shipped as non-DOT regulated material following procedures outlined in Section F.2.2 under the USACE number DOT-E10904. Further information on this exception should be obtained from the USACE Hazardous, Toxic, Radioactive Waste - Center of Expertise (HTRW-CX) prior to its application or use. For consistency, the proper preparation of sample preservatives is outlined as follows for some common preservatives used in conjunction with environmental sampling:

- Acid preservatives:
 - (1) Hydrochloric acid 500 mL water + 2.0 mL 12N hydrochloric acid
 - (2) Nitric acid 500 mL water + 2.0 mL 15.7N nitric acid
 - (3) Sulfuric acid 1000 mL water + 1.0 mL 18M sulfuric acid
- Base preservatives:

Sodium hydroxide 500 mL water + 1.0 mL 30% sodium hydroxide

Table F-1 identifies the required pH ranges for sample preservation to meet standard U.S. Environmental Protection Agency methods, and to avoid meeting the definition for a particular DOT hazard classification and packing group. Samples preserved in the field should be verified for correct pH to assess the utilization of this exception. This may become problematic if the testing materials used (i.e., pH test strips) do not distinguish pH values to the required accuracy. Based on the range limits established, it is mandatory to use pH paper capable of a minimum of 0.5 pH unit resolution, such as the use of short-range pH paper. However, due to the proximity of several of these values, it is recommended a pH meter be used to allow resolution to 0.1 pH unit. Field personnel are cautioned that, based on specific acid type, if pH is adjusted below the acid range limit or above the basic range limit, preserved samples will be regulated by DOT as a hazardous material and will require proper shipping papers, marking, and labeling as identified in Section F.2.2.2.2.

Table F-1
Preserved Sample pH Ranges Needed for DOT Exemption

Preservative Used	Acceptable Sample pH Ranges for DOT Exemption Status¹
Hydrochloric acid	pH = 1.43 to 2.00
Nitric acid	pH = 1.33 to 2.00
Sulfuric acid	pH = 1.31 to 2.00
Sodium hydroxide	pH = 12.00 to 12.58

¹ Per USACE exemption DOT-E10904

F.2.2.2.2 Acid/base preserved environmental samples. Environmental samples that have been overpreserved may meet the DOT definition of hazardous materials (i.e., corrosive liquid). When applicable, these materials must be shipped in proper DOT-approved containers, unless the shipper uses limited-quantity exceptions, or if the shipper has determined through testing that the material does not meet the definition of a DOT corrosive (Section F.2.2.2.1). DOT and IATA regulations should be reviewed to determine appropriate packaging and shipping requirements, and if a limited-quantity exemption exists. If a limited-quantity exemption does exist, the volume of hazardous material to be shipped is evaluated to determine if it exceeds this threshold limit. Refer to Table F-2 for information on the proper shipping name (PSN) and the limited quantities associated with some common types of acid preservation. When the total volumes of shipped material are less than the limited quantities noted, then the materials may be shipped as a limited quantity following the sample packaging and shipment procedures included in Section F.2.3, with “Limited Quantity” or “Ltd Qty.” recorded on the shipping papers after the PSN. Table F-3 summarizes general requirements necessary to ship DOT-limited quantities. If the shipper does not meet these requirements, then the samples are considered fully regulated DOT hazardous material, and all DOT requirements as defined in 49 CFR 171-178 must be met.

**Table F-2
PSN and Limited Quantities for Common Preservatives, Decontamination Fluids, and Potentially Hazardous Samples¹**

Chemical Compound/Sample/ Material	PSN	Lmt Qty²	Lmt Qty³
Sulfuric acid >51%	Sulfuric Acid, with more than 51% sulfuric acid, 8, UN1830, PGI	1 liter	30 Liters
Sulfuric acid <51%	Sulfuric Acid, with not more than 51% sulfuric acid, 8, UN2796, PGI	1 liter	30 Liters
Nitric acid >70%	Nitric Acid, with more than 70% nitric acid, 8, UN2031, PGI	Forbidden	2.5 Liters
Nitric acid <70%	Nitric Acid, with less than 70% nitric acid, 8, UN2031, PGI	Forbidden	2.5 Liters
Nitric acid solution (10%) ⁴	Nitric Acid, other than red fuming with less than 20% nitric acid, 8, UN2301, PGI	1 liter	30 liters
Nitric acid solution (1%) ⁴	Nitric Acid, other than red fuming with less than 20% nitric acid, 8, UN2301, PGI	1 liter	30 liters
Nitric acid preserved samples	Corrosive Liquids, Acidic, Inorganic, NOS (Nitric Acid), 8, UN3264, PGIII	5 liters	60 liters
Hydrochloric acid	Hydrochloric Acid Solution, 8, UN1789, PGI	1 liter	30 liters
Hydrochloric acid preserved samples	Corrosive Liquids, Acidic, Inorganic, NOS (Hydrochloric Acid), 8, UN3264, PG III	5 liters	60 liters
Phosphoric acid	Phosphoric Acid, 8, UN1805, PGIII	5 liters	60 liters
Sodium hydroxide solution	Sodium Hydroxide Solution, 8, UN1824, PGI	1 liter	30 liters
Sodium hydroxide preserved sample	Corrosive Liquids, Basic, Inorganic, NOS (Sodium Hydroxide), 8, UN3266, PGIII	5 liters	60 liters
Isopropyl alcohol	Isopropyl alcohol or Isopropanol, 3, UN1219, PGI	5 liters	60 liters
Methanol	Methanol, 3, UN1230, PGI	1 liter	60 liters
Hexanes	Hexanes, 3, UN1208, PGI	5 liters	60 liters
Sodium bisulfate, aqu sol	Bisulfate, aqueous solution, 8, UN2837, PGI	1 Liter	30 liters
Fuel ID/Tank Samples	Flammable Liquids, NOS (fuels), 3, UN1993, PGIII.	60 liters	220 liters

¹ Personnel should be aware that the following represents only a few of the possible Proper Shipping Names (PSNs) available for shipping hazardous materials. Not all materials field personnel may have to ship are covered by these examples. Shippers are advised to review the DOT hazardous materials table prior to shipping.

² Passenger Aircraft/Railcar.

³ Cargo Aircraft Only.

⁴ Nitric acid solutions at • 20% acid are recognized by the ICAO and IATA, and are addressed in 49 CFR 171.11.

Table F-3
Limited Quantity Packaging and Shipping Paper Criteria

Parameter	Class 3	Class 6.1	Class 8	Class 9
Outer Package (max gross wt)	30 kg/66 lb	30 kg/66 lb	30 kg/66 lb	30 kg/66 lb
Outer Package Markings:				
1. PSN	•	•	•	•
2. UN#	•	•	•	•
3. Orientation Arrows - liquids	•	•	•	•
4. Address	•	•	•	•
5. RQ	(•)	(•)	(•)	(•)
6. Other Markings: Marine Pollutant, Cargo Air Craft, etc.	(•)	(•)	(•)	(•)
Label	<u>Air:</u> Flammable Liquid <u>Other:</u> excepted	<u>Air:</u> Poisonous <u>Other:</u> excepted	<u>Air:</u> Corrosive <u>Other:</u> excepted	<u>Air:</u> Class 9 <u>Other:</u> excepted
Inner Package Size Limit:				(Not PG specific)
1. PGI	0.5 L	N/A	N/A	4.0 L/5.0 kg
2. PGII	1.0 L	N/A	1.0 L/1.0 kg	
3. PGIII	5.0 L	4.0 L/5.0 kg	4.0 L/5.0 kg	
Shipping Paper Entries:				
1. Gross wt	•	•	•	•
2. Number of packages	•	•	•	•
3. Proper shipping description	•	•	•	•
4. "Ltd Qty"	•	•	•	•
5. Marine Pollutant	(•)	(•)	(•)	(•)
6. RQ	(•)	(•)	(•)	(•)
Note:				
• Entry Required				
(•) Required if definition criteria are met				

F.2.2.2.3 Methanol preserved samples. Soil and sediment samples may require preservation with methanol if samples will be tested for volatile organics by the high-level method. In this case methanol is added neat to the sample and is, therefore, considered a hazardous material. DOT and IATA regulations should be reviewed to determine appropriate packaging and shipping requirements, and to determine if a limited-quantity exemption exists. If so, the volume of hazardous material to be shipped is evaluated to determine if it exceeds this threshold limit. Refer to Table F-2 for information on the PSN, and limited quantities associated with methanol. Additional information on limited quantities should be referenced from IATA regulations when applicable. Again, refer to Table F-3 for a summary of general requirements necessary to ship DOT-limited quantities. For instance if the total volume of methanol included within sample jars packaged in the shipping container does not exceed 1 L, then one may ship under the exception found in 49 CFR 173.150 (b)(2) for limited quantities. This is supported by the DOT Hazardous Materials Table, which identifies the methanol quantity limitation for passenger aircraft or railcar as 1 L (0.3 gal). When the total volumes of shipped material are less than the limited quantities noted, then the materials may be shipped as a limited quantity. "Limited Quantity" or "Ltd Qty." must be recorded on the shipping papers after the PSN if the exception is used. Sample packaging and shipment should follow procedures included in Section F.2.3. When greater than 1 L is included, sample packaging and shipment procedures noted within 49 CFR 172.701, Hazardous Materials Table, must be followed. Recommend packaging shipping containers to maintain the volume of methanol below the thresholds noted in Table F-2. Project personnel are also

encouraged to check with the shipping carrier used, to verify that additional, more stringent policy requirements do not exist for the shipment of flammable liquids such as methanol. Another option available under DOT is the small-quantity exception found in 49 CFR 173.4. Specifically, 49 CFR 173.4(a)(1)(i) states the maximum quantity of material per inner container is limited to 30 mL for authorized liquids, other than Division 6.1, Packing Group I materials (i.e., poisons). In other words, for Method 5035 (EPA/SW-846) preserved samples, if one has less than or equal to 30 mL of methanol or bisulfate aqueous solutions (sodium bisulfate) per inner (sample) container, this material is not subject to any other requirements of the hazardous materials regulations except those in 49 CFR 173.4. DOT hazard classes covered by this exception include Class 3, Division 4.1, Division 4.2 (PGII and PGIII), Division 4.3 (PGII and PGIII), Division 5.1, Division 5.2, Division 6.1, Class 7, Class 8, and Class 9. In addition to the 30-mL container limit, additional restrictions and requirements apply. Personnel taking this exception should review 49 CFR 173.4 carefully. Finally, no 49 CFR 173.21 (forbidden) materials may be packaged, the gross weight of the completed package cannot exceed 29 kg (64 lb), and the package cannot be opened or altered until it is no longer in commerce (transport). The shipper must certify conformance with the referenced sections by marking the outside of the package with the statement “*This package conforms to 49 CFR 173.4*” or alternatively until 1 October 2001 with the statement “*This package conforms to the conditions and limitations specified in 49 CFR 173.4.*” Further, the shipper must indicate on the air waybill under nature and quantity of goods, “*Dangerous goods in Excepted Quantities.*” The IATA also requires the application of an “Excepted Quantities” label. This label contains the certification language previously identified. Label entries include shipper signature, title, date, address, and indication of the hazard class and associated United Nations (UN) number.

F.2.2.2.4 Quantity limitations. One final restriction to note is that while 49 CFR 173.4 does not have a total net quantity limitation, IATA Dangerous Goods Regulations (DGR Section 2.7.5.2) does. For packing group II materials (i.e., methanol or sodium bisulfate) the total net quantity limit is 500 mL. This equates to 33 inner (sample) containers (i.e., VOA vials) containing up to 15 mL of preservative per outer package (cooler). When shipping DOT hazardous materials by air, shippers have additional restrictions that are identified in Columns 9A/9B of the 49 CFR 172.101 Hazardous Materials Table. Net quantity limits of methanol for passenger and cargo aircraft are 1 L and 60 L, respectively. The net quantity limits for sodium bisulfate solutions are 1 L and 30 L, respectively. Shippers should note that *these* quantities exceed the IATA small-quantity exception. Therefore, if the volume of preservative (methanol or sodium bisulfate solution) is kept less than 30 mL per inner (sample) container *and* total net quantity per outer package (cooler) is limited to 500 mL, then quantity limits given in DOT Hazardous Materials Regulations or IATA Dangerous Goods Regulations are not an issue provided packaging conforms with 49 CFR 173.4.

F.2.2.2.5 HTRW-CX assistance. The HTRW-CX has coordinated with the Logistics Support Activity Packaging, Storage, and Containerization Center at Tobyhanna Army Depot, Tobyhanna, PA, to develop a standard 49 CFR 173.4 tested and certified packaging. Materials needed to assemble these sample and shipping packages are readily available to field personnel from local hardware or retail stores. The protocol established is available for USACE personnel use by contacting HTRW-CX for additional information.

F.2.3 Procedures for shipping hazardous samples.

F.2.3.1 Hazardous samples are defined as those that are typically highly contaminated, such as oils, sludges, discarded products, and items that exhibit a hazard as defined by DOT, or if it is suspected that they may be explosive, reactive, poisonous, toxic, flammable, or corrosive. Samples with visual evidence of explosives content (e.g., TNT flakes) should be considered suspect and managed appropriately. Hazardous waste samples taken for chemical analyses are normally taken in small volumes with preservation limited to cooling. Packaging and shipping requirements for hazardous samples are typically determined based on

any known contaminants or characteristics of the samples. In several cases, field screening techniques may be used to identify the packaging requirements necessary. The shipment of these samples to the laboratory may also be considered exempt from regulation under RCRA/TSCA as previously described and as referenced from 40 CFR 261.4(d) and 40 CFR 761.65(I). However, these exemptions do not pertain to DOT or IATA regulations. DOT-defined hazardous material samples must be packaged and shipped in accordance with all applicable DOT regulations, including those establishing sample container types and specifications, marking, labeling, placarding requirements, and the preparation of associated shipping papers. In most cases, the shipper will be able to package and ship these samples under the limited-quantity requirements found in column 8A, Packaging Exceptions, of the Hazardous Materials Table (49 CFR 172.101). If no limited-quantity exceptions are found in column 8A, then field personnel should use the following guidelines to determine appropriate packaging and shipping requirements.

F.2.3.2 Initially, the shipper must determine the appropriate DOT hazard class. If the shipper is unable to determine the proper DOT hazard class, due to the unknown nature of the sample, the shipper must consult 49 CFR 171-177 to determine the proper hazard class and shipping name. The next step is to look at column 8A or 8B to determine the proper outer and (if required) inner nonbulk packaging requirements and any applicable exceptions. As it is safest to assume that the materials to be shipped do meet the definitions of a DOT hazard class, the outer container must be properly labeled and marked and the shipper must comply with all regulations concerning shipping papers and placarding. The cooler, or other outer package if considered an overpack (49 CFR 171.8 and 49 CFR 173.25), must be marked and labeled accordingly. For air shipment of samples that meet the definition of a DOT-hazardous material, the shipper must also use the quantity limitations found in column 9 of the Hazardous Materials Table (49 CFR 172.101). Further recommend that the transportation by air be designated as cargo aircraft. By specifying cargo aircraft, the shipper is permitted to ship larger volumes of material in a single outer container with less stringent regulatory requirements. The requirements for packaging, packing, and shipping for hazardous samples are outlined as follows. (Note: The following protocol should be used for the shipment of hazardous samples only if the shipper is taking a limited-quantity exception, unless the “paint can” is a UN specification container (i.e., 1A2, 1B2, etc). If the shipper is not taking a limited-quantity exception, UN performance-oriented packing requirements apply. Do not assume paint cans are UN specification packages unless they are marked in accordance with 49 CFR 178.503.)

- Ensure sample container label is complete, and adequately identifies the items prescribed in Instruction F-1.
- Verify each sample cap/lid is secured onto the bottle. Tape shut the lid onto sample containers, and place each sample in a plastic bag. Activated carbon may also be placed with the sample within the plastic bag to prevent cross-contamination.
- Place evidence tape or custody seals over the sample lid and container, or over the seal of the bag for additional security, if desired.
- Squeeze as much air as possible from the bag, and seal the bag.
- Place each bottle upright in a separate paint can. Fill the paint can with vermiculite, and affix the lid to the can. The lid must be sealed with metal clips or with filament or evidence tape; if clips are used, the manufacturer typically recommends six clips.
- Place DOT Orientation arrows on the can to indicate which end is up.

- Mark each with the proper DOT shipping name and identification number for the sample. These can be found referenced in the Hazardous Materials Table. The information may be placed on stickers or printed legibly. A liquid sample of an uncertain/unknown nature is shipped as a flammable liquid with the shipping name "FLAMMABLE LIQUID, N.O.S." and the identification number "UN1993." A solid sample of uncertain nature is shipped as a flammable solid with the shipping name "FLAMMABLE SOLID, N.O.S." and the identification number "UN1325." If the nature of the sample is known, 49 CFR 171-177 is consulted to determine the proper marking, labeling and packaging requirements. Always use DOT-approved outer containers to ship samples that meet or are suspected to meet the definitions of a hazardous material.
- Place the cans upright in a cooler that has had its drain plug taped shut inside and out, and has been lined with a garbage bag. Place vermiculite or perlite on the bottom if the materials are liquid.
- All hazardous samples should be shipped to the laboratory on ice and chilled to $4\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$.
- Place additional inert packing material (styrofoam peanuts) in the cooler to partially cover the sample bottles. If samples are required to be shipped to the laboratory with ice, place bags of ice around the containers. The cooler must then be filled with packing material and the inner liner taped shut. NOTE: Do NOT use "environmentally friendly" peanuts made of starch to pack containers of liquids. These packing materials will dissolve when they get wet or moist.
- Place the paperwork going to the laboratory inside a plastic bag and tape it to the inside of the cooler lid. A copy of the COC form should be included in the paperwork sent to the laboratory. The sampler keeps one copy of the COC form. The laboratory should be notified if a sample is suspected of containing any substance for which laboratory personnel should take safety precautions.
- Close the cooler and seal with strapping tape. Place at least two custody seals on the outside of the cooler (one on the front and one on the back). More custody seals may be used at the discretion of the sampler.
- Place the following markings on the top of the cooler:
 - (1) Proper shipping name (49 CFR 172.301).
 - (2) DOT UN/North America identification number (49 CFR 172.301).
 - (3) Shipper/consignee's name and address (49 CFR 172.301).
- Place the following labels on top of the cooler (49 CFR 172.406(e)):
 - (1) Appropriate hazard class label (adjacent to PSN).
 - (2) "Cargo Aircraft Only" (as needed, per 49 CFR 172.101).
 - (3) Certification statement: "Inside (inner) packages comply with the prescribed specifications"
- Place orientation markings on two opposite vertical sides indicating "This Way Up" in addition to the markings and labels described in preceding item (49 CFR 172.312).

- Use restricted-article air bills for shipment. The “Shipper Certification for Restricted Articles” section is filled out as follows:
 - (1) Number of packages or number of coolers
 - (2) Proper shipping name
 - (3) Classification
 - (4) Identification number
 - (5) Net quantity per package or per cooler
 - (6) Radioactive materials section (leave blank)
 - (7) Note passenger or cargo aircraft
 - (8) Name and title of shipper (printed)
 - (9) Emergency telephone contact number within 24 to 48 hr
 - (10) Shipper’s signature

IATA Dangerous Goods Regulations list the hazard classes for many compounds. If the materials to be shipped cannot be found on the list, it may be necessary to use a more generic (not otherwise specified (NOS)) description. IATA regulations apply mainly to international shipment of hazardous materials by air. However a number of overnight domestic carriers (such as FedEx and UPS) also use IATA regulations to govern domestic shipments. Quantity limitations concerning hazardous materials shipments are usually the same as DOT; however, exceptions exist. IATA regulations must be reviewed if a domestic carrier requires IATA quantity limitations. Examples of PSNs that may be appropriate for samples are included in Table F-2.

F.2.4 Procedures for shipping preservatives and decontamination fluids. Preservatives and decontamination solvents used in environmental and hazardous waste sampling are often hazardous materials. These materials must also be stored and shipped in accordance with all applicable regulations. The preferred method for transporting preservatives to the site, many of which are DOT hazardous materials, is to order them from a chemical supply company and have that company ship the materials directly to the sampling site or base of operations. This reduces the liability and regulatory compliance issues that must be dealt with for field personnel. If project personnel must ship the materials defined as DOT-hazardous for use as preservatives or decontamination fluids, compliance with all applicable DOT regulations, including proper shipping containers, container markings, placarding, packaging, labeling, and shipping paper requirements is required. When Government personnel will transport preservatives and decontamination fluids to the field in a Government vehicle via highway only, the less stringent 49 CFR 173.6, Materials of Trade Exceptions, may apply. Further information on the exception can be obtained from the HTRW-CX. Procedures for shipping preservatives and decontamination fluids are outlined as follows:

- Determine the proper DOT shipping name (PSN) for the materials to be shipped. The PSN for hazardous materials will be found in 49 CFR 172.101, Hazardous Materials Table. The PSNs for the most common preservatives are given in Table F-2.

- Determine whether there is an exception for limited quantities for the material(s) to be shipped. Refer to column 8A in 49 CFR 172.101, Hazardous Materials Table, under the PSN for the specific material that needs to be shipped.
- If there is a limited-quantity exception and the materials to be shipped meet those quantity limitations for the transportation methods shown in column 9A/9B of the Hazardous Materials Table and comply with the proper packaging requirements as shown in column 8A, then the materials may be shipped as a limited quantity. “Limited Quantity” or “Ltd Qty.” must be recorded on the shipping paper after the PSN if the exception is used. Some of the quantity limitations of the more common chemicals used as preservatives in environmental samples are given in Table F-2.
- If the material does not have an exception as a limited quantity, the next step is to determine the requirements to properly package the material under DOT regulations. Refer to 49 CFR 172.101, Column 8B. In this section (packaging authorizations for nonbulk packaging), a three-digit (***) number is present. To find the proper section for packaging authorizations, see 49 CFR 173.(***). For example, under Sulfuric Acid, the three-digit number found in column 8B is 202. So the shipper should look under 49 CFR 173.202 for the packaging authorizations for shipping sulfuric acid. The materials to be shipped **MUST** comply with the required packaging.
- Determine whether there are placarding requirements for the shipment. Refer to 49 CFR 172.500 for this information.
- Ship the materials following the criteria established.

F.2.5 Potential problems.

F.2.5.1 Field personnel should be aware that there are discrepancies for nitric acid in the shipping name tables for DOT and ICAO/IATA. IATA/ICAO allow the shipment of ≤ 20 percent nitric acid via passenger aircraft and allow these concentrations to be shipped as a limited quantity. DOT does not acknowledge this PSN entry, but does acknowledge ICAO technical instructions. Refer to 49 CFR 171.11 for additional details.

F.2.5.2 Note that excessive sample preservation is very likely to bring an environmental sample into the DOT hazardous materials regulatory realm. Depending on the specific inorganic acid used as a preservative, a difference of 0.5 pH unit (e.g., pH 1.0 versus pH 1.5) will likely trigger all DOT hazardous materials communication standards and regulations. The ranges noted in Table F-2 are provided to help field personnel make the appropriate decisions associated with the classification of preserved environmental samples for transportation.

F.2.5.3 Individual samples known to contain or are highly suspected of containing PCBs at greater than or equal to 0.45 kg (1 lb) or greater than or equal to 1 percent by weight are regulated in the air mode. In this instance DOT hazardous materials regulations are applicable. Further, PCBs are regulated as a marine pollutant, which requires additional notations on the shipping paper. Readers are referred to 49 CFR 172.203.

ATTACHMENT B
ANALYTICAL LABORATORY INFORMATION



CERTIFICATE OF ACCREDITATION

ANSI-ASQ National Accreditation Board

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 ANAB
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

ANAB Approval

Certificate Valid To: 04/27/2016
Version No. 004 Issued: 10/01/2015



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
 Melanie Levesque Phone: 916-985-1000
 melanielevesque@eurofinsus.com www.eurofinsus.com

TESTING

Valid to: April 27, 2016

Certificate Number: ADE- 1451

I. Chemical

MATRIX	SPECIFIC TEST or GROUP OF ANALYTES**	SPECIFICATION OR STANDARD METHOD	* KEY EQUIPMENT OR TECHNOLOGY USED
Air	Formaldehyde and other Carbonyl Compounds	Eurofins Air Toxics SOP#11 (ASTM D 5197, EPA TO-11A, ISO 16000-3)	DNPH Cartridges, Mass Flow Controllers, Sampling Pumps, HPLC/UV
Air	VOCs	Eurofins Air Toxics SOP#122 (ASTM D 6196, EPA TO-17, ISO 16000-6, ASTM D 7339)	Sorbent Tubes, Mass Flow Controllers, Sampling Pumps, GC/MS

II. Environmental

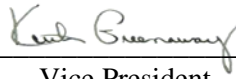
MATRIX	SPECIFIC TEST or GROUP of ANALYTES	SPECIFICATION OR STANDARD METHOD (all EPA unless specified)	* KEY EQUIPMENT OR TECHNOLOGY USED
Air and Emissions	BTEX / TPH	Modified TO-3 **	GC/PID/FID
Air and Emissions	VOCs	Modified TO-15 **	GC/MS (Full scan) GC/MS SIM
Air and Emissions	SVOCs and VOCs	Modified 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	Sulfur Compounds	Modified ASTM D-5504	GC/SCD



MATRIX	SPECIFIC TEST or GROUP of ANALYTES	SPECIFICATION OR STANDARD METHOD (all EPA unless specified)	* KEY EQUIPMENT OR TECHNOLOGY USED
Air and Emissions	VOCs	Modified TO-17 – RAD130 Passive Samplers Modified TO-17 –WMS Passive Samplers	GC/MS

Notes:

1. * = As Applicable
2. ** = These tests are accredited to the requirements of the DoD Environmental Laboratory Accreditation Program as defined in the DoD QSM V5.0. Refer to Accredited Analyte Listing for specific analytes in which the laboratory is accredited.
3. *This scope is formatted as part of a single document including the Certificate of Accreditation No. ADE- 1451*



Vice President



Eurofins Air Toxics, Inc.

Folsom, CA

Analyte	Matrix					
	Air					
	TO-15	TO-17	TO-3	TO-17 WMS	TO-17 RAD130	
Benzene	TO-15	TO-17	TO-3	TO-17 WMS	TO-17 RAD130	
Bromodichloromethane	TO-15					
Bromoform	TO-15					
2-Butanone (MEK)	TO-15	TO-17		TO-17 WMS	TO-17 RAD130	
Carbon tetrachloride	TO-15	TO-17		TO-17 WMS	TO-17 RAD130	
Chlorobenzene	TO-15	TO-17		TO-17 WMS	TO-17 RAD130	
Chloroethane	TO-15	TO-17				
Chloroform	TO-15	TO-17		TO-17 WMS	TO-17 RAD130	
Cyclohexane	TO-15	TO-17		TO-17 WMS	TO-17 RAD130	
Chlorodibromomethane	TO-15					
1,2-Dibromoethane (EDB)	TO-15					
1,2-Dichlorobenzene	TO-15	TO-17		TO-17 WMS	TO-17 RAD130	
1,4-Dichlorobenzene	TO-15	TO-17		TO-17 WMS	TO-17 RAD130	
Dichlorodifluoromethane	TO-15					
1,1-Dichloroethane	TO-15	TO-17		TO-17 WMS	TO-17 RAD130	
1,2-Dichloroethane	TO-15	TO-17		TO-17 WMS	TO-17 RAD130	
1,1-Dichloroethene	TO-15	TO-17		TO-17 WMS	TO-17 RAD130	
cis-1,2-Dichloroethene	TO-15	TO-17		TO-17 WMS	TO-17 RAD130	
1,2-Dichloropropane	TO-15	TO-17				
cis-1,3-Dichloropropene	TO-15					
trans-1,3-Dichloropropene	TO-15					
1,2-Dichlorotetrafluoroethane	TO-15	TO-17				
Ethylbenzene	TO-15	TO-17	TO-3	TO-17 WMS	TO-17 RAD130	
p-Ethyltoluene	TO-15	TO-17				
n-Heptane	TO-15	TO-17		TO-17 WMS	TO-17 RAD130	
n-Hexane	TO-15	TO-17		TO-17 WMS	TO-17 RAD130	
2-Hexanone	TO-15	TO-17				
Bromomethane	TO-15					
Chloromethane	TO-15			TO-17 WMS	TO-17 RAD130	
4-Methyl-2-pentanone (MIBK)	TO-15	TO-17		TO-17 WMS	TO-17 RAD130	
tert-Butyl methyl ether (MTBE)	TO-15	TO-17	TO-3	TO-17 WMS	TO-17 RAD130	
Propylene	TO-15					
1,1,2,2-Tetrachloroethane	TO-15	TO-17		TO-17 WMS	TO-17 RAD130	
Tetrachloroethylene	TO-15	TO-17		TO-17 WMS	TO-17 RAD130	
Toluene	TO-15	TO-17	TO-3	TO-17 WMS	TO-17 RAD130	
1,1,1-Trichloroethane	TO-15	TO-17		TO-17 WMS	TO-17 RAD130	
1,1,2-Trichloroethane	TO-15	TO-17		TO-17 WMS	TO-17 RAD130	
Trichlorofluoromethane	TO-15	TO-17				
Trichlorotrifluoroethane	TO-15	TO-17				
1,2,4-Trimethylbenzene	TO-15	TO-17		TO-17 WMS	TO-17 RAD130	
1,3,5-Trimethylbenzene	TO-15	TO-17		TO-17 WMS	TO-17 RAD130	
Vinyl chloride	TO-15	TO-17		TO-17 WMS	TO-17 RAD130	
Xylenes, total	TO-15	TO-17	TO-3			
1,3-Butadiene	TO-15	TO-17				
Ethanol	TO-15			TO-17 WMS	TO-17 RAD130	
Acetone	TO-15			TO-17 WMS	TO-17 RAD130	
2-Propanol	TO-15	TO-17			TO-17 RAD130	
Carbon disulfide	TO-15	TO-17				
3-Chloropropene	TO-15					
Methylene Chloride	TO-15	TO-17				
trans-1,2-Dichloroethene	TO-15	TO-17		TO-17 WMS	TO-17 RAD130	
Tetrahydrofuran	TO-15					
2,2,4-Trimethylpentane	TO-15	TO-17				
Trichloroethene	TO-15	TO-17		TO-17 WMS	TO-17 RAD130	
1,4-Dioxane	TO-15	TO-17				
Styrene	TO-15	TO-17		TO-17 WMS	TO-17 RAD130	

Eurofins Air Toxics, Inc.

Folsom, CA

Analyte	Matrix					
	Air					
Cumene	TO-15	TO-17				
Propylbenzene	TO-15	TO-17		TO-17 WMS	TO-17 RAD130	
1,3-Dichlorobenzene	TO-15	TO-17		TO-17 WMS	TO-17 RAD130	
alpha-chlorotoluene	TO-15					
1,2,4-Trichlorobenzene	TO-15	TO-17				
Hexachlorobutadiene	TO-15	TO-17				
m,p-Xylene	TO-15	TO-17	TO-3	TO-17 WMS	TO-17 RAD130	
o-Xylene	TO-15	TO-17	TO-3	TO-17 WMS	TO-17 RAD130	
Naphthalene	TO-15	TO-17		TO-17 WMS	TO-17 RAD130	
Ethyl Acetate				TO-17 WMS	TO-17 RAD130	
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-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					
2,5-Dimethylthiophene	ASTM D5504					
2-Ethylthiophene	ASTM D5504					
3-Methylthiophene	ASTM D5504					
Carbon Disulfide	ASTM D5504					
Carbonyl Sulfide	ASTM D5504					
Diethyl Disulfide	ASTM D5504					
Diethyl Sulfide	ASTM D5504					
Dimethyl Disulfide	ASTM D5504					
Dimethyl Sulfide	ASTM D5504					
Ethyl Mercaptan	ASTM D5504					
Ethyl Methyl Sulfide	ASTM D5504					
Hydrogen Sulfide	ASTM D5504					
Isobutyl Mercaptan	ASTM D5504					
Isopropyl Mercaptan	ASTM D5504					
Methyl Mercaptan	ASTM D5504					
n-Butyl Mercaptan	ASTM D5504					
n-Propyl Mercaptan	ASTM D5504					
tert-Butyl Mercaptan	ASTM D5504					
Tetrahydrothiophene	ASTM D5504					

Eurofins Air Toxics, Inc.

Folsom, CA

Analyte	Matrix					
	Air					
Thiophene	ASTM D5504					



OREGON

Environmental Laboratory Accreditation Program



NELAP Recognized

Eurofins Air Toxics, Inc
CA300005

180 Blue Ravine Road, Ste. B
Folsom, CA 95630

IS GRANTED APPROVAL BY ORELAP UNDER THE 2009 TNI STANDARDS, TO PERFORM ANALYSES ON ENVIRONMENTAL SAMPLES IN MATRICES AS LISTED BELOW :

<i>Air</i>	<i>Drinking Water</i>	<i>Non Potable Water</i>	<i>Solids and Chem. Waste</i>	<i>Tissue</i>
Chemistry				

AND AS RECORDED IN THE LIST OF APPROVED ANALYTES, METHODS, ANALYTICAL TECHNIQUES, AND FIELDS OF TESTING ISSUED CONCURRENTLY WITH THIS CERTIFICATE AND REVISED AS NECESSARY.

ACCREDITED STATUS DEPENDS ON SUCCESSFUL ONGOING PARTICIPATION IN THE PROGRAM AND CONTINUED COMPLIANCE WITH THE STANDARDS.

CUSTOMERS ARE URGED TO VERIFY THE LABORATORY'S CURRENT ACCREDITATION STATUS IN OREGON.

Gary K. Ward MS
Oregon State Public Health Laboratory
ORELAP Administrator
3150 NW. 229th Ave, Suite 100
Hillsboro, OR 97124



ISSUE DATE: 10/18/2015
EXPIRATION DATE: 10/17/2016
Certificate No: CA300005 - 007



Oregon

Environmental Laboratory Accreditation Program



Department of Agriculture, Laboratory Division
Department of Environmental Quality, Laboratory Division
Oregon Health Authority, Public Health Division

NELAP Recognized

ORELAP Fields of Accreditation

ORELAP ID: CA300005

EPA CODE: CA00933

Certificate: CA300005 - 008

Eurofins Air Toxics, Inc

180 Blue Ravine Road, Ste. B
Folsom CA 95630

Issue Date: 10/18/2015

Expiration Date: 10/17/2016

**As of 10/18/2015 this list supercedes all previous lists for this certificate number.
Customers. Please verify the current accreditation standing with ORELAP.**

MATRIX : Air

Reference	Code	Description
ASTM D1945 03	30024443	Natural Gas by Gas Chromatography
Analyte Code	Analyte	
4938	2-Methylbutane (Isopentane)	
4942	2-methylpropane (Isobutane)	
4323	Acetylene	
3755	Carbon dioxide	
3780	Carbon monoxide	
4747	Ethane	
4752	Ethene	
1767	Helium	
1772	Hydrogen	
4926	Methane	
5007	n-Butane	
9511	Neopentane	
1843	Nitrogen	
5028	n-Pentane	
5029	n-Propane	
3895	Oxygen	
ASTM D1946-90	30024465	Reformed Gas by Gas Chromatography
Analyte Code	Analyte	
3755	Carbon dioxide	
3780	Carbon monoxide	
4747	Ethane	
4752	Ethene	
1767	Helium	
1772	Hydrogen	
4926	Methane	
1843	Nitrogen	
3895	Oxygen	
ASTM D5504 08	30032258	Determination of Sulfur Compounds in Natural Gas and Gaseous Fuels by Gas Chromatography and Chemiluminescence
Analyte Code	Analyte	
4842	1-Propanethiol	
6113	2,5-Dimethylthiophene	
4544	2-Ethylthiophene	
4843	2-Propanethiol	
5783	3-Methylthiophene	
4450	Carbon disulfide	

ORELAP Fields of Accreditation

ORELAP ID: CA300005

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Eurofins Air Toxics, Inc

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Analyte Code	Analyte
7215	Carbonyl sulfide
6078	Diethyl Disulfide
6081	Diethyl Sulfide
4729	Dimethyl disulfide
6116	Dimethyl Sulfide
7506	Ethanethiol
3840	Hydrogen sulfide
3725	i-Butanethiol
7507	Methanethiol
9556	t-Butanethiol
9574	Tetrahydrothiophene
9578	Thiophene

EPA 325B 2013	10277437	Sorbent Tubes Coupled with Thermal Desorption and GC/MS
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Analyte Code	Analyte
4375	Benzene
4765	Ethylbenzene
5240	m+p-xylene
5250	o-Xylene
5100	Styrene
5140	Toluene

EPA TO-11A	10311805	Determination of Formaldehyde in Ambient Air Using Adsorbent Cartridge Followed by High Performance Liquid Chromatography (HPLC)
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Analyte Code	Analyte
4300	Acetaldehyde
4315	Acetone
5570	Benzaldehyde
4430	Butylaldehyde (Butanal)
4545	Crotonaldehyde
4815	Formaldehyde
3825	Hexanaldehyde (Hexanal)
6330	Isovaleraldehyde
5125	m-Tolualdehyde (1,3-Tolualdehyde)
6755	o-Tolualdehyde (1,2-Tolualdehyde)
3965	Propionaldehyde (Propanal)
6760	p-Tolualdehyde (1,4-Tolualdehyde)
4040	Valeraldehyde (Pentanal, Pentanaldehyde)

EPA TO-12	10248201	Non-Methane Organic Compounds by GC/FID
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Analyte Code	Analyte
3860	Non-methane organics

EPA TO-13A	10248405	Polycyclic Aromatic Hydrocarbons in Ambient Air by GC/MS
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Analyte Code	Analyte
5795	2-Chloronaphthalene
6385	2-Methylnaphthalene
5500	Acenaphthene
5505	Acenaphthylene
5555	Anthracene
5575	Benzo(a)anthracene
5580	Benzo(a)pyrene
5605	Benzo(e)pyrene
5590	Benzo(g,h,i)perylene
5600	Benzo(k)fluoranthene
5585	Benzo[b]fluoranthene
5855	Chrysene

ORELAP Fields of Accreditation

ORELAP ID: CA300005

EPA CODE: CA00933

Certificate: CA300005 - 008

Eurofins Air Toxics, Inc

180 Blue Ravine Road, Ste. B
Folsom CA 95630

Issue Date: 10/18/2015 Expiration Date: 10/17/2016

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Analyte Code	Analyte
5895	Dibenz(a,h) anthracene
6265	Fluoranthene
6270	Fluorene
6315	Indeno(1,2,3-cd) pyrene
5005	Naphthalene
6615	Phenanthrene
6665	Pyrene

EPA TO-13A SIM 10248449 Polycyclic Aromatic Hydrocarbons in Ambient Air by GC/MS SIM

Analyte Code	Analyte
5795	2-Chloronaphthalene
6385	2-Methylnaphthalene
5500	Acenaphthene
5505	Acenaphthylene
5555	Anthracene
5575	Benzo(a)anthracene
5580	Benzo(a)pyrene
5605	Benzo(e)pyrene
5590	Benzo(g,h,i)perylene
5600	Benzo(k)fluoranthene
5585	Benzo[b]fluoranthene
5855	Chrysene
5895	Dibenz(a,h) anthracene
6265	Fluoranthene
6270	Fluorene
6315	Indeno(1,2,3-cd) pyrene
6615	Phenanthrene
6665	Pyrene

EPA TO-14A 10248609 Volatile Organic Compounds with SUMMA canister and GC/MS

Analyte Code	Analyte
5160	1,1,1-Trichloroethane
5110	1,1,2,2-Tetrachloroethane
5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)
5165	1,1,2-Trichloroethane
4630	1,1-Dichloroethane
4640	1,1-Dichloroethylene
5155	1,2,4-Trichlorobenzene
5210	1,2,4-Trimethylbenzene
4585	1,2-Dibromoethane (EDB, Ethylene dibromide)
4695	1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon-114)
4610	1,2-Dichlorobenzene
4635	1,2-Dichloroethane (Ethylene dichloride)
4655	1,2-Dichloropropane
5215	1,3,5-Trimethylbenzene
4615	1,3-Dichlorobenzene
4620	1,4-Dichlorobenzene
4836	1-Propene
4860	2-Hexanone
4542	4-Ethyltoluene
4315	Acetone
4375	Benzene
5635	Benzyl chloride
4395	Bromodichloromethane
4455	Carbon tetrachloride
4475	Chlorobenzene
4575	Chlorodibromomethane
4485	Chloroethane (Ethyl chloride)
4505	Chloroform

ORELAP Fields of Accreditation

ORELAP ID: CA300005

EPA CODE: CA00933

Certificate: CA300005 - 008

Eurofins Air Toxics, Inc

180 Blue Ravine Road, Ste. B
Folsom CA 95630

Issue Date: 10/18/2015 **Expiration Date:** 10/17/2016

As of 10/18/2015 this list supercedes all previous lists for this certificate number. Customers. Please verify the current accreditation standing with ORELAP.

Analyte Code	Analyte
4705	cis & trans-1,2-Dichloroethene
4680	cis-1,3-Dichloropropene
4555	Cyclohexane
4625	Dichlorodifluoromethane (Freon-12)
4750	Ethanol
4765	Ethylbenzene
4835	Hexachlorobutadiene
4895	Isopropyl alcohol (2-Propanol, Isopropanol)
4950	Methyl bromide (Bromomethane)
4960	Methyl chloride (Chloromethane)
4975	Methylene chloride (Dichloromethane)
5005	Naphthalene
4825	n-Heptane
4855	n-Hexane
5090	n-Propylbenzene
5100	Styrene
5115	Tetrachloroethylene (Perchloroethylene)
5120	Tetrahydrofuran (THF)
5140	Toluene
4685	trans-1,3-Dichloropropylene
5170	Trichloroethene (Trichloroethylene)
5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)
5235	Vinyl chloride
5260	Xylene (total)

EPA TO-15

10248803

VOCs collected in Canisters by GC/MS

Analyte Code	Analyte
5160	1,1,1-Trichloroethane
5110	1,1,2,2-Tetrachloroethane
5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)
5165	1,1,2-Trichloroethane
4630	1,1-Dichloroethane
4640	1,1-Dichloroethylene
5182	1,2,3-Trimethylbenzene
5155	1,2,4-Trichlorobenzene
5210	1,2,4-Trimethylbenzene
4585	1,2-Dibromoethane (EDB, Ethylene dibromide)
4695	1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon-114)
4610	1,2-Dichlorobenzene
4635	1,2-Dichloroethane (Ethylene dichloride)
4655	1,2-Dichloropropane
5215	1,3,5-Trimethylbenzene
9318	1,3-Butadiene
4615	1,3-Dichlorobenzene
4676	1,3-Diethylbenzene
4620	1,4-Dichlorobenzene
4735	1,4-Dioxane (1,4- Diethyleneoxide)
4917	1-Butene
4833	1-Pentene
4836	1-Propene
5220	2,2,4-Trimethylpentane
4666	2,2-Dimethylbutane
4667	2,3,4-Trimethylpentane
4669	2,3-Dimethylbutane
4671	2,3-Dimethylpentane
4672	2,4-Dimethylpentane
4410	2-Butanone (Methyl ethyl ketone, MEK)
4538	2-Ethyltoluene
4860	2-Hexanone
4934	2-Methyl-2-Butene

ORELAP Fields of Accreditation

ORELAP ID: CA300005

EPA CODE: CA00933

Certificate: CA300005 - 008

Eurofins Air Toxics, Inc

180 Blue Ravine Road, Ste. B
Folsom CA 95630

Issue Date: 10/18/2015 Expiration Date: 10/17/2016

As of 10/18/2015 **this list supercedes all previous lists for this certificate number.**
Customers. Please verify the current accreditation standing with ORELAP.

Analyte Code	Analyte
4937	2-Methylbutadiene (Isoprene)
4938	2-Methylbutane (Isopentane)
4939	2-Methylheptane
4946	2-Methylhexane
4941	2-Methylpentane (Isohexane)
4942	2-methylpropane (Isobutane)
4531	3-Ethyltoluene
4529	3-Methyl-1-Butene
4532	3-Methylheptane
4533	3-Methylhexane
4534	3-Methylpentane
4542	4-Ethyltoluene
4913	4-Methyl-1-Pentene
4995	4-Methyl-2-pentanone (MIBK)
4300	Acetaldehyde
4315	Acetone
4320	Acetonitrile
4323	Acetylene
4325	Acrolein (Propenal)
4340	Acrylonitrile
4355	Allyl chloride (3-Chloropropene)
4375	Benzene
5635	Benzyl chloride
4390	Bromochloromethane
4395	Bromodichloromethane
4400	Bromoform
4450	Carbon disulfide
4455	Carbon tetrachloride
4475	Chlorobenzene
4575	Chlorodibromomethane
4485	Chloroethane (Ethyl chloride)
4505	Chloroform
4525	Chloroprene (2-Chloro-1,3-butadiene)
4705	cis & trans-1,2-Dichloroethene
4680	cis-1,3-Dichloropropene
4602	cis-2-Butene
4603	cis-2-pentene
4555	Cyclohexane
4562	Cyclopentane
4563	Cyclopentene
4625	Dichlorodifluoromethane (Freon-12)
4627	Dichlorofluoromethane (Freon 21)
4747	Ethane
4750	Ethanol
4752	Ethene
4765	Ethylbenzene
4835	Hexachlorobutadiene
4895	Isopropyl alcohol (2-Propanol, Isopropanol)
4900	Isopropylbenzene
5240	m+p-xylene
4930	Methanol
4950	Methyl bromide (Bromomethane)
4960	Methyl chloride (Chloromethane)
5000	Methyl tert-butyl ether (MTBE)
4965	Methylcyclohexane
4966	Methylcyclopentane
4975	Methylene chloride (Dichloromethane)
5005	Naphthalene
5007	n-Butane
5875	n-Decane
4825	n-Heptane

ORELAP Fields of Accreditation

ORELAP ID: CA300005

EPA CODE: CA00933

Certificate: CA300005 - 008

Eurofins Air Toxics, Inc

180 Blue Ravine Road, Ste. B
Folsom CA 95630

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Expiration Date: 10/17/2016

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Analyte Code	Analyte
4855	n-Hexane
5026	n-Nonane
5027	n-Octane
5028	n-Pentane
5029	n-Propane
5090	n-Propylbenzene
6747	n-Undecane
5250	o-Xylene
5253	p-Diethylbenzene
5100	Styrene
5115	Tetrachloroethylene (Perchloroethylene)
5120	Tetrahydrofuran (THF)
5140	Toluene
4685	trans-1,3-Dichloropropylene
4607	trans-2-Butene
4606	trans-2-Hexene
4608	trans-2-pentene
5170	Trichloroethene (Trichloroethylene)
5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)
5225	Vinyl acetate
5230	Vinyl bromide (Bromoethane)
5235	Vinyl chloride
5260	Xylene (total)

EPA TO-15 GC/MS SIM

10248858

VOCs collected in Canisters by GC/MS SIM

Analyte Code	Analyte
5160	1,1,1-Trichloroethane
5110	1,1,2,2-Tetrachloroethane
5165	1,1,2-Trichloroethane
4630	1,1-Dichloroethane
4640	1,1-Dichloroethylene
4585	1,2-Dibromoethane (EDB, Ethylene dibromide)
4695	1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon-114)
4635	1,2-Dichloroethane (Ethylene dichloride)
4620	1,4-Dichlorobenzene
4375	Benzene
4455	Carbon tetrachloride
4485	Chloroethane (Ethyl chloride)
4505	Chloroform
4645	cis-1,2-Dichloroethylene
4625	Dichlorodifluoromethane (Freon-12)
4765	Ethylbenzene
5240	m+p-xylene
4960	Methyl chloride (Chloromethane)
5000	Methyl tert-butyl ether (MTBE)
5005	Naphthalene
5250	o-Xylene
5115	Tetrachloroethylene (Perchloroethylene)
5140	Toluene
4700	trans-1,2-Dichloroethylene
5170	Trichloroethene (Trichloroethylene)
5235	Vinyl chloride

EPA TO-17

10312206

Determination of Volatile Organic Compounds in Ambient Air Using
Active Sampling Onto Sorbent Tubes

Analyte Code	Analyte
5160	1,1,1-Trichloroethane
5110	1,1,2,2-Tetrachloroethane
5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)
5165	1,1,2-Trichloroethane

ORELAP Fields of Accreditation

ORELAP ID: CA300005

EPA CODE: CA00933

Certificate: CA300005 - 008

Eurofins Air Toxics, Inc

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Analyte Code	Analyte
4630	1,1-Dichloroethane
4640	1,1-Dichloroethylene
5155	1,2,4-Trichlorobenzene
5210	1,2,4-Trimethylbenzene
4695	1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon-114)
4610	1,2-Dichlorobenzene
4635	1,2-Dichloroethane (Ethylene dichloride)
4655	1,2-Dichloropropane
5215	1,3,5-Trimethylbenzene
9318	1,3-Butadiene
4615	1,3-Dichlorobenzene
4620	1,4-Dichlorobenzene
4735	1,4-Dioxane (1,4- Diethyleneoxide)
6380	1-Methylnaphthalene
5220	2,2,4-Trimethylpentane
4410	2-Butanone (Methyl ethyl ketone, MEK)
4860	2-Hexanone (MBK)
4938	2-Methylbutane (Isopentane)
6385	2-Methylnaphthalene
4542	4-Ethyltoluene
5500	Acenaphthene
5505	Acenaphthylene
5555	Anthracene
4375	Benzene
4450	Carbon disulfide
4455	Carbon tetrachloride
4475	Chlorobenzene
4485	Chloroethane (Ethyl chloride)
4505	Chloroform
4645	cis-1,2-Dichloroethylene
4555	Cyclohexane
4765	Ethylbenzene
6265	Fluoranthene
6270	Fluorene
4835	Hexachlorobutadiene
4895	Isopropyl alcohol (2-Propanol, Isopropanol)
4900	Isopropylbenzene
5240	m+p-xylene
5000	Methyl tert-butyl ether (MTBE)
4965	Methylcyclohexane
4975	Methylene chloride (Dichloromethane)
5005	Naphthalene
4825	n-Heptane
4855	n-Hexane
5090	n-Propylbenzene
5250	o-Xylene
6615	Phenanthrene
6665	Pyrene
5100	Styrene
5115	Tetrachloroethylene (Perchloroethylene)
5140	Toluene
4700	trans-1,2-Dichloroethylene
5170	Trichloroethene (Trichloroethylene)
5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)
5235	Vinyl chloride
5260	Xylene (total)

EPA TO-17 Modified 2

10312217

Hydrocarbons in Ambient Air Using WMS Passive Sampling Tubes

Analyte Code	Analyte
5160	1,1,1-Trichloroethane

ORELAP Fields of Accreditation

ORELAP ID: CA300005

EPA CODE: CA00933

Certificate: CA300005 - 008

Eurofins Air Toxics, Inc

180 Blue Ravine Road, Ste. B
Folsom CA 95630

Issue Date: 10/18/2015 Expiration Date: 10/17/2016

As of 10/18/2015 **this list supercedes all previous lists for this certificate number.**
Customers. Please verify the current accreditation standing with ORELAP.

Analyte Code	Analyte
5110	1,1,2,2-Tetrachloroethane
5165	1,1,2-Trichloroethane
4630	1,1-Dichloroethane
4640	1,1-Dichloroethylene
5150	1,2,3-Trichlorobenzene
5155	1,2,4-Trichlorobenzene
5210	1,2,4-Trimethylbenzene
4610	1,2-Dichlorobenzene
4635	1,2-Dichloroethane (Ethylene dichloride)
5215	1,3,5-Trimethylbenzene
4615	1,3-Dichlorobenzene
4620	1,4-Dichlorobenzene
9546	1,4-Dithiane
4410	2-Butanone (Methyl ethyl ketone, MEK)
4995	4-Methyl-2-pentanone (MIBK)
4315	Acetone
6698	alpha-Pinene
4375	Benzene
4455	Carbon tetrachloride
4475	Chlorobenzene
4505	Chloroform
4645	cis-1,2-Dichloroethylene
4555	Cyclohexane
6208	d-Limonene
4750	Ethanol
4755	Ethyl acetate
4765	Ethylbenzene
6774	Halothane (2-Bromo-2-chloro-1,1,1-trifluoroethane)
5240	m+p-xylene
4960	Methyl chloride (Chloromethane)
4990	Methyl methacrylate
5000	Methyl tert-butyl ether (MTBE)
5005	Naphthalene
4825	n-Heptane
4855	n-Hexane
5090	n-Propylbenzene
5250	o-Xylene
5100	Styrene
5115	Tetrachloroethylene (Perchloroethylene)
5140	Toluene
4700	trans-1,2-Dichloroethylene
5170	Trichloroethene (Trichloroethylene)
5235	Vinyl chloride

EPA TO-3

10249000

Cryogenic Trapping

Analyte Code	Analyte
4375	Benzene
4765	Ethylbenzene
5140	Toluene
5260	Xylene (total)

Modified EPA TO-17 Passive RAD130 Tube 2 60032351

The Determination of Hydrocarbons in Air Via RAD130 RADIELLO
Passive Sample Tubes

Analyte Code	Analyte
5160	1,1,1-Trichloroethane
5110	1,1,2,2-Tetrachloroethane
5165	1,1,2-Trichloroethane
4630	1,1-Dichloroethane
4640	1,1-Dichloroethylene
5210	1,2,4-Trimethylbenzene

ORELAP Fields of Accreditation

ORELAP ID: CA300005

EPA CODE: CA00933

Certificate: CA300005 - 008

Eurofins Air Toxics, Inc

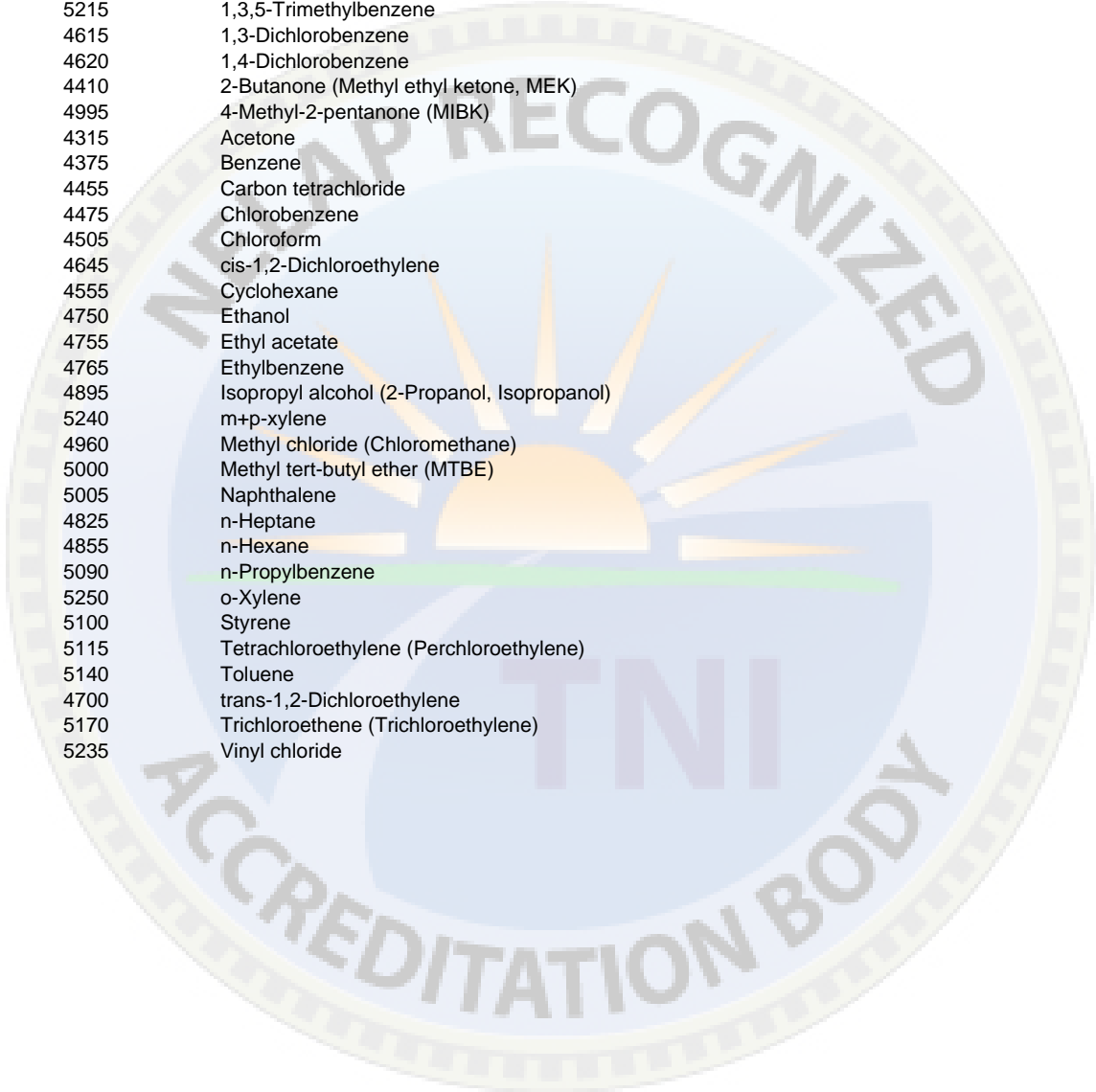
180 Blue Ravine Road, Ste. B
Folsom CA 95630

Issue Date: 10/18/2015

Expiration Date: 10/17/2016

As of 10/18/2015 this list supercedes all previous lists for this certificate number. Customers. Please verify the current accreditation standing with ORELAP.

Analyte Code	Analyte
4610	1,2-Dichlorobenzene
4635	1,2-Dichloroethane (Ethylene dichloride)
5215	1,3,5-Trimethylbenzene
4615	1,3-Dichlorobenzene
4620	1,4-Dichlorobenzene
4410	2-Butanone (Methyl ethyl ketone, MEK)
4995	4-Methyl-2-pentanone (MIBK)
4315	Acetone
4375	Benzene
4455	Carbon tetrachloride
4475	Chlorobenzene
4505	Chloroform
4645	cis-1,2-Dichloroethylene
4555	Cyclohexane
4750	Ethanol
4755	Ethyl acetate
4765	Ethylbenzene
4895	Isopropyl alcohol (2-Propanol, Isopropanol)
5240	m+p-xylene
4960	Methyl chloride (Chloromethane)
5000	Methyl tert-butyl ether (MTBE)
5005	Naphthalene
4825	n-Heptane
4855	n-Hexane
5090	n-Propylbenzene
5250	o-Xylene
5100	Styrene
5115	Tetrachloroethylene (Perchloroethylene)
5140	Toluene
4700	trans-1,2-Dichloroethylene
5170	Trichloroethene (Trichloroethylene)
5235	Vinyl chloride



Method: EPA Method TO-14A/TO-15 Volatile Organic Compounds (Standard/Quad)

Eurofins Air Toxics SOP #6 Revision 33 Effective Date: March 16, 2015 Methods Manual Summary

Description: This method involves full scan gas chromatograph/mass spectrometer (GC/MS) analysis of whole air samples collected in evacuated stainless steel canisters. Samples are analyzed for volatile organic compounds (VOCs) using EPA Method TO-14A/TO-15 protocols. An aliquot of up to 0.5 liters of air is withdrawn from the canister utilizing a volumetric syringe, volumetric loop, or mass flow controller. This volume is loaded onto a hydrophobic multibed sorbent trap to remove water and carbon dioxide and to concentrate the vapor sample. The focused sample is then flash-heated to sweep adsorbed VOCs onto a secondary trap for further concentration and/or directly onto a GC/MS for separation and detection.

Eurofins Air Toxics maintains a suite of TO-14A/TO-15 methods, each optimized to efficiently meet the data objectives for a wide range of targeted concentration ranges. The methods, their reporting limits, and typical applications are summarized in the table below. This method summary describes TO-14A/TO-15 (Standard or Quad).

Eurofins Air Toxics Method	Base Reporting Limits	Typical Application
TO-14A/TO-15 (5&20)	5 – 20 ppbv	Soil gas and ppmv range vapor matrices
TO-14A/TO-15 (Standard or Quad)	0.5 – 5.0 ppbv	Ambient air, soil gas, and ppbv level vapor matrices
TO-14A/TO-15 (Low-level)	0.1 – 0.5 ppbv	Indoor and outdoor air
TO-14A/TO-15 SIM	0.003 – 0.5 ppbv	Indoor and outdoor air

Certain compounds are not included in Eurofins Air Toxics' standard target analyte list. These compounds are communicated at the time of client proposal request. Unless otherwise directed, Eurofins Air Toxics reports these non-routine compounds with partial validation. Validation may include a 3-point calibration with the lowest concentration defining the reporting limit, no second source verification analyzed, and no method detection limit study performed unless previous arrangements have been made. In addition, stability of the non-standard compound during sample storage is not validated. Full validation may be available upon request.

Eurofins Air Toxics takes no modifications of technical significance to Method TO-15 for the "Quad" configurations. Since Eurofins Air Toxics applies TO-15 methodology to all Summa canisters regardless of whether TO-14A or TO-15 is specified by the project, the laboratory performs a modified version of method TO-14A as detailed in Table 1. Please note that Methods TO-14A and TO-15 were validated for specially treated canisters. As such, the use of Tedlar bags for sample collection is outside the scope of the method and not recommended for ambient or indoor air samples. It is the responsibility of the data user to determine the usability of TO-14A and TO-15 results generated from Tedlar bags.

Table 1. Summary of TO-14A Method Modifications

Requirement	TO-14A	Eurofins Air Toxics Modifications
Sample Drying System	Nafion Drier	Multibed hydrophobic sorbent
Blank acceptance criteria	≤ 0.2 ppbv	≤ RL
BFB ion abundance criteria	Ion abundance criteria listed in Table 4 of TO-14A	Follow abundance criteria listed in TO-15.
BFB absolute abundance criteria	Within 10% when comparing to the previous daily BFB	CCV internal standard area counts are compared to ICAL; corrective action when recovery is less than 60%.
Initial Calibration	≤ 30% RSD for listed 39 VOCs	≤ 30% RSD with 2 of Eurofins Air Toxics' 62 standard compounds allowed out to ≤ 40% RSD

The standard target analyte list, reporting limit (RL) also referred to as Limit of Quantitation, QC criteria, and QC summary can be found in Tables 2 through 5.

Table 2. Method TO-14A/TO-15 Analyte List (Quad)

Analyte	RL/LOQ (ppbv)	QC Acceptance Criteria			
		ICAL (%RSD)	CCV (%R)	ICV/LCS (%R)	Precision Limits (Max. RPD)
1,1,2,2-Tetrachloroethane	0.5	≤ 30%	70 – 130	70 – 130	± 25
1,1,2-Trichloroethane	0.5	≤ 30%	70 – 130	70 – 130	± 25
1,1-Dichloroethane	0.5	≤ 30%	70 – 130	70 – 130	± 25
1,1-Dichloroethene	0.5	≤ 30%	70 – 130	70 – 130	± 25
1,2,4-Trichlorobenzene	2.0	≤ 30%	70 – 130	70 – 130	± 25
1,2,4-Trimethylbenzene	0.5	≤ 30%	70 – 130	70 – 130	± 25
1,2-Dibromoethane (EDB)	0.5	≤ 30%	70 – 130	70 – 130	± 25
1,2-Dichlorobenzene	0.5	≤ 30%	70 – 130	70 – 130	± 25
1,2-Dichloroethane	0.5	≤ 30%	70 – 130	70 – 130	± 25
1,2-Dichloropropane	0.5	≤ 30%	70 – 130	70 – 130	± 25
1,3,5-Trimethylbenzene	0.5	≤ 30%	70 – 130	70 – 130	± 25
1,3-Dichlorobenzene	0.5	≤ 30%	70 – 130	70 – 130	± 25
1,4-Dichlorobenzene	0.5	≤ 30%	70 – 130	70 – 130	± 25
Benzene	0.5	≤ 30%	70 – 130	70 – 130	± 25
Bromomethane*	5.0	≤ 30%	70 – 130	70 – 130	± 25
Carbon Tetrachloride	0.5	≤ 30%	70 – 130	70 – 130	± 25
Chlorobenzene	0.5	≤ 30%	70 – 130	70 – 130	± 25
Chloroethane	2.0	≤ 30%	70 – 130	70 – 130	± 25
Chloroform	0.5	≤ 30%	70 – 130	70 – 130	± 25

Analyte	RL/LOQ (ppbv)	QC Acceptance Criteria			
		ICAL (%RSD)	CCV (%R)	ICV/LCS (%R)	Precision Limits (Max. RPD)
Chloromethane	5.0	≤ 30%	70 – 130	70 – 130	± 25
Chlorotoluene (Benzyl Chloride)	0.5	≤ 30%	70 – 130	70 – 130	± 25
cis-1,2-Dichloroethene	0.5	≤ 30%	70 – 130	70 – 130	± 25
cis-1,3-Dichloropropene	0.5	≤ 30%	70 – 130	70 – 130	± 25
Dichloromethane (Methylene Chloride)	5.0	≤ 30%	70 – 130	70 – 130	± 25
Ethylbenzene	0.5	≤ 30%	70 – 130	70 – 130	± 25
Freon 11 (Trichlorofluoromethane)	0.5	≤ 30%	70 – 130	70 – 130	± 25
Freon 113 (Trichlorotrifluoroethane)	0.5	≤ 30%	70 – 130	70 – 130	± 25
Freon 114	0.5	≤ 30%	70 – 130	70 – 130	± 25
Freon 12 (Dichlorodifluoromethane)	0.5	≤ 30%	70 – 130	70 – 130	± 25
Hexachlorobutadiene	2.0	≤ 30%	70 – 130	70 – 130	± 25
m,p-Xylene	0.5	≤ 30%	70 – 130	70 – 130	± 25
Methyl Chloroform (1,1,1-Trichloroethane)	0.5	≤ 30%	70 – 130	70 – 130	± 25
o-Xylene	0.5	≤ 30%	70 – 130	70 – 130	± 25
Styrene	0.5	≤ 30%	70 – 130	70 – 130	± 25
Tetrachloroethene	0.5	≤ 30%	70 – 130	70 – 130	± 25
Toluene	0.5	≤ 30%	70 – 130	70 – 130	± 25
trans-1,3-Dichloropropene	0.5	≤ 30%	70 – 130	70 – 130	± 25
Trichloroethene	0.5	≤ 30%	70 – 130	70 – 130	± 25
Vinyl Chloride	0.5	≤ 30%	70 – 130	70 – 130	± 25
1,3-Butadiene	0.5	≤ 30%	70 – 130	70 – 130	± 25
1,4-Dioxane	2.0	≤ 30%	70 – 130	70 – 130	± 25
2-Butanone (Methyl Ethyl Ketone)	2.0	≤ 30%	70 – 130	70 – 130	± 25
2-Hexanone	2.0	≤ 30%	70 – 130	70 – 130	± 25
4-Ethyltoluene	0.5	≤ 30%	70 – 130	70 – 130	± 25
4-Methyl-2-Pentanone (MIBK)	0.5	≤ 30%	70 – 130	70 – 130	± 25
Acetone	5.0	≤ 30%	70 – 130	70 – 130	± 25
Bromodichloromethane	0.5	≤ 30%	70 – 130	70 – 130	± 25
Bromoform	0.5	≤ 30%	70 – 130	70 – 130	± 25
Carbon Disulfide	2.0	≤ 30%	70 – 130	70 – 130	± 25
Cyclohexane	0.5	≤ 30%	70 – 130	70 – 130	± 25
Dibromochloromethane	0.5	≤ 30%	70 – 130	70 – 130	± 25
Ethanol	2.0	≤ 30%	70 – 130	70 – 130	± 25
Heptane	0.5	≤ 30%	70 – 130	70 – 130	± 25
Hexane	0.5	≤ 30%	70 – 130	70 – 130	± 25

Analyte	RL/LOQ (ppbv)	QC Acceptance Criteria			
		ICAL (%RSD)	CCV (%R)	ICV/LCS (%R)	Precision Limits (Max. RPD)
Isopropanol	2.0	≤ 30%	70 – 130	70 – 130	± 25
Methyl t-Butyl Ether (MTBE)	0.5	≤ 30%	70 – 130	70 – 130	± 25
Tetrahydrofuran	0.5	≤ 30%	70 – 130	70 – 130	± 25
trans-1,2-Dichloroethene	0.5	≤ 30%	70 – 130	70 – 130	± 25
2,2,4-Trimethylpentane	0.5	≤ 30%	70 – 130	70 – 130	± 25
Cumene	0.5	≤ 30%	70 – 130	70 – 130	± 25
Propylbenzene	0.5	≤ 30%	70 – 130	70 – 130	± 25
3-Chloroprene	2.0	≤ 30%	70 – 130	70 – 130	± 25
Naphthalene**	1.0	≤ 40%	60 – 140	60 – 140	± 25
TPH (Gasoline) ***	50	1-Point Calibration	N/A	ICV only; 60 – 140	± 25
NMOC (Hexane/Heptane)***	10	1-Point Calibration	N/A	NA	± 25

*Bromomethane recovery can be variable due to moisture/sorbent interactions specifically on the 2-trap concentration system. Data may require qualifier flags.

**Due to its low vapor pressure, Naphthalene may exceed TO-15 performance requirements. The wider QC limits reflect typical performance. Although Naphthalene is not on Eurofins Air Toxics “standard” TO-15 list, it is commonly requested and included in Table 2.

***TPH and NMOC are not on Eurofins Air Toxics’ “standard” TO-15 list, but are included in Table 2 due to common requests.

Table 3. Internal Standards

Table 4. Surrogates

Analyte	Accuracy (% R)	Analyte	Accuracy (% R)
Bromochloromethane	60 – 140	1,2-Dichloroethane-d ₄	70 – 130
1,4-Difluorobenzene	60 – 140	Toluene-d ₈	70 – 130
Chlorobenzene-d ₅	60 – 140	4-Bromofluorobenzene	70 – 130

Table 5. Summary of Calibration and QC Procedures for Methods TO-14A/TO-15

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Tuning Criteria	Every 24 hours	TO-15 ion abundance criteria	Correct problem then repeat tune.
Minimum 5-Point Initial Calibration (ICAL)	Prior to sample analysis	% RSD \leq 30 with 2 compounds allowed out to \leq 40% RSD	Correct problem then repeat Initial Calibration curve.
Initial Calibration Verification and Laboratory Control Spike (ICV and LCS)	After each Initial Calibration curve, and daily prior to sample analysis	Recoveries for 85% of "Standard" compounds must be 70–130%. No recovery may be $<$ 50%. If specified by the client, in-house generated control limits may be used.	Check the system and reanalyze the standard. Re-prepare the standard if necessary to determine the source of error. Re-calibrate the instrument if the primary standard is found to be in error.
Initial Calibration Verification and Laboratory Control Spike (ICV and LCS) for Non-standard compounds	Per client request or specific project requirements only	Recoveries of compounds must be 60–140%. No recovery may be $<$ 50%.	Check the system and reanalyze the standard. Re-prepare the standard if necessary to determine the source of error. Re-calibrate the instrument if the primary standard is found to be in error.
Continuing Calibration Verification (CCV) for Standard compounds	At the start of each analytical clock after the tune check	70–130%	Compounds exceeding this 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%, corrective action will be taken. If any compound exceeds 60–140%, 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.
Continuing Calibration Verification (CCV) for Non-standard Compounds	Per client request or specific project requirements only.	Recoveries of compounds must be 60–140%. No recovery may be $<$ 50%.	Check the system and reanalyze the standard. Re-prepare the standard if necessary to determine the source of error. Re-calibrate the instrument if the primary standard is found to be in error.
Laboratory Blank	After analysis of standards and prior to sample analysis, or when contamination is present.	Results less than the laboratory reporting limit	Inspect the system and re-analyze the blank. "B"-flag data for common contaminants.
Internal Standard (IS)	As each standard, blank, and sample is being loaded	Retention time (RT) for blanks and samples must be within \pm 0.33 min of the RT in the CCV and within \pm 40% of the area counts of the daily CCV internal standards.	For blanks: Inspect the system and reanalyze the blank. For samples: Re-analyze the sample. If the ISs are within limits in the re-analysis, report the second analysis. If ISs are out-of-limits a second time, dilute the sample until ISs are within acceptance limits and narrate.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Surrogates	As each standard, blank, and sample is being loaded	70–130% If specified by the client, in-house generated control limits may be used.	For blanks: Inspect the system and reanalyze the blank. For samples: Re-analyze the sample unless obvious matrix interference is documented. If the %Rs are within limits in the re-analysis, report the second analysis. If %Rs are out-of-limits a second time, report data from first analysis and narrate.
Laboratory Duplicates – Laboratory Control Spike Duplicates (LCSD)	One per analytical batch	RPD \leq 25%	Narrate exceedances. If more than 5% of compound list is outside criteria or if compound has >40%RPD, investigate the cause and perform maintenance as required. If instrument maintenance is required, calibrate as needed.

Method: ASTM D5504 – Sulfur Compounds
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Eurofins Air Toxics SOP #13 Revision 18 Effective Date: September 4, 2014 Methods Manual Summary

Description: This method involves gas chromatograph (GC) analysis of whole air samples for sulfur compounds collected in Tedlar bags. Detection of volatile sulfur compounds is accomplished using a Sulfur Chemiluminescence Detector (SCD) following method ASTM D5504.

Care should be taken to ensure samples to be analyzed for reduced sulfur compounds do not come into contact with any metal surfaces. In addition, because of the reactivity of Hydrogen Sulfide (H₂S), and mercaptans, samples collected in Tedlar bags should be analyzed within 24 hours of collection. Samples collected in Tedlar bags should also be protected from heat and light.

Certain compounds are not included in Eurofins Air Toxics' standard target analyte list. These compounds are communicated at the time of client proposal request. Unless otherwise directed, the laboratory reports these non-standard compounds with partial validation. Validation includes a 3-point calibration with the lowest concentration defining the reporting limit, no second source verification is analyzed, and no method detection limit study is performed unless previous arrangements have been made. In addition, stability of the non-standard compound during sample storage is not validated. Full validation may be available upon request.

The laboratory is not equipped to handle >100 ppmv levels of sulfur compounds. Please notify the laboratory if ppmv levels of sulfur compounds are anticipated.

Method Modifications:

Modifications to ASTM D5504-12 used to carry out the analyses of air samples appear in Table 1.

Table 1. Summary of Method Modifications

Requirement	ASTM D5504	ATL Modifications
Sulfur Standards	Use compressed gases and permeation devices to generate calibration standards.	Compressed gases are used for Hydrogen Sulfide, Carbonyl Sulfide, and Methyl Mercaptan. Other sulfurs compounds are blended in the vapor phase using methanolic stock standards.

The Quality Control (QC) elements listed in the latest ASTM Method D5504-12 are suggested, *not required*. In general, calibration protocols followed by the laboratory are designed to meet standard NELAP and EPA environmental data acceptance criteria. Several method suggestions of note are not included in the laboratory QC procedures unless requested by the client. The deviations from the method recommendations are as follows:

- Calibration is not accomplished using a 3-point calibration forced through zero.
- Daily calibration standards are not analyzed in triplicate to meet the requirement that consecutive runs yield a maximum span of 5%.
- Relative response factor normalized with the number of sulfur atoms is not compared to Hydrogen Sulfide and evaluated against the 5% difference criterion.
- All field samples are not analyzed in duplicate.
- Daily spiked field samples are not analyzed.
- Calibration standard re-analysis is performed at the end of the analytical batch as recommended; however, acceptance criterion is 70-130% instead of 90-110%.

Additionally, upon special request, Eurofins Air Toxics provides passivated canisters for sulfur collection. *Air Toxics does not examine passivated canisters for continued sulfur stability as required by the method, and previous studies have demonstrated that recoveries of the glass-lined canisters indicate a potential loss of inertness which can vary from canister to canister.* Sample analysis results derived from passivated canister media are reported with the appropriate narration. Per the ASTM D5504 method, the storage time when using a passivated/lined canister is not to exceed 7 days.

The standard target analyte list, reporting limits (RL), QC criteria, and QC summary can be found in the following tables.

Table 1. ASTM Method D5504 Compound List and QC Limits

Analyte	RL (ppbv)	QC Acceptance Criteria		
		ICAL (% RSD)	LCS/ CCV* (% R)	Precision (% RPD)
2,5-Dimethylthiophene	4.0	≤ 30	70 – 130	≤ 25
2-Ethylthiophene	4.0	≤ 30	70 – 130	≤ 25
3-Methylthiophene	4.0	≤ 30	70 – 130	≤ 25
Carbon Disulfide	5.0	≤ 30	70 – 130	≤ 25
Carbonyl Sulfide	4.0	≤ 30	70 – 130	≤ 25
Diethyl Disulfide	4.0	≤ 30	70 – 130	≤ 25
Diethyl Sulfide	4.0	≤ 30	70 – 130	≤ 25
Dimethyl Disulfide	4.0	≤ 30	70 – 130	≤ 25
Dimethyl Sulfide	4.0	≤ 30	70 – 130	≤ 25
Ethyl Mercaptan	4.0	≤ 30	70 – 130	≤ 25
Ethyl Methyl Sulfide	4.0	≤ 30	70 – 130	≤ 25
Hydrogen Sulfide	4.0	≤ 30	70 – 130	≤ 25
Isobutyl Mercaptan	4.0	≤ 30	70 – 130	≤ 25
Isopropyl Mercaptan	4.0	≤ 30	70 – 130	≤ 25
Methyl Mercaptan	4.0	≤ 30	70 – 130	≤ 25
n-Butyl Mercaptan	4.0	≤ 30	70 – 130	≤ 25
n-Propyl Mercaptan	4.0	≤ 30	70 – 130	≤ 25
tert-Butyl Mercaptan	4.0	≤ 30	70 – 130	≤ 25
Tetrahydrothiophene	4.0	≤ 30	70 – 130	≤ 25
Thiophene	4.0	≤ 30	70 – 130	≤ 25

*The recovery for all analytes should be 70-130%; end check recoveries are 70-130% with 2 allowed out up to 60-140%. The recovery for Hydrogen Sulfide, Carbonyl Sulfide and Carbon Disulfide must be 70-130%.

Table 2. Summary of Calibration and QC Procedures for ASTM Method D 5504

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Initial Calibration (ICAL)	Prior to sample analysis	A minimum of 5 points (3 points may be accepted to meet sample hold times.) % RSD \leq 30	Evaluate system. Re-prepare and/or re-analyze calibration points.
Second Source Verification (LCS)	With each Initial Calibration; with each analytical batch.	70–130% of the expected values for all the compounds	Check the system, re-prepare and/or re-analyze standard. Re-calibrate instrument if CCV shows similar recoveries. If recoveries are high and no detections are expected, sample analysis may proceed. If hold-time is at risk, flagging and narration of non-compliant compounds may be appropriate.
Continuing Calibration Verification (CCV)	Daily prior to sample analysis	%Recovery = 70–130%	Check the system, re-prepare and re-analyze standard. Re-calibrate instrument if re-analysis shows similar recoveries. If recoveries are high and no detections are expected, sample analysis may proceed. If hold-time is at risk, flagging and narration of non-compliant may be appropriate.
Laboratory Blank	After daily LCS and after high level samples and mid-check standards as needed	Results less than the laboratory reporting limit.	Inspect the system and re-prepare the lab blank bag. Flag associated detections with a “B” flag.
End Check	At the end of the analytical sequence	Recoveries within 70–130% with 2 target analytes not exceeding 60–140%. The recovery for Hydrogen Sulfide, Carbonyl Sulfur and Carbon Disulfide must be 70–130%.	Re-analyze the standard to confirm loading procedure. If the 2 nd analysis fails, identify and correct the problem. If possible re-analyze all or a subset samples after the last compliant QC check. If re-analysis within hold-time is not possible, flag data affected data. No flags are required if recovery is high and no associated compounds are detected.

Laboratory Duplicates – LCS/LCSD	One per analytical batch	RPD \leq 25%	Verify that the sample or LCS is securely attached to the sample introduction line. If a problem is identified, document in the run log and re-analyze the duplicate pair. If no loading problem is identified, narrate exceedances. If LCSD is analyzed immediately after LCS and precision is not met, notify manager or technical support team before proceeding with sample analysis.
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Method: ASTM D1945 – Fixed Gases & C1-C6

Eurofins Air Toxics SOP #54 Revision 20 Effective Date: August 28, 2014 Methods Manual Summary

Description: This method involves gas chromatograph (GC) analysis of soil gas, landfill gas, ambient air, or stack gas collected in Summa™ canisters, Tedlar bags, or any vessel that has been demonstrated to be clean and leak free. Samples are analyzed for Methane and fixed gases and can be used to speciate individual light hydrocarbons up to C6. This method is also used to provide an estimation of the heating value of the gas by method ASTM D3588. Because the sample is withdrawn from the vessel by positive pressure, rigid containers are first filled to positive pressure using UHP Helium or Nitrogen. Samples are then analyzed using a GC equipped with a Flame Ionization Detector (FID) and a Thermal Conductivity Detector (TCD).

Certain compounds are not included in Eurofins Air Toxics' standard target analyte list. These compounds are communicated at the time of client proposal request. Unless otherwise directed, the laboratory reports these non-standard compounds with partial validation. Validation includes a 5-point calibration with the lowest concentration defining the reporting limit (RL), no second source verification is analyzed, and no method detection limit study is performed unless previous arrangements have been made. In addition, stability of the non-standard compounds during sample storage is not validated. Full validation may be available upon request.

Since the protocols in the ASTM D1945 standard were designed for the analysis of natural gas, the laboratory has made modifications in order to apply the method to environmental samples covering a wide concentration range and to implement standard NELAP and EPA calibration criteria. The method modifications, standard target analyte list, RL, Quality Control (QC) criteria, and QC summary can be found in the following tables.

Table 1. Summary of Method Modifications for ASTM D1945

Requirement	ASTM D1945	Eurofins Air Toxics Modifications
Sample Injection Volume	0.50 mL to achieve Methane linearity.	1.0 mL
Calibration	A single point calibration is performed using a reference standard closely matching the composition of the unknown. Standard is analyzed such that 2 consecutive runs meet method repeatability requirements.	A minimum 5-point calibration curve is performed. Quantitation is based on the initial calibration response factor. A single run of a mid-level calibration standard is used to verify the initial calibration and may or may not resemble the composition of the associated samples.
Sample Analysis	Equilibrate samples to 20-50° F above source temperature at field sampling.	No heating of samples is performed.
Sample Calculation	Response factor is calculated using peak height for C5 and lighter compounds.	Peak areas are used for all target analytes to quantitate concentrations.
Normalization	Sum of original values should not differ from 100.0% by more than 1.0%.	Sum of original values may range between 85–115%; normalization of data not performed unless client requested.

Table 2. ASTM Method D1945 Compound List and QC Limits

Analyte	Reporting Limit (%)	QC Acceptance Criteria		
		ICAL (%RSD)	CCV/LCS/ICV (%R)	Precision* (%RPD)
Carbon Dioxide	0.01	≤ 15%	± 15%	≤ 25%
Carbon Monoxide	0.01	≤ 15%	± 15%	≤ 25%
Ethene	0.001	≤ 15%	± 15%	≤ 25%
Ethane	0.001	≤ 15%	± 15%	≤ 25%
Acetylene	0.001	≤ 15%	± 15%	≤ 25%
Isobutane	0.001	≤ 15%	± 15%	≤ 25%
Isopentane	0.001	≤ 15%	± 15%	≤ 25%
Methane	0.0001	≤ 15%	± 15%	≤ 25%
n-Butane	0.001	≤ 15%	± 15%	≤ 25%
Neopentane	0.001	≤ 15%	± 15%	≤ 25%
n-Pentane	0.001	≤ 15%	± 15%	≤ 25%
Nitrogen**	0.10	≤ 15%	± 15%	≤ 25%
NMOC (C6+)	0.01	≤ 15%	± 15%	≤ 25%
Oxygen	0.10	≤ 15%	± 15%	≤ 25%
Propane	0.001	≤ 15%	± 15%	≤ 25%
Hydrogen***	0.01	≤ 15%	± 15%	≤ 25%
Helium****	0.05	≤ 15%	± 15%	≤ 25%

* For detections at > 5X the Reporting Limit.

**For canisters that have been pressurized with Nitrogen, the amount of Nitrogen in the sample is determined by subtraction.

***For canisters that have been pressurized with Helium, the Reporting Limit is 1.0%.

****Included by special request only.

Note: Results are reported in units of mol %. If required to report volume % or ppmV, a compressibility factor of 1 for all gases will be assumed. As a result, mol % is assumed to be equivalent to volume %. This assumption may result in a bias for highly compressible gases at high concentrations and pressures.

Table 3. Summary of Calibration and QC Procedures for Mod. ASTM Method D1945

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Initial Calibration (ICAL)	Prior to sample analysis and annually	$\leq 15\%$ RSD	Correct problem, then repeat Initial Calibration.
Initial Calibration Verification and Laboratory Control Spike (ICV and LCS)	After each Initial Calibration and once per analytical batch.	85–115% Recovery If specified by the client, in-house generated control limits may be used.	Check the system and re-analyze the standard. Re-prepare the standard if necessary. If the primary standard is found to be in error, re-prepare the primary and calibrate the instrument.
Continuing Calibration Verification (CCV)	Daily prior to sample analysis, and can be used as an End Check.	$\pm 15\%$ Difference	Check the system and re-analyze the standard. Re-prepare the standard if necessary. Re-calibrate the instrument if the criteria cannot be met. If the closing CCV fails, the system is checked and the standard is re-analyzed. Re-prepare the standard if necessary. If the second analysis fails, identify and correct the problem, then re-analyze all samples since the last acceptable CCV.
Laboratory Blank	After analysis of standards and prior to sample analysis, or when contamination is present.	Results less than the laboratory Reporting Limit	Inspect the system and re-analyze the Laboratory Blank.
Laboratory Duplicates-Laboratory Control Spike Duplicate (LCSD)	One per analytical batch	RPD $\leq 25\%$	Narrate exceedances. Investigate the cause and perform maintenance as required and re-calibrate as needed.

ATTACHMENT C
FIELD DOCUMENTATION FORMS

PM Jeff Fenton
Ft. Ord. GW monitoring 0406
12/14

Team 2
SB/SK
Sounder 36392
Cor. -.06

0746 @ MW-02-04-180 WL-94.57
SN2 @ 103' Cor. -.06

0757 sampled # 0650L002024F
Dropped 1 @ 2

0808 @ MW-12-05-180 WL-74.61
SN3 @ 88' Cor. -.06

¹⁸
0820 sampled # 0650L012025F & 026D
Dropped 1 @ 3

0835 @ MW-10-04-180 WL-259.75
SN2 @ 271' Cor. -.06

0845 sampled # 0650L010027F
Dropped 1 @ 2

0902 @ MW-002-25-A WL-129.38
SN4 @ 146' Cor. -.06

0910 sampled # 0650L002028F
Dropped 1 @ 4

0919 @ MW-002-53-180 WL-204.09
SN5 @ 259' Cor. -.06

0927 sampled # 0650002029F
Dropped 1 @ 5

0934 @ MW-002-39-180 WL-203.99
SN4 @ 244' Cor. -.06

0943 sampled # 0650L002030F
Dropped 1 @ 4

Team 2
SB/SK
12/14/06

0950 @ MW-002-24-180 WL-187.97
SN3 @ 214 Cor. -.06

1002 sampled # 0650L002031F
Dropped 1 @ 3

1009 @ MW-002-09-180R WL-156.08
SN2 @ 199' Cor. -.06

¹⁰²²
1024 sampled # 0650L002032F & 033D
Dropped 1 @ 2

1029 @ MW-002-06-A WL-106.26
SN6 @ 128' Cor. -.06

1039 sampled # 0650L002034F
Dropped 1 @ 6

1046 @ MW-002-06-180R WL-157.87
SN4 @ 214' Cor. -.06

1053 sampled # 0650L002035F (ms/msd)
Dropped 1 @ 4

1110 @ MW-002-07-180R WL-182.36
SN3 @ 233' Cor. -.06

1117 sampled # 0650L002036F
Dropped 1 @ 3

1123 @ MW-002-05-180 WL-155.49
SN4 @ 215' Cor. -.06

1130 sampled # 0650L002037F
Dropped 1 @ 1

**UNITED STATES ARMY CORPS OF ENGINEERS
PROJECT SITE SAFETY LOG**

GENERAL DATA

Job # _____

Activity _____

Location Description _____

**DOCUMENTATION OF DAILY MORNING SAFETY MEETING:
TOPICS OF DISCUSSION (check all that apply)**

_____ scope of work/SAP	_____ PPE requirements
_____ potential hazards	_____ equipment calibration
_____ health and safety plan highlights/revisions	_____ special topics (specify) _____
_____ emergency procedures	_____

MEETING ATTENDEES:

NAME	DATE	COMPANY	SIGNATURE

DAILY INSPECTIONS: (Site crew chief shall initial each completed inspection)

_____ PPE	_____ required eyewash station filled, and charged
_____ field equipment	_____ fire extinguisher
_____ vehicles	_____ communication check
_____ safety equipment	method _____
_____ field health and safety binder in vehicle	time _____
_____ first aid kit	

Note any deficiencies:

I acknowledge that the above health and safety program self audit and inspections have been performed prior to the initiation of scheduled work.

Signature of Site Health and Safety Officer (SHSO) _____

LIST OF AUTHORIZED VISITORS NOT NORMALLY ASSIGNED TO THIS SITE

(Note: SHSO must initial verification that each personnel record is present in the field binder.)

NAME	HAZWOPER CERTIFICATION	MEDICAL CLEARANCE	RESPIRATOR FIT TEST	FIRST AID/CPR

I have read and become familiar with all aspects of the Site Safety and Health Plan. I also understand that the Site Safety and Health Plan may be supplemented with other site--specific health and safety documents for which I will be held equally responsible.

NAME	DATE	COMPANY	SIGNATURE



296 12th St
Marina, CA 93933
(831) 384-3735

CHAIN OF CUSTODY

Chain of Custody #: _____

Project Information:							Analysis Requested								Lab Sample Receipt		
Project Location: _____			Sampler/s: _____												Laboratory Sample Delivery		
Project Name: _____			Report To: Ahtna Environmental												Group #: _____		
Project Number: _____			E-Mail: _____												Custody Seal: _____		
Sampling Event: _____			Laboratory: Eurofins Air Toxics														
Lab Number	Sample Collection		Matrix	# of Containers	Preservative												
	Date	Time			None	HNO ₃	NaOH	HCL	H ₂ SO ₄	MeOH	NaHSO ₄	Other					
Sample Number/Description	Date	Time	Matrix	# of Containers	None	HNO ₃	NaOH	HCL	H ₂ SO ₄	MeOH	NaHSO ₄	Other					

Turnaround Time:	<input checked="" type="checkbox"/> : Standard _____ : 3-5 Day Rush _____ : 48 Hour Rush _____ : 24 Hour Rush	Shipment Method: _____
Comments:	Tracking ID: _____	
Chain of Custody Tracking:		
Relinquished By Sampler: _____	Date/Time: _____	Received By: _____
Relinquished By: _____	Date/Time: _____	Received By: _____
Relinquished By: _____	Date/Time: _____	Received By Laboratory: _____
		Date/Time: _____



INSTRUMENT CALIBRATION RECORD

Daily Log	Date:			
	No.			
	Sheet	1 Of		1

PROJECT NAME: FORT ORD, CA Project Number: 05055.02.15

FIELD ACTIVITY SUBJECT: Calibration of Landtec GEM 2000

DESCRIPTION OF DAILY ACTIVITIES AND EVENTS

Landtec Calibration Gas (high-level) Lot# _____, Expiration Date: _____

Compound	Initial Reading	Calibrated to	Comments
CH4		50%	
CO2		35%	

Landtec Calibration Gas (Oxygen) Lot# _____, Expiration Date: _____

Compound	Initial Reading	Calibrated to	Comments
O2		4%	

VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS:

WEATHER CONDITIONS:	IMPORTANT TELEPHONE CALLS:

PERSONNEL ON SITE:

SIGNATURE: _____ DATE: _____

ATTACHMENT D
THREE PHASE QUALITY CONTROL PROCESS AND
DOCUMENTATION

PREPARATORY PHASE INSPECTION COVER SHEET

Contract No.: _____

Date: _____

Task No.: _____

Location/Project: _____

A. Key Personnel Present:

	<u>Name</u>	<u>Position</u>	<u>Company</u>
1.	_____	_____	_____
2.	_____	_____	_____
3.	_____	_____	_____
4.	_____	_____	_____
5.	_____	_____	_____
6.	_____	_____	_____
7.	_____	_____	_____
8.	_____	_____	_____
9.	_____	_____	_____
10.	_____	_____	_____

B. Submittals:

1. Review submittals and/or submittal register. Have all applicable submittals been approved?
Yes ___ No ___

If No, what items have not been submitted?

- a. _____
- b. _____
- c. _____

USACE Representative Signature

Quality Control Manager Signature

INVESTIGATION PROJECT PREPARATORY PHASE INSPECTION CHECKLIST

Assessment Activity	Assessment Mechanism	Person(s) Responsible	Response Action	Completed by/Date
Have planning documents been prepared in accordance with the statement of work, regulatory requirements, and contract requirements?	Quality control review of document by Project Manager and QC reviewer.	Project Manager, QC Reviewer	Modify document as directed by reviewers	
Prior to project activities: Have planning documents been read by appropriate project personnel (including subcontractors) before work is conducted.	Documentation (e.g., sign-off form, note to file, email acknowledgement) that document has been read and requirements are understood.	Subcontractors as required. Project Manager, Task Manager, and Project Chemist to check signoff and forms.	Direct project personnel to read relevant documents.	
Prior to project activities: Has required preliminary work (e.g., clearance activities, permits, site access) been completed in accordance with project plan.	Comparison of information obtained from preliminary work completion assessment as specified in the project planning document(s).	Project Manager, Safety and Health Officer, Quality Control Manager, Task Manager, Project Chemist, Field Staff	Delay startup if necessary preliminary work has not been completed. Implement corrective actions by directing appropriate personnel or subcontractors to complete necessary preliminary work.	
Prior to project activities: Are staff and subcontractors prepared to implement project activities according to planning documents?	Review and discussion of planned activities prior to implementation.	Project Manager, Safety and Health Officer, Quality Control Manager, Task Manager, Project Chemist, Field staff.	Delay startup if staff and subcontractors are not prepared to implement activities <i>in</i> accordance with specification.	
Prior to project activities: Is necessary field equipment available and in acceptable working order?	Compare field equipment list with planned activities. Compare field equipment calibration documentation with project goals specified in the SAP.	Project Manager, Quality Control Manager, Task Manager, Project Chemist, Field staff.	Delay startup if equipment is unavailable or not in proper working order. Implement corrective actions to include use of alternate equipment, or recalibration of available equipment.	

INITIAL PHASE INSPECTION COVER SHEET

Contract No.: _____

Date: _____

Task No.: _____

Location/Project: _____

Description and Location of Work
Inspected: _____

A. Key Personnel Present:

	<u>Name</u>	<u>Position</u>	<u>Company</u>
1.	_____	_____	_____
2.	_____	_____	_____
3.	_____	_____	_____
4.	_____	_____	_____
5.	_____	_____	_____
6.	_____	_____	_____
7.	_____	_____	_____
8.	_____	_____	_____
9.	_____	_____	_____
10.	_____	_____	_____

Quality Control Manager Signature

INITIAL PHASE INSPECTION CHECKLIST

Assessment Activity	Assessment Mechanism	Person(s) Responsible	Response Action	Completed by/Date
Beginning of project activity: Is work being performed according to project plans?	Conduct field and laboratory audits.	Project Manager, Quality Control Manager, Task Manager, Project Chemist, Field staff.	Stop work if audits indicate significant deviation from project plan. Implement immediate or long- term corrective actions. Communicate deficiencies to USACE Project Manager.	
Early phase of project: Have necessary audits been performed?	Review project phase and check to see if required audits have been satisfactorily completed.	Project Manager, Project Manager, Quality Control Manager_	Stop work if reviewer decides that absence of audit jeopardizes successful implementation of project plans. Immediately schedule necessary audits.	
Ongoing throughout project: Are daily quality control reports being prepared according to contract requirements?	Review daily CQCRs from field supervisors.	Project Manager, Task Manager, Project Chemist, Project Staff	Correct deficiencies in reports or reporting delays.	
Ongoing throughout project: Do project plans adequately address any changes in project activities or goal?	Compare data gathered to assess conformance to the project plan and conceptual site model.	Project Manager, Safety and Health Officer, Quality Control System Manager, Task Manager, Project Chemist, Field staff.	Stop work if assessor decides that project plan deficiencies are significant. Implement corrective action to include modification of project plans. Notify USACE Project Manager.	
Ongoing throughout project: Do project plans adequately address any changes in project activities or goals?	Compare data gathered to assess conformance to the conceptual site model, data quality objectives, and project plan.	Project Manager, Quality Control Manager, Task Manager, Project Chemist, data users and evaluators.	Stop work if assessor decides that project plan deficiencies are significant. Implement corrective action to include modification of project plans. Notify USACE Project Manager. Identify data gaps.	

FOLLOW-UP PHASE INSPECTION COVER SHEET

Contract No.: _____

Date: _____

Task No.: _____

Location/Project: _____

Project/Area of Inspection:

A. Key Personnel Present:

	<u>Name</u>	<u>Position</u>	<u>Company</u>
1.	_____	_____	_____
2.	_____	_____	_____
3.	_____	_____	_____
4.	_____	_____	_____
5.	_____	_____	_____
6.	_____	_____	_____
7.	_____	_____	_____
8.	_____	_____	_____
9.	_____	_____	_____
10.	_____	_____	_____

B. Definable Features of Work:

Status of Inspection:

_____	_____
_____	_____
_____	_____
_____	_____
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_____	_____

Quality Control Manager

FOLLOW-UP PHASE INSPECTION CHECKLIST

Assessment Activity	Assessment Mechanism	Person(s) Responsible	Response Action	Completed by/Date
Reporting phase of project: Have data reports been prepared in accordance with project plans?	Compare data reports to specifications detailed in planning documents.	Project Manager, Quality Control Manager, Task Manager, Project Chemist, data users and evaluators.	Revise documents and reports as appropriate.	
After draft report submittal or project completion: Are reports adequate to meet client and regulatory agency requirements?	Review client and agency comments. Prepare responses to comments.	Project Manager, Quality Control Manager, Task Manager, Project Chemist, data users and evaluators.	Revise documents and reports as appropriate.	
Have other definable features of work been completed in accordance to project requirements	Compare definable features of work with project requirements.	Project Manager, Quality Control Manager	Complete definable feature of work as required.	

ATTACHMENT E
ELECTRONIC DATA DELIVERABLE FILE SPECIFICATIONS

ADR Electronic Data Deliverable (EDD) File Specifications

The ADR EDD consists of three separate, comma-delimited ASCII text files or Excel CSV files (two, if instrument calibration information is not required by the project). Each file corresponds to a table in the ADR application. These tables are identified as the Analytical Results Table (A1), Laboratory Instrument Table (A2), and Sample Analysis Table (A3). Each file follows the naming convention of using the Laboratory Reporting Batch ID (SDG Number or some other identifier for the EDD) followed by the table identifier (A1, A2, or A3), and then a ".txt" or ".csv" extension. For example, the EDD file names for a laboratory reporting batch identified as SDG001 that includes instrument calibration data would be as follows.

SDG001A1.txt or SDG001A1.csv
SDG001A2.txt or SDG001A2.csv (A2 file is optional)
SDG001A3.txt or SDG001A3.csv

Analytical Results Table (A1 File)

The Analytical Results table contains analytical results and related information on an analyte level for field samples and associated laboratory quality control samples (excluding calibrations and tunes). Field QC blanks and laboratory method blanks must report a result record for each analyte reported within a method. The method target analyte list is matrix dependent and specified in the project library. Laboratory control samples (LCS and LCSD) and matrix spike samples (MS and MSD) must report a result record for every analyte specified as a spiked analyte in the project library. The project library is a reference table ADR uses for both EDD error checking and automated data review. The project library is populated with information from the project QAPP. Refer to the User Manual for detailed information on project libraries. Table 1 in this document lists all field names and their descriptions for the Analytical Results Table (A1).

Laboratory Instrument Table (A2 File)

The Laboratory Instrument table contains results and related information on an analyte level for instrument initial calibration standards, initial calibration verification standards, continuing calibration standards, and GC/MS tunes. A record must exist for each target analyte reported in a method (specified in the project library), for every calibration type (the field named QCType) associated to samples reported in the EDD. Initial calibrations, initial calibration verifications, and associated samples are linked to each other using a unique Run Batch ID for every distinct initial calibration within a method. Continuing calibrations and associated samples are linked to each other using a unique Analysis Batch ID for every distinct continuing calibration within a method. GC/MS tunes are linked to initial and continuing calibrations (and hence samples) using the Run Batch and Analysis Batch IDs respectively. The Laboratory Instrument Table (A2) is optional. Depending on the level of validation required by the data user, the Laboratory Instrument table may not be requested in the deliverable. Table 2 in this document lists field names and descriptions for the Laboratory Instrument Table (A2).

Sample Analysis Table (A3 File)

The Sample Analysis table contains information on a sample level for field samples and laboratory quality control analyses (excluding calibrations and tunes). A sample record exists for each sample/method/matrix/analysis type combination. Table 3 in this document lists field names and descriptions for the Sample Analysis Table (A3).

EDD Field Properties

Tables 1, 2, and 3 in this document specify the EDD field properties for each file. These include the field name and sequence, field name description, data type and length for each field, and whether or not a particular field requires a standard field. Field elements in the EDD must be sequenced according to the order they appear in Tables 1, 2, and 3. For example, in the Analytical Result table (the A1 file), the field “ClientSampleID” will always be the first piece of information to start a new line of data (or database record), followed by the fields “LabAnalysisRefMethodID”, “AnalysisType”, and so on.

Table 4 in this document lists standard values for those fields that hold standard values. Required field constraints depend on the combination of sample, matrix, method, analyte type, and calibration or QC type information reported in a record. Tables 5 through 9 in this document indicate required fields for each EDD file (table) according to the method category, matrix, analyte type, sample, and QC or calibration type reported in a record.

When creating an EDD as a text file, use the ASCII character set in a file of lines terminated by a carriage return and line feed. No characters are allowed after the carriage return and line feed. Enclose each data set in double quotes (") and separate each field by a comma (comma delimited). Data fields with no information (null) may be represented by two consecutive commas. For example, in the Sample Analysis table, since the “Collected”, “ShippingBatchID”, and “Temperature” fields do not apply to laboratory generated QA/QC samples, the record for a Laboratory Control Sample by Method 8270C would be entered as follows. Note that the first two fields (“ProjectNumber” and “ProjectName”) are omitted in this example.

...“LCSW100598”,,”AQ”,,”LCSW100598”,,”LCS”,,”8270C”,... (and so on)

Do not pad fields with leading or trailing spaces if a field is populated with less than the maximum allowed number of characters. In the above example, although the “MatrixID” field can accommodate up to 10 characters, only 2 characters were entered in this field.

The EDD can be constructed within Excel and saved as .csv file for import into the application. Be sure to format all cells as text beforehand, otherwise Excel will reformat entered values in some cases.

Table 1

Field Descriptions for the Analytical Results Table (A1 file)

Contains laboratory test results and related information for field and QC samples (excluding instrument calibrations) on an analyte level for environmental chemistry including radiochemistry

Field Name	Field Name Description	Field Type	Field Length	Standard Value List
ClientSampleID	<p>Client or contractor's identifier for a field sample as reported on the chain-of-custody</p> <p>If a sample is analyzed as a laboratory duplicate, matrix spike, or matrix spike duplicate, append suffixes DUP, MS and MSD respectively to the Client Sample ID with no intervening spaces or hyphens (i.e. MW01DUP, MW01MS, and MW01MSD). For Method Blanks, LCS, and LCSD enter the unique LaboratorySampleID into this field</p> <p>Do not append suffixes to the ClientSampleID for dilutions, reanalyses, or re-extracts (the AnalysisType field is used for this distinction). For example, MW01<u>DL</u> and MW01<u>RE</u> are not allowed</p> <p>Parent sample records must exist for each MS and MSD. If an MS/MSD is shared between two EDDs, records for the MS/MSD and its parent sample must exist in the Analytical Results table for both EDDs.</p>	Text	25	NO
LabAnalysisRefMethodID	Laboratory reference method ID. The method ID may be an EPA Method number or a Lab Identifier for a method such as a SOP Number, however; method ID is specified by the project. The method ID must be entered into the standard list.	Text	25	YES (specified in project plan)
AnalysisType	Defines the analysis type (i.e., Dilution, Reanalysis, etc.). This field provides distinction for sample result records when multiple analyses are submitted for the same sample, method, and matrix; for example dilutions, re-analyses, and re-extracts.	Text	10	YES (See Table 4)
LabSampleID	<p>Laboratory tracking number for field samples and lab generated QC samples such as method blank, LCS, and LCSD. There are no restrictions for the LabSampleID except for field length and that the LabSampleID must be distinct for a given field sample or lab QC sample and method.</p> <p>Suffixes may be applied to the LabSampleID to designate dilutions, reanalysis, etc.</p>	Text	25	NO
LabID	Identification of the laboratory performing the analyses.	Text	7	NO
ClientAnalyteID	<p>CAS Number or unique client identifier for an analyte or isotope.</p> <p>If a CAS Number is not available, use a unique identifier provided by the client or contractor. The ClientAnalyteID for a particular target analyte or isotope should be specified by the project and must exist in the standard value tables for Analytes.</p> <p>For the LCS, LCSD, MS, and MSD, it is only necessary to report the compounds designated as spikes in the library (and surrogates for organic methods.)</p> <p>For TICs from GC/MS analyses, enter the retention time in decimal minutes as the Client Analyte ID.</p>	Text	12	YES (specified by project)

Table 1

Field Descriptions for the Analytical Results Table (A1 file)

Contains laboratory test results and related information for field and QC samples (excluding instrument calibrations) on an analyte level for environmental chemistry including radiochemistry

Field Name	Field Name Description	Field Type	Field Length	Standard Value List
AnalyteName	Chemical name for the analyte or isotope. The project specifies how an analyte or isotope is named. The analyte name must be associated to a ClientAnalyteID in the standard values table for Analytes (excluding compounds designated as TIC's).	Numeric	60	YES (specified by project)
Result	Result value for the analyte or isotope. Entries must be numeric. For non-detects of target analytes or isotopes and spikes, do not enter "ND" or leave this field blank. If an analyte or spike was not detected, enter the reporting limit value corrected for dilution and percent moisture as applicable. Do not enter "0"	Text	10	NO
ResultUnits	The units defining how the values in the Result, DetectionLimit, and ReportingLimit fields are expressed. For radiochemistry this also includes how the value in the Error field is expressed.	Text	10	YES (specified by project in the library)
LabQualifiers	A string of single letter result qualifiers assigned by the lab based on client-defined rules and values. <u>The "U" Lab Qualifier must be entered for all non-detects.</u> Other pertinent lab qualifiers may be entered with the "U" qualifier. Order is insignificant. Lab qualifiers other than those listed in the standard values table may be used. If so, these must be added to the standard value table in the application.	Text	7	YES (See Table 4)
DetectionLimit	For radiochemistry methods, the minimum detectable activity for the isotope being measured. For all other methods: The minimum detection limit value for the analyte being measured. For DoD QSM enter the Limit of Detection (LOD)	Numeric	10	NO
DetectionLimitType	Specifies the type of detection limit (i.e., MDA, MDL, IDL, etc.).	Text	10	YES (See Table 4)
RetentionTime or Error	<u>For radiochemistry methods only</u> , enter the 2 Sigma Counting Error. The units for error are entered in the ResultUnits field. <u>For GC/MS methods only</u> , enter the time expressed in decimal minutes between injection and detection for <u>GC/MS TICs only</u> <u>For target analytes in all other methods</u> , leave this field blank. Note: GC retention times are not evaluated at this time.	Text	5	NO
AnalyteType	Defines the type of result, such as tracer, surrogate, spike, or target compound.	Text	7	YES (See Table 4)

Table 1

Field Descriptions for the Analytical Results Table (A1 file)

Contains laboratory test results and related information for field and QC samples (excluding instrument calibrations) on an analyte level for environmental chemistry including radiochemistry

Field Name	Field Name Description	Field Type	Field Length	Standard Value List
PercentRecovery	<p>For radiochemistry methods: The tracer yield, if applicable.</p> <p>For all other analytical methods: The percent recovery value of a spiked compound or surrogate.</p> <p>If the spike or surrogate was not recovered because of dilution, enter "DIL". If a spike or surrogate was not recovered because of matrix interference, enter "INT". If a spike or surrogate was not recovered because it was not added to the sample, enter "NS".</p>	Numeric	5	NO
RelativePercentDifference	<p>The relative percent difference (RPD) of two QC results, such as MS/MSD, LCS/LCSD, and Laboratory Duplicates. Report RPD in Laboratory Duplicate, LCSD, and MSD records only.</p> <p>If the RPD is not calculable, enter "NC".</p>	Numeric	5	NO
ReportingLimit	<p>Reporting limit value for the measured analyte or isotope Factor in the dilution factor and percent moisture correction, if applicable. The Reporting Limit for each analyte and matrix in a given method is specified in the project library or QAPP.</p> <p>For DoD QSM enter the Limit of Quantitation (LOQ)</p>	Numeric	10	NO
ReportingLimitType	<p>Specifies the type of reporting limit (i.e., CRQL, PQL, SQL, RDL, etc). The Reporting Limit Type for each method and matrix is specified in the project library or QAPP.</p>	Text	10	YES (specified by the project)

Table 1

Field Descriptions for the Analytical Results Table (A1 file)

Contains laboratory test results and related information for field and QC samples (excluding instrument calibrations) on an analyte level for environmental chemistry including radiochemistry

Field Name	Field Name Description	Field Type	Field Length	Standard Value List
ReportableResult	<p>This field indicates whether or not the laboratory chooses an individual analyte or isotope result as reportable. Enter "YES" if the result is reportable. Enter "NO" if the result is not reportable. This field applies to target analytes only.</p> <p>If only one analysis is submitted for a particular sample and method, enter "YES" for all target compounds (where Analyte Type = TRG). For GC/MS methods enter yes for tentatively identified compounds (where Analyte Type = TIC).</p> <p>If two or more analyses are submitted for a particular sample and method (i.e. initial analysis, reanalysis and/or dilutions), enter "YES" from only <u>one</u> of the analyses for each target compound. For example: a sample was run a second time at dilution because benzene exceeded the calibration range in the initial, undiluted analysis. All target analytes are reported in each analysis. For the initial analysis, (Analysis Type = RES), enter "NO" for benzene and enter "YES" for all other compounds. For the diluted analysis (Analysis Type = DL), enter "YES" for benzene and enter "NO" for all other compounds.</p> <p>For TICs (Analyte Type = TIC), if more than one analysis is submitted for a particular sample and method, choose only one of the analyses where Reportable Result = YES for <u>all</u> TICs. For example, a sample was run a second time because one or more target compounds exceeded the calibration range in the undiluted analysis. Choose a particular analysis and enter "YES" for all TICs. In the other analysis enter "NO" for all TICs.</p> <p>Note that it is not necessary to report the full target analyte list for the initial result, dilution, re-analysis, or re-extraction. However, each target analyte must be reported YES once and once only in the case of multiple analyses for a given sample, method, and matrix. In the case of organics, all surrogates must be reported for all analyses submitted for a given sample, method, and, matrix.</p>	Text	3	YES (See Table 4)
MDL_DoD	<p>This field is not part of the standard ADR EDD format.</p> <p>For DoD QSM enter the MDL, otherwise leave blank. (ADR does not perform error checks on this field)</p>	Numeric	10	NO

Table 2**Field Descriptions for the Laboratory Instrument Table (A2 file)**

Contains related to laboratory instrument calibration on an analyte level and GC/MS Tune information. This table is optional depending on project requirements. **Do not report Table A2 for radiochemistry methods.**

Field Name	Field Name Description	Field Type	Field Length	Standard Value List
InstrumentID	Laboratory instrument identification.	Text	15	NO
QCType	Type of instrument QC (i.e., Instrument_Performance_Check or type of calibration standard).	Text	10	YES (See Table 4)
Analyzed	Analysis date/time for BFB, DFTPP, initial calibration verification standards, calibration verification standards, and continuing calibration standards. For the <u>initial calibration</u> , enter date and time of the <u>last</u> standard analyzed. Also, see comments about initial calibrations in the Alternate_Lab_Analysis_ID field name description.	Date/Time	*	NO
AlternateLab_AnalysisID	Common laboratory identification used for standards (i.e., VOA STD50, CCAL100, BFB50, etc). For initial calibration, enter ICAL. Information from the initial calibration is entered as one record for each analyte that summarizes the results of the initial calibration (i.e. %RSD, correlation coefficient, and avg RF). Records are <u>not</u> entered for each individual standard within the initial calibration.	Text	12	NO
LabAnalysisID	Unique identification of the raw data electronic file associated with the calibration standard or tune (i.e., 9812101MS.DV). Leave this field blank for the initial calibration. See comments about initial calibrations in the Alternate_Lab_Analysis_ID field description. This field is only applicable where an electronic instrument file is created as part of the analysis.	Text	15	NO
LabAnalysisRefMethodID	Laboratory reference method ID (i.e., 8260B, 8270C, 6010B, etc.). The method ID is specified by the project. The LabAnalysisRefMethodID must be in the standard value list for Method IDs.	Text	25	YES (specified by the project)
ClientAnalyteID	CAS number or unique client identifier for an analyte. If a CAS number is not available, use a unique identifier provided by the client. The unique identifier for a particular analyte should be specified by the project and must exist in the standard value list for ClientAnalyteID. Records for each calibration must report the full target analyte list including surrogates as applicable. The target analyte list is specified for each method and matrix in the project	Text	12	YES (specified by the project)
AnalyteName	The chemical name for the analyte. The project specifies how an analyte is named. The AnalyteName must be associated to a ClientAnalyteID in the standard values.	Text	60	YES (specified by the project)

Table 2**Field Descriptions for the Laboratory Instrument Table (A2 file)**

Contains related to laboratory instrument calibration on an analyte level and GC/MS Tune information. This table is optional depending on project requirements. **Do not report Table A2 for radiochemistry methods.**

Field Name	Field Name Description	Field Type	Field Length	Standard Value List
RunBatch	Unique identifier for a batch of analyses performed on one instrument under the control of one initial calibration and initial calibration verification. The Run Batch ID links both the initial calibration and initial calibration verification to subsequently analyzed and associated continuing calibrations, field samples, and QC analyses. For GC/MS methods, the Run_Batch ID also links a BFB or DFTPP tune and the initial calibration and initial calibration verification standards to associated samples and method QC analyses. A new and unique Run Batch ID must be used with every new initial calibration.	Text	12	NO
AnalysisBatch	<p>Unique laboratory identifier for a batch of analyses performed on one instrument and under the control of a continuing calibration or continuing calibration verification. The Analysis Batch ID links the continuing calibration or calibration verification to subsequently analyzed and associated field sample and QC analyses. For GC/MS methods, the Analysis Batch ID also links the BFB or DFTPP tune. A new and unique Analysis Batch ID must be used with every new continuing calibration or continuing calibration verification.</p> <p>For GC methods, only report opening standards, do not include closing standards (unless the closing standard functions as the opening standard for a subsequent set of analyses, in which case a new and unique Analysis Batch ID is assigned).</p> <p>When dual or confirmation columns/detectors are used, enter results from the primary column/detector only (this is similar to CLP Pesticide reporting).</p>	Text	12	NO
LabReportingBatch	Unique laboratory identifier for a batch of samples including associated calibrations and method QC, reported as a group by the lab (i.e., lab work order #, log-in #, or SDG). Links all instrument calibrations, samples, and method QC reported as a group or SDG.	Text	12	NO
PercentRelativeStandard Deviation	<p>The standard deviation relative to the mean used to evaluate initial calibration linearity. Organic methods may use either %RSD or Correlation Coefficient.</p> <p>If applicable, enter the %RSD. Leave this field blank if the Correlation Coefficient is used.</p>	Numeric	5	NO
CorrelationCoefficient	<p>The correlation coefficient resulting from linear regression of the initial calibration. For metals by ICAP, enter '1.0' if a two-point initial calibration was analyzed. Organic methods may use either %RSD or Correlation Coefficient.</p> <p>If applicable, enter the Correlation Coefficient. Leave this field blank if the %RSD is used</p>	Numeric	5	NO
RelativeResponseFactor	<p>This field applies to GC/MS only.</p> <p>For continuing calibration enter the relative response factor.</p> <p>For initial calibration enter the <u>average</u> relative response factor. Refer to comments about initial calibration records in the field description for Alternate_Lab_Analysis_ID.</p>	Numeric	5	NO

Table 2**Field Descriptions for the Laboratory Instrument Table (A2 file)**

Contains related to laboratory instrument calibration on an analyte level and GC/MS Tune information. This table is optional depending on project requirements. **Do not report Table A2 for radiochemistry methods.**

Field Name	Field Name Description	Field Type	Field Length	Standard Value List
Percent_Difference (or Percent Recovery)	<p>For <u>organic methods</u>, this field is the difference between 2 measured values expressed as a percentage.</p> <p>If %RSD is reported, enter the % difference between the average response factor of the initial calibration (IC) and the response factor of the initial calibration verification (ICV) or continuing calibration (CCV).</p> <p>If correlation coefficient is used, enter the % difference between the true value and the measured value.</p> <p>The Percent_Difference is expressed as a negative or positive value. Do not express Percent_Difference as an absolute value. Use a negative value if the CCV or ICV response factor is less than the IC average response factor or, in the case of correlation coefficient, the CCV or ICV measured value is less than the true value. Use a positive value if the CCV or ICV response factor is greater than the IC average response factor, or in the case of correlation coefficient, the CCV or ICV measured value is greater than the true value.</p> <p>For <u>inorganic methods</u>, this field is the recovery of an analyte expressed relative to the true amount (i.e., %R for a metal in the continuing calibration or initial calibration verification by Method 6010B).</p>	Numeric	5	NO
PeakID01	Identifies individual m/z ions for GC/MS tuning compounds. For BFB enter 50, for DFTPP enter 51.	Numeric	10	NO
PercentRatio01	<p>For BFB enter the relative percent abundance of m/z 50 measured relative to the raw abundance of m/z 95.</p> <p>For DFTPP enter the relative percent abundance of m/z 51 measured relative to the raw abundance of m/z 198.</p>	Numeric	10	NO
PeakID02	Identifies individual m/z ions for GC/MS tuning compounds. For BFB enter 75, for DFTPP enter 68.	Numeric	10	NO
PercentRatio02	<p>For BFB enter the relative percent abundance of m/z 75 measured relative to the raw abundance of m/z 95.</p> <p>For DFTPP enter the relative percent abundance of m/z 68 measured relative to the raw abundance of m/z 69.</p>	Numeric	10	NO
PeakID03	Identifies individual m/z ions for GC/MS tuning compounds. For BFB enter 95, for DFTPP enter 69.	Numeric	10	NO
PercentRatio03	<p>For BFB enter the ion abundance of m/z 95 as 100 percent.</p> <p>For DFTPP enter the relative percent abundance of m/z 69 measured relative to the raw abundance of m/z 198.</p>	Numeric	10	NO
PeakID04	Identifies individual m/z ions for GC/MS tuning compounds. For BFB enter 96, for DFTPP enter 70.	Numeric	10	NO

Table 2**Field Descriptions for the Laboratory Instrument Table (A2 file)**

Contains related to laboratory instrument calibration on an analyte level and GC/MS Tune information. This table is optional depending on project requirements. **Do not report Table A2 for radiochemistry methods.**

Field Name	Field Name Description	Field Type	Field Length	Standard Value List
PercentRatio04	For BFB enter the relative percent abundance of m/z 96 measured relative to the raw abundance of m/z 95. For DFTPP enter the relative percent abundance of m/z 70 measured relative to the raw abundance of m/z 69	Numeric	10	NO
PeakID05	Identifies individual m/z ions for GC/MS tuning compounds. For BFB enter 173, for DFTPP enter 127.	Numeric	10	NO
PercentRatio05	For BFB enter the relative percent abundance of m/z 173 measured relative to the raw abundance of m/z 174. For DFTPP enter the relative percent abundance of m/z 127 measured relative to the raw abundance of m/z 198	Numeric	10	NO
PeakID06	Identifies individual m/z ions for GC/MS tuning compounds. For BFB enter 174, for DFTPP enter 197.	Numeric	10	NO
PercentRatio06	For BFB enter the relative percent abundance of m/z 174 measured relative to the raw abundance of m/z 95. For DFTPP enter the relative percent abundance of m/z 197 measured relative to the raw abundance of m/z 198.	Numeric	10	NO
PeakID07	Identifies individual m/z ions for GC/MS tuning compounds. For BFB enter 175, for DFTPP enter 198.	Numeric	10	NO
PercentRatio07	For BFB enter the relative percent abundance of m/z 175 measured relative to the raw abundance of m/z 174. For DFTPP enter the ion abundance of m/z 198 as 100 percent.	Numeric	10	NO
PeakID08	Identifies individual m/z ions for GC/MS tuning compounds. For BFB enter 176, for DFTPP enter 199.	Numeric	10	NO
PercentRatio08	For BFB enter the relative percent abundance of m/z 176 measured relative to the raw abundance of m/z 174. For DFTPP enter the relative percent abundance of m/z 199 measured relative to the raw abundance of m/z 198.	Numeric	10	NO
PeakID09	Identifies individual m/z ions for GC/MS tuning compounds. For BFB enter 177, for DFTPP enter 275.	Numeric	10	NO
PercentRatio09	For BFB enter the relative percent abundance of m/z 177 measured relative to the raw abundance of m/z 176. For DFTPP enter the relative percent abundance of m/z 275 measured relative to the raw abundance of m/z 198.	Numeric	10	NO
PeakID10	Identifies individual m/z ions for GC/MS tuning compounds. For BFB leave blank, for DFTPP enter 365.	Numeric	10	NO

Table 2

Field Descriptions for the Laboratory Instrument Table (A2 file)

Contains related to laboratory instrument calibration on an analyte level and GC/MS Tune information. This table is optional depending on project requirements. **Do not report Table A2 for radiochemistry methods.**

Field Name	Field Name Description	Field Type	Field Length	Standard Value List
PercentRatio10	For BFB leave blank. For DFTPP enter the relative percent abundance of m/z 365 measured relative to the raw abundance of m/z 198.	Numeric	10	NO
PeakID11	Identifies individual m/z ions for GC/MS tuning compounds. For BFB leave blank, for DFTPP enter 441.	Numeric	10	NO
PercentRatio11	For BFB leave blank. For DFTPP the percent abundance of m/z 441 measured relative to the raw abundance of m/z 443	Numeric	10	NO
PeakID12	Identifies individual m/z ions for GC/MS tuning compounds. For BFB leave blank, for DFTPP enter 442.	Numeric	10	NO
PercentRatio12	For BFB leave blank. For DFTPP enter the relative percent abundance of m/z 442 measured relative to the raw abundance of m/z 198.	Numeric	10	NO
PeakID13	Identifies individual m/z ions for GC/MS tuning compounds. For BFB leave blank, for DFTPP enter 443.	Numeric	10	NO
PercentRatio13	For BFB leave blank. For DFTPP enter the relative percent abundance of m/z 443 measured relative to the raw abundance of m/z 442.	Numeric	10	NO

* Date/time format is: MM/DD/YYYY hh:mm where MM = month, DD = day, YYYY = four digits of the year, hh = hour in 24 hour format, and mm = minutes.

Table 3
Field Description for the Sample Analysis (A3 file)

This table contains information related to analyses of field samples and laboratory QC samples (excluding calibrations and tunes) on a sample level for environmental chemical analyses including radiochemistry

Field Name	Field Name Description	Field Type	Field Length	Standard Value List
ProjectNumber	Project number assigned by the client.	Text	30	YES (specified by project)
ProjectName	Project name assigned by the client.	Text	90	YES (specified by project)
ClientSampleID	<p>Client or contractor's identifier for a field sample</p> <p>If a sample is analyzed as a laboratory duplicate, matrix spike, or matrix spike duplicate, append suffixes DUP, MS and MSD respectively to the Client Sample ID with no intervening spaces or hyphens (i.e. MW01DUP, MW01MS, and MW01MSD). For Method Blanks, LCS, and LCSD enter the unique LaboratorySampleID into this field</p> <p>Do not append suffixes to the ClientSampleID for dilutions, reanalyses, or re-extracts (the Analysis_Type field is used for this distinction). For example, MW01DL and MW01RE are not allowed</p> <p>Parent sample records must exist for each MS and MSD. If an MS/MSD is shared between two EDDs, records for the MS/MSD and its parent sample must exist in the Sample Analysis table for both EDDs.</p>	Text	25	NO
Collected	<p><u>For radiochemistry methods</u> the Date of sample collection. Refer to the date format for radiochemistry methods at the end of this table.</p> <p><u>For all other methods</u> the Date and Time of sample collection. Refer to the date/time format at the end of this table.</p> <p>Leave this field blank for Method Blank, LCS, and LCSD</p>	Date/Time	16*	NO
MatrixID	Sample matrix (i.e., AQ, SO, etc.)	Text	10	YES (See Table 4)
LabSampleID	<p>Laboratory tracking number for field samples and lab generated QC samples such as method blank, LCS, and LCSD.</p> <p>There are no restrictions for the LabSampleID except field length and that the LabSampleID must be unique for a given field sample or lab QC sample and method.</p>	Text	25	NO
QCType	This record identifies the type of quality control sample QC (i.e., Duplicate, LCS, Method Blank, MS, or MSD). <u>For regular samples, leave this field blank.</u>	Text	10	YES (See Table 4)
ShippingBatchID	Unique identifier assigned to a cooler or shipping container used to transport client or field samples. Links all samples to a cooler or shipping container. No entry for method blanks, LCS, and LCSD. This field is optional.	Text	25	NO
Temperature	<p>Temperature (in centigrade degrees) of the sample as received.</p> <p><u>This field is not required for radiochemistry methods.</u></p>	Numeric	10	NO

Table 3
Field Description for the Sample Analysis (A3 file)

This table contains information related to analyses of field samples and laboratory QC samples (excluding calibrations and tunes) on a sample level for environmental chemical analyses including radiochemistry

Field Name	Field Name Description	Field Type	Field Length	Standard Value List
LabAnalysisRefMethodID	Laboratory reference method ID. The method ID may be an EPA Method number or laboratory identifier for a method such as a SOP number, however; values used for Laboratory Method IDs are specified by the project and must be contained in the standard value list for method IDs.	Text	25	YES (Specified by the project)
PreparationType	Preparation Method Number (i.e., 3010A, 3510C, 3550C, 5030B, etc.) For analytical procedures that do not have a specific preparation method number, use "Gen Prep".	Text	25	YES (See Table 4)
AnalysisType	Defines the type of analysis such as initial analysis, dilution, re-analysis, etc. This field provides distinction for sample records when multiple analyses are submitted for the same sample, method, and matrix, for example: dilutions, re-analyses, and re-extracts.	Text	10	YES (See Table 4)
Prepared	<u>For radiochemistry leave this field blank.</u> For all other methods enter the date and time of sample preparation or extraction. Refer to the date/time format at the end of this table.	Date/Time	16*	NO
Analyzed	<u>For radiochemistry methods</u> the date of sample analysis. Refer to the date format for radiochemistry methods at the end of this table. <u>For all other methods</u> the date and time of sample analysis. Refer to the date and time format at the end of this table.	Date/Time	*	NO
LabID	Identification of the laboratory performing the analysis.	Text	7	NO
QCLevel	The level of laboratory QC associated with the analysis reported in the EDD. If only the Analytical Results Table (A1) and the Sample Analysis Table (A3) information are submitted for the sample, enter "COA". If the Laboratory Instrument Table (A2) information is also submitted for the sample, enter "COCAL"	Text	6	YES (See Table 4)
ResultBasis	Indicates whether results associated with this sample record are reported as wet or percent moisture corrected. This field is only required for soils and sediments. Enter "WET" if results are not corrected for percent moisture. Enter "DRY" if percent moisture correction is applied to results.	Text	3	YES (See Table 4)
TotalOrDissolved	This field indicates if the results related to this sample record are reported as a total or dissolved fraction. This field is only required for metal methods. For all other methods leave this field blank.	Text	3	YES (See Table 4)
Dilution	Dilution of the sample aliquot. Enter "1" for method blanks, LCS, and LCSD, or if the field samples was analyzed without dilution.	Numeric	10	NO
HandlingType	Indicates the type of leaching procedure, if applicable (i.e., SPLP, TCLP, WET). Leave this field blank if the sample analysis was <u>not</u> performed on a leachate.	Text	10	YES (See Table 4)

Table 3
Field Description for the Sample Analysis (A3 file)

This table contains information related to analyses of field samples and laboratory QC samples (excluding calibrations and tunes) on a sample level for environmental chemical analyses including radiochemistry

Field Name	Field Name Description	Field Type	Field Length	Standard Value List
HandlingBatch	<p>Unique laboratory identifier for a batch of samples prepared together in a leaching procedure (i.e., SPLP, TCLP, or WET preparation). The HandlingBatch links samples with leaching blanks.</p> <p>Leave this field blank if the sample analysis was <u>not</u> performed on a leachate</p>	Text	12	NO
LeachateDate	<p>Date and time of leaching procedure (i.e., date for SPLP, TCLP, or WET preparation). Refer to the date and time format at the end of this table.</p> <p>Leave this field blank if the sample analysis was <u>not</u> performed on a leachate</p>	Date /Time	16*	NO
Percent_Moisture	Percent of sample composed of water. Enter for soil and sediment samples only.	Numeric	10	NO
MethodBatch	<p>Unique laboratory identifier for a batch of samples of similar matrices analyzed by one method and treated as a group for matrix spike, matrix spike duplicate, or laboratory duplicate association</p> <p>The method batch links the matrix spike and/or matrix spike duplicate or laboratory duplicates to associated samples. Note, the MethodBatch association may coincide with the PreparationBatch association. The MethodBatch is specifically used to link the MS/MSD and/or DUP to associated samples.</p>	Text	12	NO
PreparationBatch	<p>Unique laboratory identifier for a batch of samples prepared together for analysis by one method and treated as a group for method blank, LCS and LCSD association.</p> <p>The PreparationBatch links method blanks and laboratory control samples (blank spikes) to associated samples. Note, the PreparationBatch association may coincide with the MethodBatch association but the PreparationBatch specifically links the Method Blank and LCS to associated samples.</p>	Text	12	NO
RunBatch	<p><u>For radiochemistry methods leave this field blank.</u></p> <p><u>For all other methods</u> the RunBatch is the unique identifier for a batch of analyses performed on one instrument under the control of one initial calibration and initial calibration verification. The RunBatch links both the initial calibration and initial calibration verification to subsequently analyzed and associated continuing calibrations, field samples, and QC analyses. For GC/MS methods, the RunBatch also links a BFB or DFTPP tune. A distinct RunBatch must used with every new initial calibration within a method</p> <p>The value entered in this field links a particular sample/method/analysis type record to a set of associated initial calibration and initial calibration verification records from Table A2.</p> <p>This field is only required if the A2 table is included with the EDD.</p>	Text	12	NO

Table 3
Field Description for the Sample Analysis (A3 file)

This table contains information related to analyses of field samples and laboratory QC samples (excluding calibrations and tunes) on a sample level for environmental chemical analyses including radiochemistry

Field Name	Field Name Description	Field Type	Field Length	Standard Value List
AnalysisBatch	<p><u>For radiochemistry methods</u> leave this field blank.</p> <p><u>For all other methods</u> the AnalysisBatch is the unique identifier for a batch of analyses performed on one instrument and under the control of a continuing calibration or continuing calibration verification. The AnalysisBatch links the continuing calibration or calibration verification to subsequently analyzed and associated field sample and QC analyses. For GC/MS methods, the AnalysisBatch also links the BFB or DFTPP tune. A distinct AnalysisBatch must be used with every new continuing calibration or continuing calibration verification within a method</p> <p>The value entered in this field links a particular sample/method/analysis type record to a set of associated continuing calibration records in the Laboratory Instrument table.</p> <p>This field is only required if the A2 table is included with the EDD.</p>	Text	12	NO
LabReportingBatch	Unique laboratory identifier for the EDD. This is equivalent to the sample delivery group, lab work number, login ID, etc. The LabReportingBatch links all records in the EDD reported as one group. The value entered in this field must be the same in all records.	Text	12	NO
LabReceipt	Date and time the sample was received in the lab. A time value of 00:00 may be entered. Refer to the date/time format at the end of this table.	Date/Time	16*	
LabReported	Date and time hard copy reported delivered by the lab. A time value of 00:00 may be entered. Refer to the date/time format at the end of this table.	Date/Time	16*	

* For radiochemistry methods format Date as MM/DD/YYYY (where MM = two digit month, DD = two digit day, and YYYY = four digit year)

For all other methods format Date and Time as MM/DD/YYYY hh:mm YYYY (where MM = two digit month, DD = two digit day, and YYYY = four digit year, hh = hour in 24 hour format, and mm = minutes)

Table 4
Standard Value List

Field Name	Standard Value	Standard Value Description
Analysis_Type	DL	Dilution of the original sample
	DL2	Second dilution of the original sample
	DL3	Third dilution of the original sample
	DL4	Fourth dilution of the original sample
	RE	Reanalysis/re-extraction of sample
	RE2	Second reanalysis/re-extraction of sample
	RE3	Third reanalysis/re-extraction of sample
	RE4	Fourth reanalysis/re-extraction of the original sample
	RES	The initial or original sample.
Analyte_Name	Refer to QAPP and Project Library	Analyte names are specified by the project and entered into the library for each method and matrix. Analyte Names used in project libraries must first exist in the standard value table. The same holds true for the ClientAnalyteID
Analyte_Type	IS	Internal standard as defined per CLP usage
	SPK	Spiked analyte
	SURR	Surrogate as defined as per CLP usage
	TIC	Tentatively identified compound for GC/MS analysis
	TRG	Target compound
Detection_Limit_Type ¹	CRDL	Contract required detection limit
	IDL	Instrument detection limit
	MDA	Minimum detectable activity
	MDL	Method detection limit
Handling_Type ²	WET	Wet leaching procedure
	SPLP	Synthetic Precipitation Leaching Procedure
	TCLP	Toxicity Characteristic Leaching Procedure
Lab_Analysis_Ref_Method_ID	Refer to QAPP and Project Library	Method IDs are specified by the project and entered into the library. Methods used in project libraries must first exist in the standard value table
Lab_Qualifiers ³	*	INORG: Duplicate analysis was not within control limits
	*	ORG: Surrogate values outside of contract required QC limits
	+	INORG: Correlation coefficient for the method of standard additions (MSA) was less than 0.995
	A	ORG: Tentatively identified compound (TIC) was a suspected aldol-condensation product
	B	INORG: Value less than contract required detection limit but greater than or equal to instrument detection limit
	B	ORG: Compound is found in the associated blank as well as in the sample
	C	ORG: Analyte presence confirmed by GC/MS
	D	Result from an analysis at a secondary dilution factor
	E	INORG: Reported value was estimated because of the presence of interference
	E	ORG: Concentrations exceed the calibration range of the instrument
	H	Analysis performed outside method or client-specified holding time requirement
	J	Estimated value
	M	INORG: Duplicate injection precision was not met
	N	INORG: Spiked sample recovery was not within control limits
	N	ORG: Presumptive evidence of a compound
	P	ORG: Difference between results from two GC columns unacceptable (>25% Difference)
	S	Reported value was determined by the method of standard additions (MSA)
	U	Compound was analyzed for but not detected. Analyte result was below the Reporting Limit.
	W	INORG: Post digestion spike was out of control limits
X	Reserved for a lab-defined data qualifier	
Y	Reserved for a lab-defined data qualifier	
Z	Reserved for a lab-defined data qualifier	
Matrix_ID	AIR	Air
	AQ	Water
	ASH	Ash

Table 4
Standard Value List

Field Name	Standard Value	Standard Value Description
Matrix_ID (continued)	BIOTA	Biological matter
	FILTER	Filter
	LIQUID	Non-aqueous liquid
	OIL	Oil
	SED	Sediment
	SLUDGE	Sludge
	SO	Soil
	SOLID	Non-soil/sediment solid
	TISSUE	Tissue
	WASTE	Waste
	WIPE	Wipe
Preparation_Type ⁴	3005A	Acid Digestion of Waters for Total Recoverable or Dissolved Metals by FLAA or ICP
	3010A	Acid of Aqueous Samples and Extracts for Total Metals by FLAA or ICP
	3015	Microwave Assisted Acid Digestion of Aqueous Samples and Extracts
	3020A	Acid Digestion of Aqueous Samples and Extracts for Total Metals by GFAA
	3031	Acid Digestion of Oils for Metals Analysis by AA or ICP
	3050B	Acid Digestion of Sediments, Sludges, and Soils
	3051	Microwave Assisted Acid Digestion of Sediments, Sludges, Soils and Oils
	3052	Microwave Assisted Acid Digestion of Siliceous and Organically Based Matrices
	3060A	Alkaline Digestion for Hexavalent Chromium
	3510C	Separatory Funnel Liquid-Liquid Extraction
	3520C	Continuous Liquid-Liquid Extraction
	3535	Solid Phase Extraction
	3540C	Soxhlet Extraction
	3541	Automated Soxhlet Extraction
	3545	Pressurized Fluid Extraction
	3550B	Ultrasonic Extraction
	3560	Supercritical Fluid Extraction of Total Recoverable Petroleum Hydrocarbons
	5030B	Purge and Trap for Aqueous Samples
	5035	Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples
	7470A	Acid digestion of waters for Mercury analysis
	7471A	Acid digestion of soils and solids for Mercury analysis
	Gen Prep	Generic preparation type when a preparation method ID does not exist (used mostly for general chemistry methods)
QC_Level	COA	Certificate of Analysis (accuracy and precision, no calibration)
	COACAL	Certificate of Analysis (accuracy and precision including calibration)
QC_Type	MB	Analytical control consisting of all reagents and standards that is carried through the entire procedure (Method Blank)
	CV	(Calibration Verification) Analytical standard run at a specified frequency to verify the calibration of the analytical system
	CCV	(Continuing Calibration Verification) Analytical standard run every 12 hours to verify the calibration of the GC/MS system
	DUP	A second aliquot of a sample that is treated the same as the original aliquot to determine the precision of the method
	IC	(Initial Calibration) Analysis of analytical standards for a series of different specified concentrations
	ICV	(Initial Calibration Verification) Analytical standard run at a specified frequency to verify the accuracy of the initial calibration of the analytical system
	IPC	(Instrument Performance Check) Analysis of DFTPP or BFB to evaluate the performance of the GC/MS system
	LCS	(Laboratory Control Sample) A control sample of known composition
	LCSD	(Laboratory Control Sample Duplicate) A duplicate control sample of known composition
	MS	(Matrix Spike) Aliquot of a matrix spiked with known quantities and subjected to the entire analytical procedure to measure recovery
	MSD	(Matrix Spike Duplicate) A second aliquot of the same matrix as the matrix spike that is spiked in order to determine the precision of the method
Reporting_Limit_Type ¹	CRDL	Contract required detection limit
	CRQL	Contract required quantitation limit

Table 4
Standard Value List

Field Name	Standard Value	Standard Value Description
Reporting_Limit_Type (continued)	PQL	Practical quantitation limit
	SQL	Sample quantitation limit
	RDL	Reportable detection limit
Result_Basis	DRY	Result was calculated on a dry weight basis
	WET	Result was calculated on a wet weight basis
Result_Units ⁵	ug/L	Micrograms per liter
	mg/L	Milligrams per liter
	ug/Kg	Micrograms per kilogram
	mg/Kg	Milligrams per kilogram
	pg/L	Picograms per liter
Total_Or_Dissolved	ng/Kg	Nanograms per kilogram
	DIS	Dissolved
	TOT	Total

- 1 Additional Detection Limit Types and Reporting Limit Types may be used. These must be added to the application standard values.
- 2 Additional Handling Types (leachate procedures) may be used. These must be added to the application standard values
- 3 Additional Lab Qualifiers may be used, or listed Lab Qualifiers may be used in a different manner than described in this table. New lab qualifiers must be added to the application standard value tables. NOTE: The “U” Lab Qualifier must be used for all non-detects.
- 4 Additional Preparation Types may be used. These must be added to the application standard value tables.
- 5 Additional Result Units may be used. The project library specifies the reporting limit used for each method and matrix

Note: If new standard values are used then these standard values must be entered in the software standard values for both the lab and contractor. The application will automatically update the standard values tables if an importing library contains standard values (method, client analyte ID, and analyte name) that do not exist in the software importing the new library.

Table 5

Required Fields in the Analytical Results Table for GC/MS, GC, and HPLC Methods

Field	GC/MS Methods			GC and HPLC Methods		
	Regular Sample*	MS/MSD	Method Blank, LCS/LCSD	Regular Sample*	MS/MSD	Method Blank, LCS/LCSD
Client_Sample_ID	X	X	X	X	X	X
Lab_Analysis_Ref_Method_ID	X	X	X	X	X	X
Analysis_Type	X	X	X	X	X	X
Lab_Sample_ID	X	X	X	X	X	X
Lab_ID	X	X	X	X	X	X
Client_Analyte_ID	X	X	X	X	X	X
Analyte_Name	X	X	X	X	X	X
Result	X	X	X	X	X	X
Result_Units	X	X	X	X	X	X
Lab_Qualifiers	Q	Q	Q	Q	Q	Q
Detection Limit	X	X	X	X	X	X
Detection_Limit_Type	X	X	X	X	X	X
Retention_Time	T		T			
Analyte_Type	X	X	X	X	X	X
Percent_Recovery	S	R	R	S	R	R
Relative_Percent_Difference		D	D		D	D
Reporting_Limit	X	X	X	X	X	X
Reporting_Limit_Type	X	X	X	X	X	X
Reportable_Result	X	X	X	X	X	X

Key

- X Required Field
- D Required field for spiked compounds in the LCSD and MSD only
- Q Required field if laboratory has qualified result. The "U" qualifier MUST be entered if the result is non-detect.
- R Required field if Analyte_Type = "SPK" or "SURR"
- S Required field for surrogate compounds only
- T Required field for tentatively identified compounds by GC/MS only
- * Also includes Equipment Blanks, Field Blanks, and Trip Blanks

Table 6
Required Fields in the Analytical Results Table for ICAP, AA, and IC Methods

Field	ICAP and AA Methods			IC and Wet Chemistry Methods		
	Regular Sample*	Sample Duplicate, MS/MSD	Method Blank, LCS/LCSD	Regular Sample*	Sample Duplicate MS/MSD	Method Blank, LCS/LCSD
Client_Sample_ID	X	X	X	X	X	X
Lab_Analysis_Ref_Method_ID	X	X	X	X	X	X
Analysis_Type	X	X	X	X	X	X
Lab_Sample_ID	X	X	X	X	X	X
Lab_ID	X	X	X	X	X	X
Client_Analyte_ID	X	X	X	X	X	X
Analyte_Name	X	X	X	X	X	X
Result	X	X	X	X	X	X
Result_Units	X	X	X	X	X	X
Lab_Qualifiers	Q	Q	Q	Q	Q	Q
Detection Limit	X	X	X	X	X	X
Detection_Limit_Type	X	X	X	X	X	X
Retention_Time						
Analyte_Type	X	X	X	X	X	X
Percent_Recovery		S	S		S	S
Relative_Percent_Difference		R	R		R	R
Reporting_Limit	X	X	X	X	X	X
Reporting_Limit_Type	X	X	X	X	X	X
Reportable_Result	X	X	X	X	X	X

Key

- X Required field
- Q Required field if laboratory has qualified result. The “U” qualifier MUST be entered if the result is non-detect
- R Required field for spiked compounds in LCSD or MSD, or target compounds in the Sample Duplicate only
- S Required field if Analyte_Type = “SPK”
- * Also includes Trip Blanks, Equipment Blanks, and Field Blanks

Table 7
Required Fields in the Laboratory Instrument Table

Field	GC/MS Tunes		Initial Calibration				Initial Calibration Verification				Calibration Verification, Continuing Calibration
	VOA	SVOA	GC/MS	GC HPLC	ICP/AA	IC*	GC/MS	GC HPLC	ICP/AA	IC*	ALL METHODS
Instrument_ID	X	X	X	X	X	X	X	X	X	X	X
QC_Type	X	X	X	X	X	X	X	X	X	X	X
Analyzed	X	X	X	X	X	X	X	X	X	X	X
Alternate_Lab_Analysis_ID	X	X	X	X	X	X	X	X	X	X	X
Lab_Analysis_ID	X	X					X	X	X	X	X
Lab_Analysis_Ref_Method_ID	X	X	X	X	X	X	X	X	X	X	X
Client_Analyte_ID	X	X	X	X	X	X	X	X	X	X	X
Analyte_Name	X	X	X	X	X	X	X	X	X	X	X
Run_Batch	X	X	X	X	X	X	X	X	X	X	X
Analysis_Batch	C	C									X
Lab_Reporting_Batch	X	X	X	X	X	X	X	X	X	X	X
Percent_Relative_Standard_Deviation			X	X							
Correlation_Coefficient			B	B	X	X					
Relative_Response_Factor			X				X				M
Percent_Difference							X	X	X	X	X
Peak_ID_01	X	X									
Percent_Ratio_01	X	X									
Peak_ID_02	X	X									
Percent_Ratio_02	X	X									
Peak_ID_03	X	X									
Percent_Ratio_03	X	X									
Peak_ID_04	X	X									
Percent_Ratio_04	X	X									
Peak_ID_05	X	X									
Percent_Ratio_05	X	X									
Peak_ID_06	X	X									
Percent_Ratio_06	X	X									
Peak_ID_07	X	X									
Percent_Ratio_07	X	X									
Peak_ID_08	X	X									
Percent_Ratio_08	X	X									
Peak_ID_09	X	X									
Percent_Ratio_09	X	X									
Peak_ID_10		X									
Percent_Ratio_10		X									
Peak_ID_11		X									
Percent_Ratio_11		X									
Peak_ID_12		X									
Percent_Ratio_12		X									
Peak_ID_13		X									
Percent_Ratio_13		X									

Key

- X Required field (some fields are not applicable to some General (Wet) Chemistry tests)
- B Required field if reporting best fit
- C Required field if BFB or DFTPP associated with a continuing calibration only
- M Required field for GC/MS continuing calibration only

*IC Includes Ion Chromatography and Classical or Wet Chemistry methods. Methods such as pH, Conductivity, and others do not use traditional calibration procedures: therefore some fields marked as a required field under the "IC" column do not apply for these methods.

Table 8
Required Fields in the Sample Analysis Table

Field	GC, GC/MS, HPLC Methods		ICAP and AA Methods		IC and Wet Chemistry Methods	
	Method Blanks, LCS/LCSD	Regular Samples*, Sample Duplicate, MS/MSD	Method Blanks, LCS/LCSD	Regular Samples*, Sample Duplicate, MS/MSD	Method Blanks, LCS/LCSD	Regular Samples*, Sample Duplicate, MS/MSD
Client_Sample_ID	X	X	X	X	X	X
Collected		X		X		X
Matrix_ID	X	X	X	X	X	X
Lab_Sample_ID	X	X	X	X	X	X
QC_Type	X	Q	X	Q	X	X
Shipping_Batch_ID		X		X		X
Temperature		X				X
Lab_Analysis_Ref_Method_ID	X	X	X	X	X	X
Preparation_Type	X	X	X	X	X	X
Analysis_Type	X	X	X	X	X	X
Prepared	A	A	X	X	N	N
Analyzed	X	X	X	X	X	X
Lab_ID	X	X	X	X	X	X
QC_Level	X	X	X	X	X	X
Results_Basis		S		S		S
Total_Or_Dissolved			W	W		
Dilution	X	X	X	X	X	X
Handling_Type	L	L	L	L	L	L
Handling_Batch	L	L	L	L	L	L
Leachate_Date	L	L	L	L	L	L
Percent Moisture		S		S		S
Method_Batch	X	X	X	X	X	X
Preparation_Batch	X	X	X	X	X	X
Run_Batch	C	C	C	C	C	C
Analysis_Batch	C	C	C	C	C	C
Lab_Reporting_Batch	X	X	X	X	X	X
Lab_Receipt		X		X		X
Lab_Reported	X	X	X	X	X	X

Key

- X Required field
- A Required field for samples prepared by methanol extraction
- C Required field if Instrument Calibration Table (A2) is included in EDD
- L Required field if analysis performed on SPLP, TCLP, or WET extracts
- N Required field only for samples that require preparation before analysis
- Q Required field for Sample Duplicate, MS, and MSD only
- S Required field if "Matrix_ID" = "SO" or "SED"
- W Required field for aqueous samples only
- * Includes Trip Blanks, Equipment Blanks, and Field Blanks

**Reviewed EDD Export File Specifications - Analytical Results (A1)
Comma Delimited Text File**

Order	Field Name*	Field Description
1	RecordID	Record number.
2	ClientSampleID	Client field sample identifier.
3	LabAnalysisRefMethodID	Laboratory reference method (i.e. 8260B, 6010B, etc.).
4	AnalysisType	Defines type of analysis (i.e. dilution, reanalysis, etc.).
5	LabSampleID	Internal laboratory sample tracking number for samples and lab generated QC.
6	LabID	Identifier of laboratory performing the analysis.
7	ClientAnalyteID	CAS number or unique analyte identifier.
8	AnalyteName	Chemical name for analyte.
9	Result	Reportable result for the analyte.
10	ResultUnits	Units of measure for the result (i.e. mg/Kg, ug/L, etc.).
11	LabQualifiers	A string of letter or symbol qualifiers assigned by the lab based on contractor defined rules and values.
12	DetectionLimit	Detection limit for the analyte being measured.
13	DetectionLimitType	Specifies the type of detection limit (i.e. MDL, IDL, etc.).
14	RetentionTime	The time expressed in decimal minutes between injection and detection for GC/MS TICs only.
15	AnalyteType	Defines the type of result such as surrogate, spike, or target analyte.
16	PercentRecovery	The percent recovery of a spiked QC compound such as a matrix spike, LCS spike, or surrogate.
17	RelativePercentDifference	RPD between to QC results such as MS/MSD.
18	ReportingLimit	Analyte reporting limit.
19	ReportingLimitType	Defines the type of reporting limit (PQL, CRQL, etc.).
20	ReportableResult	(YES or NO) Indicates which result is the useable result when results from two or more analyses for the same sample and method (ie dilutions, reanalyses, etc) are reported in the EDD.
21	Filename	File name of the EDD. The same as the LabReportingBatch in the Sample Analysis table (A3).
22	DVModifiedConcentration	ADR modified analyte result due to blank contamination.
23	DVQualTemperature	Data review qualifier for temperature outlier.
24	DVQualPreservation	Data review qualifier for preservation anomaly.
25	DVQualHTSamplingToAnalysis	Data review qualifier for holding time violation from sampling time to analysis time.
26	DVQualHTSamplingToExtraction	Data review qualifier for holding time violation from sampling time to extraction.
27	DVQualHTExtractionToAnalysis	Data review qualifier for holding time violation from extraction time to analysis time.
28	DVQualHoldingTime	Overall data review qualifier for holding time violation.
29	DVQualMethodBlanks	Data review qualifier for contamination in an associated method blank.
30	DVQualSurrogateRecovery	Data review qualifier for surrogate recovery outlier.
31	DVQualMS	Overall data review qualifier for associated MS and MSD recovery and/or RPD outlier.
32	DVQualMSRecovery	Data review qualifier for MS and/or MSD recovery outlier.
33	DVQualMSRPD	Data review qualifier for MS/MSD RPD outlier.
34	DVQualLCS	Overall data review qualifier for LCS and LCS recovery and/or RPD outlier.
35	DVQualLCSRecovery	Data review qualifier for associated LCS and/or LCSD recovery outlier.
36	DVQualLCSRPD	Data review qualifier for LCS/LCSD RPD outlier.
37	DVQualRepLimits	Data review qualifier for result reported below the reporting limit.
38	DVQualReportingLimits	Data review comment ("OutX") when reporting limit exceeds the project reporting limit.
39	DVQualFieldQC	Overall data review qualifier for Field QC.
40	DVQualFieldBlank	Data review qualifier for contamination in an associated Field Blank.
41	DVQualEquipmentBlank	Data review qualifier for contamination in an associated Equipment Rinsate or Equipment Blank.
42	DVQualTripBlank	Data review qualifier for contamination in an associated Trip Blank.
43	DVQualFieldDuplicate	Data review qualifier for an associated Field Duplicate RPD outlier.
44	DVQualIC	Overall data review qualifier for associated initial calibration outliers.
45	DVQualInitialCalibrationRRF	Data review qualifier for an associated initial calibration relative response

Order	Field Name*	Field Description
		factor outlier.
46	DVQualInitialCalibrationRSD	Data review qualifier for an associated initial calibration relative percent difference outlier.
47	DVQualInitialCalibrationCC	Data review qualifier for an associated initial calibration correlation coefficient outlier.
48	DVQualICV	Overall data review qualifier for an associated initial calibration verification.
49	DVQualInitialCalibrationVerificationRRF	Data review qualifier for an associated initial calibration verification relative response factor outlier.
50	DVQualInitialCalibrationVerificationPD	Data review qualifier for an associated initial calibration verification percent difference outlier.
51	DVQualCCV	Overall data review qualifier for associated continuing calibration outliers.
52	DVQualContinuingCalibrationVerificationRRF	Data review qualifier for an associated continuing calibration relative response factor outlier.
53	DVQualContinuingCalibrationVerificationPD	Data review qualifier for an associated continuing calibration percent difference outlier.
54	DVQualOverall	Overall data review qualifier for all QC and calibration qualifiers.
55	TagLabSampleID (see comment)	Temporary placeholder.
56	TagDetQual01 (see comment)	Temporary placeholder.
57	TagNonDetQual01 (see comment)	Temporary placeholder.
58	TagDetQual02 (see comment)	Temporary placeholder.
59	TagNonDetQual02 (see comment)	Temporary placeholder.
60	surDVQualDet (see comment)	Temporary placeholder.
61	surDVQualNonDet (see comment)	Temporary placeholder.
62	DVQualInstrumentPerformanceCheckRunBatch	Data review qualifier for GC/MS Tune outlier related to initial calibration.
63	DVQualInstrumentPerformanceCheckAnaBatch	Data review qualifier for GC/MS Tune outlier related to continuing calibration.
64	DVQualIPC	Overall data review qualifier for GC/MS tune outliers.
65	DVQualLabDup	Data review qualifier for RPD outlier in laboratory duplicate.
66	DVQualCode	User-defined Reason Code
67	FieldDupRPD	RPD calculated from Field duplicate and parent sample
68	DVQualMergedQualifier	Merged lab and data review qualifiers
69	DVQualMergedResult	Final result (modified concentration if applicable)
70	DVQualPercMoi ¹	Data review qualifier for percent moisture
71	DVQualLabDupNR ¹	Data review qualifier for laboratory duplicate not reported
72	DVQualLcsNR ¹	Data review qualifier for laboratory control sample(s) not reported
73	DVQualDissTotDiff ¹	Data review qualifier for dissolved and total fraction differing by more than 10%
74	Error	Radiochemistry error
75	DVQualSampleDupCount ¹	Data review qualifier for sample count being >20 in a duplicate batch
76	DVQualMsSampleCount ¹	Data review qualifier for sample count being >20 in a matrix spike batch
77	DVQualLcsCount ¹	Data review qualifier for sample count being >20 in a laboratory control sample batch
78	DVQualMbMissing ¹	Data review for missing method blank
79	DVQualPercMoiDissTotDiff ¹	Combined data review qualifier for percent moisture and total vs dissolved difference outliers
80	DVQualInternalStandard ²	Data review qualifier for internal standard outlier
81	DVQualCalibrationBlank ²	Data review qualifier for calibration blank contamination
82	DVQualRcm ²	Data review qualifier for resolution check mixture problem
83	DVQualPem ²	Data review qualifier for performance evaluation mixture problem
84	DVQualProfessionalJudgement ²	Data review qualifier for any reason deemed necessary by data-review chemist
85	DOD_MDL	Method detection limit for QSM 4.2

Comment: Fields that contain temporary placeholders hold information contributed during the review process that is used in generating reports. This information is kept with the output file so that if the file is ever imported back into the application, reports can be generated without having to rerun the review module.

* Field Names in bold font are added to the EDD during review and included in the exported reviewed EDD file

¹ Data review qualifiers in these cases are added for EPA Region II assessment. ADR.Net does not currently perform EPA Region II assessment.

² Data review qualifiers in these cases are added manually by the user and not assessed by automated data review.

Reviewed EDD Export File Specifications - Sample Analysis (A3) Comma Delimited Text File

Order	Field Name*	Field Description
1	RecordID	Record number.
2	ProjectNumber	Project Number assigned by client.
3	ProjectName	Project Name assigned by client.
4	ClientSampleID	Client field sample identifier.
5	Collected	Date and time sample was collected.
6	MatrixID	Sample matrix.
7	LabSampleID	Internal laboratory sample tracking number for samples and lab generated QC.
8	QCType	Identifies the type of quality control sample, regular field samples are null.
9	ShippingBatchID	Unique identifier assigned to a cooler or shipping container used to transport field samples.
10	Temperature	Temperature in degrees C of the samples as received in the lab.
11	LabAnalysisRefMethodID	Laboratory reference method (i.e. 8260B, 6010B, etc.).
12	PreparationType	Preparation method number (i.e. 3010A, 3510C, etc.).
13	AnalysisType	Defines type of analysis (i.e. dilution, reanalysis, etc.).
14	Prepared	Date and time of sample preparation/extraction.
15	Analyzed	Date and time of sample analysis.
16	LabID	Identifier of laboratory performing analysis.
17	QCLevel	Level of analytical QC associated with analysis (i.e. Level III, etc.).
18	ResultBasis	Indicates if a result is expressed as wet or dry.
19	TotalorDissolved	Indicates if a result is expressed as total or dissolved (for metals only).
20	Dilution	Sample dilution during analysis.
21	HandlingType	Type of leaching procedure, if applicable (i.e. SPLP, TCLP, etc.).
22	HandlingBatch	Unique laboratory identifier for a batch of samples prepared together for a leaching procedure.
23	LeachateDate	Date and time of leaching procedure.
24	PercentMoisture	Percent moisture of sample.
25	MethodBatch	Unique laboratory identifier for a batch of samples with similar matrix and analyzed together by one method. Links samples to matrix spikes and duplicates.
26	PreparationBatch	Unique laboratory identifier for a batch of samples prepared together for analysis by one method. Links samples with method blanks and laboratory control samples.
27	RunBatch	Unique laboratory identifier for a batch of analyses performed on one instrument under the control of on an initial calibration. Links the initial calibration to associated samples.
28	AnalysisBatch	Unique laboratory identifier for a batch of analyses performed on one instrument under the control of a continuing calibration. Links continuing calibrations to associated samples.
29	LabReportingBatch	Unique laboratory identifier for a batch of samples, QC, and calibration standards reported as a group by the lab (i.e. order number, SDG #, etc.).
30	LabReceipt	Date samples received in laboratory.
31	LabReported	Date laboratory hardcopy submitted.
32	DataReviewCompany**	Company running the automated review software.
33	DataReviewDate	Date and time EDD was validated.
34	ValidatedBy**	Person running the automated review.
35	ValidationDate**	Date and time when automated data review qualifiers were reviewed
36	ApprovedBy**	Person performing secondary review of data review flags.
37	ApprovalDate**	Date and time of secondary review by "ApprovedBy".
38	FileName	File name of EDD (same as LabReportingBatch).
39	TagLabSampleID (see comment)	Temporary place holder.
40	TagDetQual (see comment)	Temporary place holder.
41	TagNonDetQual (see comment)	Temporary place holder.
42	TempFlag (see comment)	Temporary place holder.
43	LabMethodCategory	The category of the method, used by EDMS

Comment: Fields that contain temporary placeholders hold values created during the validation process. These values are used in generating reports. This information is kept with the output file so that if the file is ever imported back into the application, reports can be generated without having to rerun the validation module.

* Field Names in bold font are added to the EDD during automated data review and included in the exported data-reviewed EDD file

** Automated data review does not update these fields with any information but these fields are still part of the exported data-reviewed file. These fields may be populated manually by the user from various forms in the application prior to exporting.

*** Date/Time format: MM/DD/YYYY hh:mm

ATTACHMENT F

Responses to Comments on the QAPP, Volume I, Appendix D, Draft Revision 1, Operable Unit 2 Landfills

Responses to Comments submitted by the California Department of Toxic Substances Control (DTSC) Human and Ecological Risk Office (HERO)¹

COMMENT 1: Worksheet #11 – Data Quality Objective (DQO) #3 – Compliance Perimeter Probes. Under the analytical approach, page 24, the decision rules related to VOCs mention that the concentrations detected in the compliance perimeter probes are compared to the most current EPA² Region IX residential ambient air regional screening level (RSL) for vinyl chloride. HERO has the following questions.

- a. Why is vinyl chloride the only VOC³ mentioned in the decision rules? What about the other VOCs?
- b. HERO recommends using the EPA residential air RSLs in conjunction with the DTSC residential air screening levels (DTSC-SLs). The DTSC-SLs are discussed in our HHRA⁴ Note 3 and they can be found at: <http://www.dtsc.ca.gov/AssessingRisk/upload/HHRA-Note-3-2016-01.pdf>.

END OF COMMENTS

RESPONSE TO COMMENT 1a: Based on historic concentrations of VOCs detected in perimeter probes at the Operable Unit 2 (OU2) Landfills, the Fort Ord Base Realignment and Closure (BRAC) Cleanup Team (BCT)⁵ agreed in June 2006⁶ that vinyl chloride is an appropriate indicator compound for VOCs in landfill gas at the OU2 Landfills. Subsequently, a variance to the Post Closure Operation and Maintenance Plan, Areas B through F, Operable Unit 2 Landfills Remedial Action was issued to describe the decision rules pertaining to vinyl chloride detections.⁷ These decision rules were then carried forward to the 2008 Landfill Gas Sampling and Analysis Plan (Appendix F to the Operation and Maintenance Plan, Operable Unit 2 Landfills⁸), the 2014 Quality Assurance Project Plan, Superfund Response Actions, Volume I, Appendix D, Operable Unit 2 Landfills⁹ and this current revision of the QAPP. A review of VOC data collected since 2006 indicates chloroform and tetrachloroethene (PCE) are also commonly detected in landfill gas at concentrations exceeding 100 times the RSLs; therefore, the decision rules were revised to include these two compounds.

RESPONSE TO COMMENT 1b: The QAPP was revised to include DTSC-SLs per the comment. The DTSC-SLs are two orders of magnitude lower than the EPA RSLs for vinyl chloride and PCE (see table below).

	DTSC-SL		EPA RSL	
	µg/m ³	ppbv	µg/m ³	ppbv
Vinyl chloride	0.0095	0.0037	0.17	0.067
PCE	0.48	0.071	11	1.62
Chloroform	NA	NA	0.12	0.025

¹ In a letter dated May 20, 2016 (see Administrative Record No. [AR#] OU2-702.2).

² EPA = United States Environmental Protection Agency, Region 9.

³ VOC = volatile organic compound.

⁴ HHRA = human health risk assessment.

⁵ The BCT includes the United States Department of the Army, EPA, DTSC and the California Central Coast Regional Water Quality Control Board.

⁶ See BCT meeting minutes at AR# BW-1768H.

⁷ See AR# [OU2-593A.5](#).

⁸ See AR# [OU2-593F](#).

⁹ See AR# [OU2-688A](#).

Additionally, 100 times the DTSC-SL for vinyl chloride (0.37 ppbv) is still be below the analytical method limit of quantitation (0.5 ppbv); therefore, if vinyl chloride is present at a concentration less than the limit quantitation, it would be reported as estimated or not detected. Accordingly, the decision rules were revised to use 1,000 times the DTSC-SL as the reference concentration for decisions for vinyl chloride and PCE. Since chloroform does not have an associated DTSC-SL, 100 times the EPA RSL will be used for that compound.